Today's Dietitian
The Magazine for Nutrition Professionals
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TODAY'S DIETITIAN

Dietitians in the Health Care Classroom — Assessing Learners' Prior Knowledge Is Key: Part One of a Three-Part Series

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Suggested CDR Learning Codes: 1000, 6010, 6030, 6060; Level 1

Suggested CDR Performance Indicators: 9.1.3, 9.1.4, 9.2.1, 9.4.1

As teachers, RDs inform clients suffering from various challenges and diseases about lifestyle and behavior changes. In the past, most of this teaching took place one-on-one with a patient over the course of follow-up appointments. Today, however, dietitians may be called upon to provide the same services in a classroom setting to people with varying levels of prior knowledge about health and nutrition. This presents a new challenge for RDs. While lab tests can pinpoint physical conditions, there's no single approach or concrete test to assess prior knowledge; it must be assessed in subtle ways. That said, it's one of the most important nutrition assessments the RD can perform.

Prior knowledge is the information about a particular subject area that participants bring to a new learning experience. The learners' knowledge level at the beginning of a class can have a huge impact on the progress they can make. Learners will have varying levels of nutrition knowledge that may be based on accurate information, misinformation, or misconceptions. Learners with accurate nutrition knowledge are more likely to understand what dietary and lifestyle changes they'll need to make, while those whose understanding is based on misinformation or misconceptions will not.

To instruct efficiently, RDs need to ascertain what students already know. Assessing that prior knowledge is the starting point of the education activity. Because there will be a disparity of knowledge among students in the classroom setting, dietitians must determine how much prior knowledge of nutrition each participant has and better tailor the instruction to meet needs.

After completing this continuing education course, RDs will be better able to understand the importance of prior knowledge brought by learners (who may be patients) to a classroom setting, demonstrate ways to assess prior knowledge, and take that information into account to choose teaching strategies that will help learners better apply nutrition information to their daily lives.

Prior Knowledge

Learners can derive prior knowledge about nutrition from various sources—from parents, other family members, friends, physicians, celebrities, school classes, college courses, the Internet, advertisements, media outlets, and personal experience. Prior knowledge can help learners connect something new to something previously known. As a simple example, a learner might

already realize that oranges are an excellent source of vitamin C. This prior knowledge will help this person to learn that all other citrus fruits also are excellent sources of vitamin C.

If learners have accurate prior knowledge, their new learning experience will be positive.[1] The opposite holds true for those whose prior knowledge is inaccurate. Faulty prior knowledge brought by the learner can be a negative impediment to processing new information. Misconceptions can develop when learners connect new, accurate information to a false belief. These misconceptions hinder their ability to apply what they've learned to their lives. For example, if learners inaccurately believe that dairy foods cause respiratory congestion, then even after being taught that dairy foods are rich sources of calcium for growth, they may still be reluctant to provide these foods to their children.

RDs can assume that today's patients probably have a baseline of simple nutrition knowledge. For example, many patients know that vegetables are healthful. They may know that eating items from a variety of food groups can improve their nutrient intake. They may, at least conceptually, be aware of the value of whole grains. However, RDs shouldn't make assumptions about how much prior knowledge patients have about nutrition and shouldn't assume patients know, or are even interested in, nutrition esoterica. For example, topics such as heme vs nonheme iron or other complex biochemical concepts may not hold the interest of the students.

When patients have accurate prior knowledge their confidence can grow as the RD presents new information. As observed by Hong and Sternthal in marketing research, "Consumers with extensive prior knowledge of a category evaluate the brand more favorably when the presentation … prompts a sense of progress [confidence in moving forward]. … Consumers with limited knowledge exhibit opposite outcomes."[1] It's reasonable to apply these findings to nutrition education. The more knowledge patients have, the better they can appreciate and use new information. Miller and colleagues, when researching the comprehension of nutrition education in adults, reached a similar conclusion: "In the present study, we found evidence that prior knowledge was a significant predictor of the acquisition of new nutrition knowledge."[2]

Once RDs learn how to effectively assess the level of learners' prior knowledge, they can build on that knowledge with new information. An RD, for example, can gauge the level of prior knowledge of the food group concept by asking learners to sort various pictures or models of foods into their appropriate groupings. How well can they accomplish this? Does anyone make the common error of putting eggs in the dairy group? Do learners demonstrate an understanding of protein sources? Do they give examples of high-sugar snack foods as dietary staples? There's much to be learned by simply observing the group members in action. This exercise engages learners and gives RDs a chance to evaluate them.

After completing this type of warm-up exercise, dietitians can tailor the depth of the food group concept to the lesson they're teaching. Do all the class members understand the concept, or must the RD teach the fundamentals of food groups? Perhaps the students are ready for a more advanced application of the concept. If, for example, RDs are teaching newly diagnosed diabetes patients, they can emphasize how to use the food groups when planning meals. Or, if the dietitians are teaching about diverticulitis, they can discuss substitutions patients can make

for foods within a food group to ensure that their nutrient intake is adequate. The warm-up activity already has displayed prior knowledge, and thereby helped the instructors to guide the rest of the lesson.

Another way to gauge prior knowledge is to look at the facial expressions of learners. This may seem subtle and perhaps not scientific, but it's a skill that's frequently used in classroom education. Often, learners furrow their eyebrows if they become annoyed, overwhelmed, or frustrated. This can indicate that the new knowledge doesn't correlate with their prior knowledge.[3] When learners understand new information, they may sit up straighter, nod, and smile. When they're confused by or disagree with what's being taught, they might grimace, look down or away, or perhaps even shake their heads. These nonverbal cues can indicate their level of acceptance or discomfort with the material. Instructors should observe them and mirror their positive facial expressions: Smile as they smile, nod as they nod, and reaffirm their understanding. Class members that don't seem comfortable with the material should be specifically encouraged as the lesson continues. Changing a lifestyle, even a little bit, can be an emotionally challenging experience. RDs who are observant of and sensitive to their patients' level of familiarity with the material are more likely to enhance the learning experience for everyone.

When Prior Knowledge Is Based on Falsehood

Sometimes learners come with a very concrete set of beliefs that may or may not be correct. For example, a patient may say something such as, "Carbohydrates make me fat, so I never eat carbs." Learners whose prior knowledge is based on misinformation or misconceptions are harder to reach. These misconceptions often come from unreliable sources they've learned to trust, misimpressions from daily experiences, or mistaken expectations.[4] In another example, a person may believe soymilk is a dairy product, or that gluten is only an artificial additive to bread rather than a component of wheat. An individual may believe there's a caloric difference between butter and margarine, or may not realize high fructose corn syrup and organic cane sugar are chemically similar. With so much unreliable information available, there's no limit to the number of misconceptions students may have.

As a learning exercise for the purposes of this course, RDs can explore their own prior knowledge to determine if they hold any misconceptions, so they can appreciate how this feels. For example, dietitians have taken chemistry classes and learned about the states of matter and phase changes (eg, solid, liquid, or gas), yet they commonly hold misconceptions related to the concept of "water vapor." Even textbooks sometimes describe water vapor as steam, fog, or clouds in the sky.[5] But water vapor is invisible to the naked eye; vapor, the gas form of water, is made of individual water molecules carried in the air. Any visible cloud, steam, or fog is made from microscopic droplets of liquid water, not water vapor. Even for chemistry students, it may come as a surprise that if you can see it, it's liquid.[6]

If RDs are surprised by this fact, they should keep in mind that their own students may be equally surprised to learn that they have been making dietary decisions based upon faulty prior knowledge. In another example, a mother, perhaps as a result of information she'd received, may choose to give her baby a bottle of orange juice, rather than a bottle of a sugar-sweetened drink mix or soda, at bedtime, believing this to be a more healthful choice. She

might not realize that the orange juice is acidic and that all three of these beverage options damage teeth and are roughly equivalent in their sugar content. Instead, she has the misconception that all fruit juices are healthful in all circumstances. The enlightenment that accompanies unlearning faulty prior knowledge may be surprising and not always comfortable.

In educational science peer-reviewed literature, misconceptions are sometimes called "alternative conceptions," apparently to make them sound less wrong.[6] But sounding less wrong may create a sense of being right about faulty concepts. In addition, misconceptions can impede future understanding, so it's important for RDs to address the misconception while teaching. However, correcting misconceptions must be done carefully and tactfully. For example, a teacher saying, "That's wrong!" can put a learner on the defensive. If dietitians point out errors in an insensitive way, students may lose self-confidence. When on the defensive, a learner might even regress.[7] If a teacher instead says something such as, "Let me explain how that works," the learner can remain open to new information from an expert.

Students may realize they have been misinformed and may begin making dietary and lifestyle changes based on the new information, or they may quickly dismiss their instruction and continue practicing old habits. To keep from falling back on old habits, they must grow dissatisfied with their existing beliefs.[8] Gopal and colleagues further contend that believing misconceptions often is associated with "... disastrous academic results and other personal consequences for individual students."[8] In dietetics, these potentially "disastrous" consequences have long-term implications.

As learners encounter new material, they will give it greater consideration and be more likely to apply it to their lives if they perceive the information to be "intelligible, plausible, and fruitful."[8] If they don't understand it, or don't believe it will benefit them, they will tend to ignore it. New information may be "blocked" by a learner's prior misconceptions, and therefore not given serious consideration. To counteract misconceptions, it's important to give learners the correct information in a positive way while they're seated in the classroom: "Let's take a look at how carbohydrates really work in the body, and what they can do for you. Let's also discuss the role of carbs in weight management."

RDs can help learners become dissatisfied with incorrect old beliefs by encouraging classroom discussions about the subject matter and how to apply it to daily life.[9]

Presenting statistics also may help. But unless dietitians have assessed their learners' prior knowledge of mathematical concepts, they won't know if the students understand statistical information. It may be more productive to discuss a case study related to the topic, using photos to illustrate disease progression when dietary and lifestyle changes aren't made. Again, using the baby bottle example, discussing tooth decay with statistics about pediatric dental problems to develop a dissatisfaction with the behavior may not be as effective as showing photos in a class setting. Seeing and understanding that putting a child to bed with a bottle of substrate can destroy teeth may be new and persuasive information.

However, RDs should tread carefully when using scare tactics. Dissatisfaction may be an ally, but paralyzing fear can lead to despondency and hopelessness. Showing beautiful teeth and

how to help a child to have them would be the next step in empowering the learners. The goal is to have students walk out of a nutrition class feeling encouraged, rather than experiencing a sense of doom.

Building a Knowledge Base

When learning something new, people usually refer to what they already know.[10,11] It's as if they anchor the new information to something familiar. If information isn't delivered within some sort of familiar context, it's often abstract and confusing. To help learners make connections and avoid confusion, RDs can walk them through the process of surrendering lifelong beliefs and habits based on misconceptions. Embracing new habits requires motivation, encouragement, and coaching.

The following are a few techniques that can help RDs teach students to overcome their lifelong habits and beliefs and move forward to treat their diagnoses with new and accurate knowledge:

• **Respect patients as individuals.** The RD should regard learners' prior knowledge, whether correct or faulty, with respect. It's part of who they are and, therefore, should be approached respectfully. Teach at a pace that's appropriate, using dignified yet conversational language, defining scientific words. Don't overwhelm students. Listen to their words, look at their facial expressions, and observe their body language. In this way the RD can get hints about how much students understand and how difficult the material is for them, all in an atmosphere of respect.

• **Maintain gentle authority in situations that become emotionally heated.** For example, a learner might be absolutely convinced that all foods should be eaten raw, to the point of believing that cooking damages all food and ruins its nutritional value. It might be necessary to gently explain that even raw food has challenging problems, such as the oxalic acid content of raw spinach, that are solved by cooking. Should the learner's facial expression and other indicators show that this is still controversial, it might be best to move on, offering to give a bit more information on this subject after class, rather than continuing to focus on one student. This is a learning time for all the students in the class. One person shouldn't dominate too much class time with a personal opinion, belief, or experience.

• **Encourage learners to formulate and verbalize their responses to questions.** As each concept is presented, ask the students questions right away to make sure they understand. Don't be afraid of silence while awaiting responses. This gives the learners time to formulate their answers. When responses indicate that at least one learner correctly understands the concept, the RD should repeat the correct concept using that learner's words. The RD should not repeat incorrect answers or information.

• **Reinforce the instruction.** Enlist another RD or health care professional, or a past learner who has successfully made changes, to take a moment to reinforce the message. This can help the learners surrender their faulty beliefs as they see the correct information in action. Other RDs can discuss recent and successful case studies from their own practices to reinforce the material. Past learners (graduates) can present their own cases and successes.

• **Give learners clear parameters by which to measure success.** These metrics can include upcoming lab tests, changes in body weight or fitness, improvement in daily blood sugar values, or other appropriate measurements.

• **Ask learners to commit to at least one change, boldly extending an invitation to do so.** The instructor can emphasize that lifestyle changes can bring about positive results and directly ask participants for their commitment to make one or more specific lifestyle changes. Ask them to state appropriate actionable goals they can set for themselves. Using straightforward questions such as, "Will you commit to making this change?" can help the learner to decide on a positive step. It's important to emphasize that new information and new lifestyle habits will require commitment to achieve that success.

• **Leave students with food for thought.** Provide a food sample to taste, something written, or a picture they can take home and think about. For example, in a class about lactose intolerance, a sample of acidophilus milk and a manufacturer's coupon for acidophilus milk may help the learner to taste, see, think about, and perhaps even try a new product. This will help them build on their foundation of correct prior and new knowledge, and overcome any misconceptions. A simple message will be more powerful than a long list of data. For example, a small card on which to write an exercise goal may be more useful and motivating than a long list of various activities and their caloric demand per kilogram per minute.

Making Connections — The Use of the Analogy

Because nutrition education is science education, and nutrition is a science clients apply to their everyday lives, RDs must be able to effectively teach scientific concepts. In science education, analogies often are used, and RDs frequently connect abstract concepts to metaphors or analogies to improve patients' understanding. But dietitians will be able to do this successfully only if they use the analogies or metaphors effectively. Otherwise, they run the risk of misleading learners who can develop lasting misconceptions. When using an analogy, some degree of prior knowledge or experience with the analogous concept is assumed.[11]

Some analogies are so embedded in dietetics that an RD may not realize they are analogies and may use them ineffectively. For example, an RD may say, "Swallowing and the motion of moving food through the digestive tract is a wavelike motion." This describes peristalsis, but it's actually an analogy connected to prior knowledge. While the RD is thinking of rings of muscle each contracting and relaxing in turn as they move food along, the learner may hear "wave" and think of a huge cascade of water curling over and crashing down. This could be connected improperly to the concept of swallowing, creating a visual image of food crashing down into the stomach and beyond.

According to Harrison and Treagust, "Different analogical models are regularly used to teach science … even though little is known about how each student's mental models [imagination, visualization, and prior knowledge] interact with the various models presented by teachers and in textbooks. Mounting evidence suggests that students do not interpret scientific analogical models in the way intended."[12] It's important to simply explain things as clearly as possible without using words or images that could be misinterpreted. Instead, an RD could say,

“Swallowing and the motion of moving food through the digestive tract involves rings of muscle that contract and relax in sequence, pushing food along,” without using the word “wave.”

Analogies can be useful when carefully constructed. Consider, for example, the toy pop bead analogy, used in biochemistry to teach about polymer chains of proteins and essential amino acids (indispensible amino acids). If such an analogy is to be used, RDs should ensure they have a set of colored toy pop beads as a visual aid and be consistent in their discussion of the analogy. It’s important to not assume that everyone in the room has prior knowledge of colored pop beads; the dietitian should hold them up and show them. The RD could use the beads to represent essential (indispensible) amino acids, holding up a bead model of the concept, while explaining that all the essential (indispensible) amino acids must be assembled from various foods. A color should be assigned to each of the amino acids. To demonstrate a complete protein made from the amino acids, the RD connects the pop beads and the “protein” gets longer. The assembly of a complete protein can be demonstrated this way. If the dietitian is vague, or doesn’t have the visual aid, the learner may not understand. In this case, learners can’t see the microscopic real thing (molecular polymers of amino acids). The abstractions and analogies of principles of the unseen world of molecular nutrition can result in misunderstood concepts if the analogies aren’t easy to understand. Therefore, the pop bead analogy would best be supported with visual aids of real foods such as meat, beans, and tortillas or peanut butter with whole grain bread, along with information about the amino acid content of each. For example, to explain the concept of complementary amino acids, show it with the pop bead chains connecting to form complete proteins. Then show beans and tortillas and explain how this analogy applies in real life.

Analogies must accurately connect abstract thoughts to everyday objects or common occurrences that all age groups can understand. Some of today’s adults were born after 1997, or in other words, after round-face clocks, busy signals, and paper roadmaps became less commonplace. They may never have seen a teakettle or a radio dial, so they may not be able to relate to an analogy that refers to such objects or concepts. Similarly, not everyone in a class of senior citizens will understand an analogy involving the Internet, cell phones, or GPS systems.

Here’s an example of an analogy that may not work for everyone: “The circulatory system resembles a roadmap of major roads (“arterials”) leading to smaller roads, which lead to little lanes and down to little alleys and driveways that allow you to reach every single address in town. In this same concept design, blood can flow from the heart through major arteries into smaller ones and eventually into capillaries and on to every individual cell in the body.” This is a great analogy for someone who can visualize and has had experience using a roadmap; it wouldn’t work for someone who has only used voice-command GPS to locate a new address and doesn’t have experience reading a printed map.

Therefore, when teaching, RDs should use universal analogies: the weather, the four seasons, local plants and terrain, temperature, and other concepts such as light vs dark.

While analogies are useful when teaching abstract concepts, it isn’t necessary to use analogies when the concepts to be taught are concrete. For example, dividing foods into food

groups isn't analogous to sorting socks of different colors. A sock-sorting analogy would be inappropriate; simply teach learners how to sort foods of similar origin or nutrient content. In this example, an analogy is not needed; use an analogy only when it will improve understanding.

Assessing Prior Knowledge

As mentioned, before an RD begins a nutrition class, it's important to assess the learners' prior knowledge.[3] As important as it is to understand the impact of prior knowledge, it's difficult to fully assess. That being said, tactics can be used to assess prior knowledge both before and during a classroom situation. Experience helps RDs recognize clues to prior knowledge in addition to the concrete information they can glean. Reviewing medical charts and patient histories can provide clues about age, past experiences, education, and cultural background. However, having learners complete preclass assessment information to gauge prior knowledge is a good approach; there will be fewer surprises, and RDs will have more time to prepare.

One effective strategy is to create a questionnaire to assess prior knowledge and issue the same questionnaire as a posttest.[13] In this way, RDs can gain insight into patients' prior knowledge, gather general information about their nutrition beliefs, and determine whether they gained knowledge from the class. For example, a quick survey given before a prenatal nutrition class could reveal that a participant has been vegan for several years. This would help the RD to include information about adequate protein, calories, B_{12}, iron, and calcium nutrition for expectant vegan mothers. It might also alert the RD that there may be a need for additional teaching about complementary proteins and alternative sources of nutrients. In addition, learning this about a participant would prompt a review of this individual's medical chart to see if there were any relevant issues that could be addressed in the course material. The posttest could assess this person's learning gains, if any, concerning vegetarian nutrition and prenatal demands.

Another way to assess prior knowledge is to begin class with an icebreaker that will provide clues. For example, ask learners to help assign foods to food groups or create simple menus and read them aloud. Ask open-ended rather than leading questions: "What are your thoughts about that?" is generally preferable to a yes-or-no scenario. Questions should also be kept general. "What did you feed your 5-year-old yesterday?" vs "What did you serve your 5-year-old for Sunday dinner?" RDs also should avoid questions that include bias. For example, asking, "What was the last thing you ate?" will garner better information than, "What did you have for breakfast today?" Experienced RDs realize some patients don't eat breakfast or follow any meal pattern. It's important to avoid making patients feel as though they're being put on the spot; this could give them the impression that they need to give the "right" answer, whether accurate or not. Getting the truth from patients is key to providing help and education.

There are students who can provide all the right answers yet cannot apply them to their own lives; they may feel they don't need education. Some learners already know what they could do to improve their situations. If this is apparent from a prior knowledge assessment, the RD can focus teaching on motivation and commitment.

Conclusion

Even though inaccurate prior knowledge creates challenges, having correct prior knowledge can be a useful foundation upon which to build. Assessing and then using the learners' existing foundation in a classroom setting enhances the experience for all. When a heart patient, for example, comes to class with a rudimentary understanding of dietary fats, receives education that builds on that foundation, and leaves with a more developed understanding of diet and health, that patient will be empowered to make improved lifestyle choices.

Dietetics is an area of health care that requires sensitivity and finesse. It's as much about education as it is about therapy. Patients' prior knowledge is an area that demonstrates this need for insight and finesse from the RD. A dietitian must take complex scientific concepts and convey them in a way that's understandable and motivating. Meanwhile, each patient comes to the RD with habits, beliefs, and biases that will influence his or her perception of everything the RD teaches. Prior knowledge isn't easy to identify or assess, but it can make all the difference in the success of nutrition education. An awareness of its existence in every patient and realizing the impact it can have will improve RDs' effectiveness as teachers. Going to the next level—watching for clues and asking questions—can help the dietitian glean information about a patient's prior knowledge.

Finally, written assessment tools can provide some concrete information for the RD to build on. Without an understanding of learners' starting points, it's difficult to take them further and help them make the necessary dietary and lifestyle changes to live healthier lives.

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Click here for handout "A Prior Knowledge Preclass Assessment."

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Examination

1. An alternative conception refers to which of the following?
A. A misconception
B. A bright idea
C. Another viable option
D. A lifestyle choice

2. Faulty prior knowledge brought by the learner is best described as which of the following?
A. A positive starting point for processing new learning
B. A negative impediment to processing new information
C. A positive force that makes learning easy
D. There is no faulty prior knowledge in nutrition education

3. Learners' prior knowledge can be gathered from any source.
A. True
B. False

4. For class participants born after 1997, which of the following analogies would make the least sense?
A. A reference to a social media website
B. The tuning of a radio dial for good reception
C. The difference between cellular and Wi-Fi
D. A GPS mapping guide of an unfamiliar area

5. What's the main reason for assessing the prior knowledge of a class participant?
A. So that the class members can all start from the same point
B. So that it can be used as a foundation on which to build new knowledge
C. To allow a patient to be excused from having to take the class
D. To avoid contention between the dietitian and a student in class

6. What's the result of a patient arriving to class with faulty prior knowledge?
A. Prior knowledge has only a positive impact on the learner
B. It will be dismissed when the patient attends the dietitian's class.
C. It will be of no consequence when learning new material.
D. It may have a negative impact on the patient's ability to process new information.

7. The use of effective analogies in the health care classroom setting has which of the following effects?
A. It can be strategically used to link common prior knowledge and experience to analogous concepts.
B. It often confuses the learner and should have no real place in teaching scientific concepts.
C. It can seem argumentative and defensive to a participant, building mistrust.
D. Analogous concepts waste time that should be spent learning facts and data that apply to the diagnosis.

8. Which of the following is true about prior nutrition knowledge brought by class members?
A. It makes a difference in one-on-one counseling but not in the classroom setting.
B. It may be assessed by the RD before the class through pretests or review of medical charts and also during the class.
C. It must be unlearned during class because the RD is the nutrition expert and must make the class members understand the correct concepts.
D. It's always of benefit, so the classes should be open forums where everyone gets to have their say.

9. Which of the following expressions or gestures may learners make in response to positive learning experiences?
A. Knitting their eyebrows
B. Opening their eyes widely
C. Frowning and pursing their lips
D. Hanging their heads downward

10. To cause a lifestyle change, new knowledge must be linked to which of the following?
A. Science
B. A medical diagnosis
C. Dissatisfaction
D. An examination