Educating Young Children

A Neurodevelopmental Approach

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by

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About the Author

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Maria Sargent has been active for more than 30 years in general education, special education, behavior intervention, and arts intervention. She is a full professor at Ashland University in Ashland, Ohio. Dr. Sargent is known for cross-disciplinary work training professionals in medicine, psychology, the arts, and the legal sector, in addition to the expected audience of educators. Her work history has also spanned a wide variety of ages and populations (e.g., Behavioral Intervention Coordinator/Cuyahoga County Board of Mental Health; Research Coordinator/Akron Children's Hospital's Family Child Learning Center; Infant-Toddler Program Coordinator/Kent State University and Child Development Center; Director of the Behavior and Parenting Resource Center/multiple state, national, and international locations; Behavior Intervention and Curriculum Design Consultant/birth through grade 12), and she has just finished a 12-year tenure as a board member or board president of ArtSparks (https://www.artsparksdance.org/), an arts intervention program operating across Northeast Ohio.

Introduction

Individuals enter the field of teacher education with the full intent of developing a set of teaching skills that will benefit students and allow them to become productive adults. In an attempt to reach this goal, they research, study, and rehearse a vast array of strategies that supposedly reflect the best approaches in the field. Eventually, though, conflicting messages are received about most of these components, especially if a career spans decades. What was previously considered a best practice in one moment is discarded in the next.

At first glance, this transformation can be construed as the normal evolution of pedagogy. As additional information becomes available, models should be refined or eliminated. This is not the reality of the field, however. In education, techniques are adopted, discarded, and then adopted once more at a later time, often very close to their original form. Many educators do not realize this cycle is occurring because either their tenure in the field is too short or slight differences in naming mask the similarity of a newer design with a historical one.

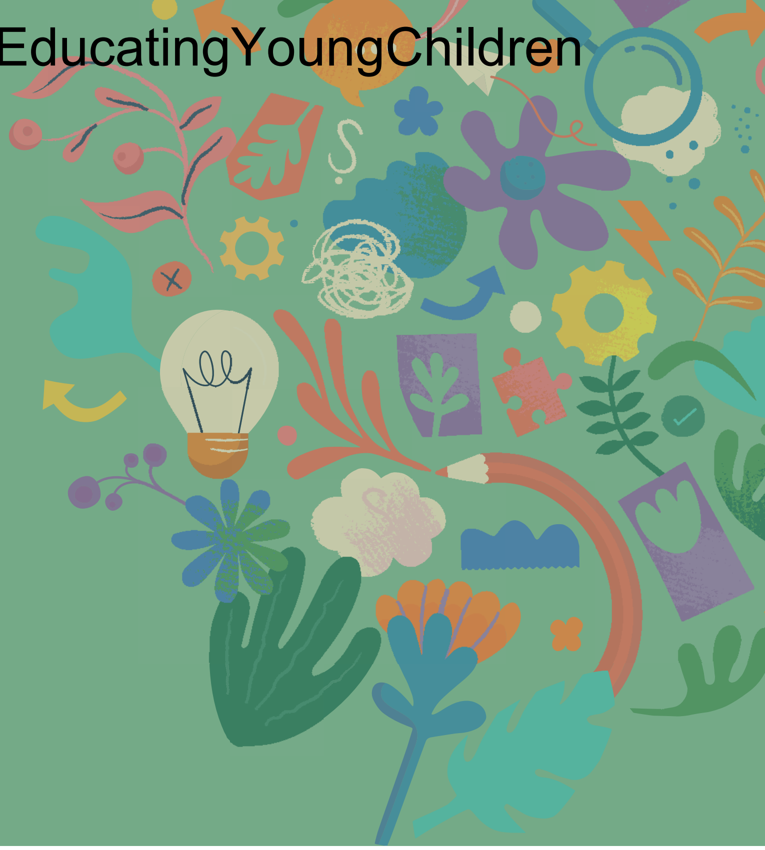
This book attempts to unify the considerable number of theories that drive educational strategies under the umbrella of neurodevelopmental learning. When that process is completed, it becomes clear that most methods truly are valuable, but maybe only valuable in a certain situation or for a certain population. Teachers, in their honorable quest for excellence, notice the struggles of some students, and in an attempt to correct the problem, they begin migrating to the opposite side of neurological continuums. Back and forth across the spectrum of practice travels the field in a pedagogy-go-round circle that never seems to end. Sadly, many teachers never realize that the answer to developing fully responsive practice for diverse populations is not achieved by adopting the latest model but, instead, is found by embracing the total array of models that span teaching history.

The goal of this book is to break this cycle and reclaim our heritage as teachers. A wholesale adoption of each and every method is not being suggested. A systematic framework will be used to fully analyze and collapse strategies into logical categories that will meet the needs of all students. Readers are encouraged to infuse their own knowledge and experience into this design in hopes that their own expertise will also be captured. Only in this manner will educational pedagogy move forward rather than retreading the same roadways of the past.

This book is dedicated to JMJ, ADP, JBLS, SJC, SOH, JNN, SJB, SJOC, EAS, BON, STC, TLF, SDG, SPP, MMA, and especially RPS and my family. Thank you for your assistance with this project.

1

Brain Research and Learning



Exemplary practice in early childhood education has been pursued since education of young children was formalized in the distant past. In the modern day, it would be difficult to find an early childhood professional who couldn't rattle off any number of fundamental beliefs. Even those in the earliest years of their preparation would find a list of a few of the most basic concepts familiar:

- Active learning
- Attractive environments
- Authentic assessment
- Behavior support
- Choice making
- Developmentally appropriate practice
- Differentiated teaching
- Engaging materials
- Family/caregiver involvement
- Play
- Respect for diversity

The list could go on and on. Early childhood professionals understand these concepts and appreciate their purpose, but the question is, can they fully explain *why* they are effective? There definitely has been enough experience to show that these practices do work, and work well, but the question remains, what are the physiological reasons why these practices are so successful in classrooms serving young children?

In this chapter, that question will be explored. Some may ask why it is important to know all of the science behind these methods, and it is a legitimate question to ask. So, consider a person making a chair out of wood. The individual who creates the chair from a kit will end up with a lovely chair at the end, but if a piece breaks or does not fit properly or a second chair needs to be produced, the person would struggle. All they know how to do is put that chair together, step by step, following the printed instructions and using the provided pieces. They might be able to duplicate the chair pieces well enough to create a close copy, but they would probably be unable to make that chair larger or smaller, to explain why each type of wood is suitable or unsuitable to use, or to make major changes to the original design. The individual can definitely construct a chair, if given the right kit, but they would find it difficult to modify the original design or create a new chair.

Early childhood professionals are faced with the same demands. They are given practices that they must often modify. They know the basics and have a sense of why they work, so they are able to adjust them to a degree, but without a more complete framework, they are unlikely to be as responsive or creative as they could be if given a bit more information. The lovely thing these professionals will discover as they begin to explore these neurological foundations, though, is that they are on the right track in the field. There is definitely neuroscience support for every practice, so they can rest assured that the field is moving in the right direction. However, they need more information, especially given the diversity in today's classroom. The exploration of this concept will begin with one of the most foundational concepts, active learning.

BRAIN RESEARCH AND THE MEMORY PROCESS

Active learning is a thread that runs through any document about exemplary teaching practices for young children. It can be found scattered across the National Association for the Education of Young Children's *Position Statement on Developmentally Appropriate Practice* (2020) and is also the running theme found in the Division for Early Childhood/Council for Exceptional Children's *Initial Practice-Based Professional Preparation Standards for Early Interventionists/Early Childhood Special Educators* (2020). To summarize, children learn best when they are actively engaged with materials in a supportive, play-based environment that engages all of their senses. Educators not only intuitively know this fact but also can readily verify it by just watching young children learn. They move, they touch, they taste, they smell, they listen, they observe, and they have a darn good time doing it. So, active learning, a foundational concept of the field, is a given. The neuroscience behind this most basic of beliefs, however, needs to be explored.

The Process of Engram (Memory) Development

Teaching is designed to help students put information into memory in such a way that they will be able to retrieve it at a later time. This information comes into the brain through a filter, known as the reticular activating system (RAS), which automatically determines which information should be given priority. It is very receptive to intense sensory input, especially if it is exciting and occurring in a comfortable and secure environment. These are the memories that will be permitted to move on to be processed (Willis, 2010). Early childhood classrooms are typically primed to be just this type of learning environment. They are engaging, exciting, and joyful. The environment that teachers are driven to create for students is just the type of setting that will super-charge the RAS process, increasing the likelihood that the information the students are taking in will receive priority in their brains and be stored long term. But, there is more.

Once information makes its way past the barriers of the RAS system that will (should) filter out the unnecessary stimuli, which include things like the sensation the students feel from the clothing on their backs, it continues to be processed by the brain and hopefully will eventually end up in memory. This process is known as engram formation.

Engrams, originally theorized by Richard Semon in 1904, were suggested as a physical model that would illustrate how the brain forms a memory (Josselyn & Tonegawa, 2020). An engram is formed when neurons are activated by stimuli. When this activation occurs, the neurons, which are scattered across the brain, are linked, and they then become sensitive to that stimulus as a group, or circle, of neurons. Repeat that learning experience, and the connections between the neurons that form that memory are strengthened, and they begin to fire together. In other words, a memory is not stored in one place in the brain; it is a linkage of activated neurons that are found in many parts of the brain (Sousa, 2016b), as can be seen in Figure 1.1.

That initial theory, suggesting the formation of engrams, was difficult to substantiate in the early 20th century, however, and was essentially abandoned for years. But modern science, with its improved technology, has expanded the concept and solidified its validity. Engrams as a working framework for memory formation are now a widely accepted part of the neuroscience field. It has even been found that engrams are not only formed for physical and sensory information but also formed for other aspects of learning, including emotional learning (Bocchio et al., 2017). Not only have

ENGRAM FORMATION

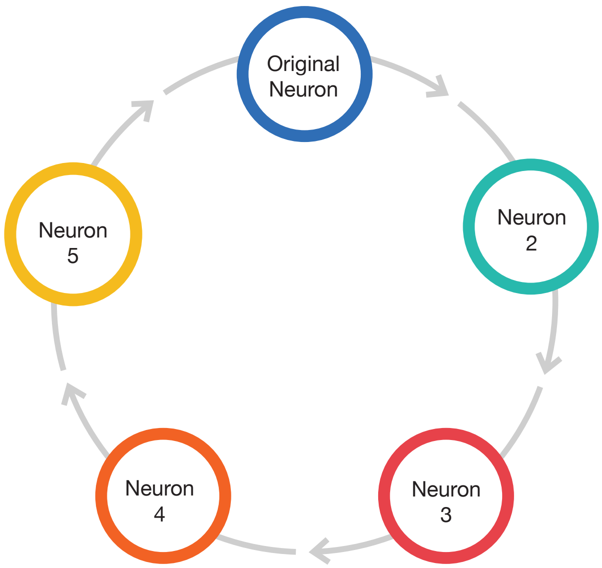


Figure 1.1. An engram crosses multiple areas of the brain. Make sure to help students construct a robust memory by using the processing modes preferred by the student.

scientists verified the process, but they have also started to map specific engram formations to the degree that specific responses can be triggered with consistent results (Tonegawa et al., 2015).

The science behind engrams is especially intriguing for early childhood educators because it means that when children are engaged in multisensory learning, they are forming extensive engrams (memories) that cross multiple parts of the brain. The wider the experience, the more expansive is the circle of neurons it will produce. That in itself is powerful support for learning experiences that engage a student's physical body, vision, hearing, touch, emotions, and other senses. In other words, there is a strong reason why active learning is the foundation of most classrooms. Educators intuitively know that active learning strengthens memory, but now they can put in words exactly why it works. Understanding this foundation also means that a teacher can manipulate the process in a purposeful manner—to build a new chair, so to speak.

All children have learning preferences. Some like to move, and others prefer to sit and quietly observe. Some children are drawn to intense sensory experiences; others want a more gentle interaction. It is clear that students have learning preferences and, in turn, parts of their brain that tend to be favored during the learning process. Teachers can link this observed difference with the process of engram formation and leverage it to the fullest.

If educators are working with a student who learns best through sensory experiences, they just need to make sure to widen that engram to include sensory information. For some reason, that student processes and retrieves information best when that part of the brain is involved, so this type of learning should be included, even if it has to be artificially added to the learning experience. Here are a few examples of interventions that build upon this engram-expansion concept:

Problem	Student's Strength	Approach Used
Reading comprehension	Physical movement	Read while drawing a small line on paper with one hand
Spelling words	Sensory	Write words on paper that has been placed on top of sandpaper, causing slight pencil vibration
Square versus rectangle	Visual	Visualize a square being pressed down into a rectangle by a big foot
Behavior chart failure	Physical + sensory	Make chart interactive with Velcro so student has to place and remove pieces

Of course these are just examples, so the exact techniques to be used for a particular situation will vary, but this approach really does work, and best of all, it works regardless of the age of the student. It can be used to help a student learn addition, but it can also be used to help college students study algebra. Find the part of the brain that retrieves memory best for that student, and then just make sure that it is included in the learning experience. In short, make sure to expand that engram.

The Difference Between Implicit and Explicit Memory

A general sense of engram/memory formation has now been established, but there are many other aspects of memory to be explored. One worth mentioning is the difference between implicit (nondeclarative) and explicit (declarative) memory.

Implicit memories occur at an unconscious level. There are many aspects of a skill that are influenced by factors that fly under the radar, and many of them may be quite distant from the actual learning event. A student may have been laughed at once during a sharing time in class and will carry that memory unconsciously into other social interactions in the later years. The student will not specifically recall the event, but the discomfort that was felt long ago created a memory that will trigger a sense of anxiety in similar events over the long term. In other words, implicit memories have a powerful impact even when they are hidden as distinct learning episodes (Jensen & McConchie, 2020).

In turn, the memories that are part of consciousness are explicit memories, and these can be recalled and examined in a direct manner. Sometimes these explicit memories are semantic in nature; they are memories associated with facts and other discreet pieces of knowledge they have learned. Other times, they are episodic, associated with a location or event.

For example, when a student recalls an episodic memory of a field trip to the zoo, that event pulls other related memories forward to consciousness. The student remembers the animals that were seen, the special pizza lunch that was enjoyed that day, and the bus trip to the location. These explicit memories are further enhanced when the episode or semantic knowledge is exciting and draws intense attention, a fact that circles us right back to the development of engrams. Multisensory experiences, by their very nature, are motivating (Jensen & McConchie, 2020).

Linking the knowledge of engram formation with awareness of memory forms (implicit and explicit) provides a powerful way to enhance learning. The engram can be expanded to include multisensory modes of learning, and this will produce a novel learning situation that is likely to be retained as an episodic or semantic memory. The more expansive the multisensory approach, the more likely it is that a teacher will include the learning preferences of all the students in the classroom. As long as an attempt is made to include as many different learning modalities as possible, an educator can feel secure that they are providing a variety of neural avenues for engram development.

Explicit memories are rather easy to enhance because they are targeted so heavily in typical classroom activities, but what about implicit memories? Well, they are a bit more difficult to address, and that is unfortunate because the learning curve associated with implicit memory development is rapid and not as impacted by age as explicit memories. This means that when skills are embedded into activities, they are unconsciously absorbed and memories are formed and formed well, even in the youngest of children (Jongbloed-Perebooma et al., 2019).

There is a great deal of overlap between explicit and implicit learning, so it is true that rarely does one form of learning progress without the other, but it is also clear that unconscious (or less targeted) learning activities could be used more in classrooms. Just knowing the difference between implicit and explicit memories really helps educators understand how to teach various skills. For example, a dancer must develop an implicit memory for many different dance steps. Until these memories are well formed and recalled perfectly from the subconscious, the dancer cannot free up the brain enough to address explicit or conscious information. They are not able to interpret music, problem-solve an unexpected change in stage position, or create using that step. The same process occurs for any skill that involves both an unconscious motor pattern and a conscious application of the skill. This is why learning to drive is such a difficult task for most people. They are so busy trying to remember which peddle works the gas that the brain cannot deal with other little items such as road signs. It is not until the motor patterns of driving become automatic that the driver can free up enough of the brain to manage other tasks, such as looking at a map or talking to a friend, without compromising driving ability.

What are some implicit activities that can be targeted for enhancement in the classroom? The best candidates are the skills that need to be rotely learned but require a level of practice that could be boring if brought to consciousness. To make matters worse, these repetitive skills tend to be the ones that must be learned at an automatic recall level before any real problem solving with those skills can be completed easily and rapidly. For example, basic math facts must be learned well before a student can go on to use them for advanced concepts such as long division. It is true that these facts could be taught in a direct manner, but giving

COLORING ACTIVITY

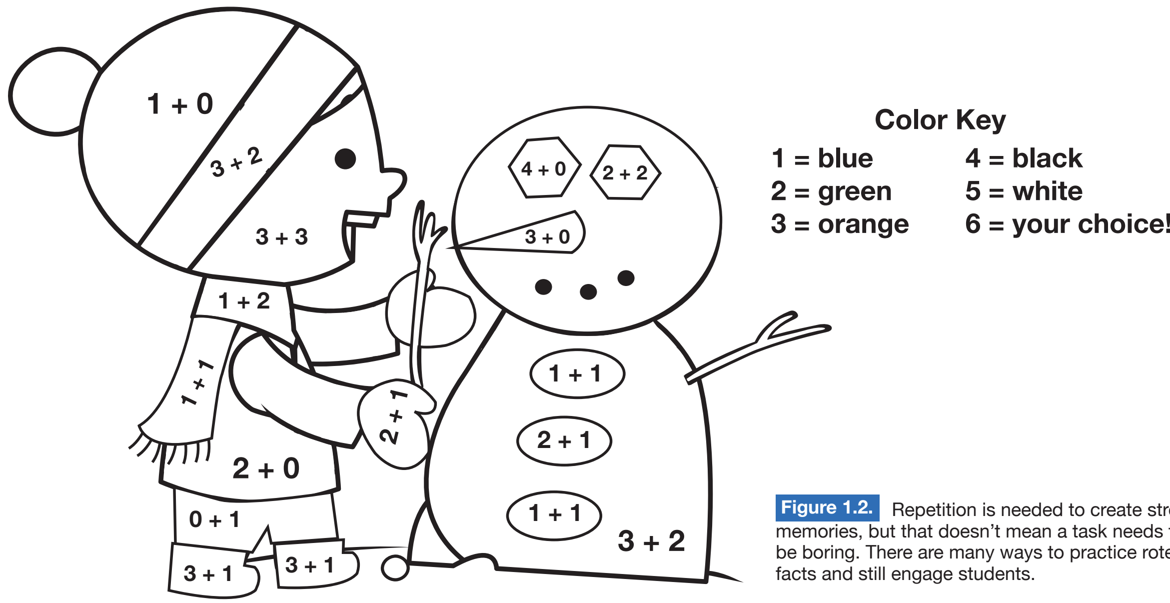
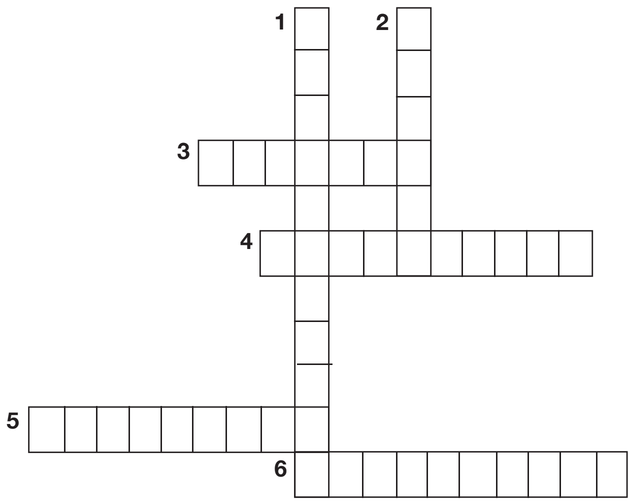


Figure 1.2. Repetition is needed to create strong memories, but that doesn't mean a task needs to be boring. There are many ways to practice rote facts and still engage students.

students pages of equations to complete is rather boring, which may hinder memory by reducing attention. It is a much better idea to try an unusual but interesting activity such as having students create color-by-equation sheets instead, as illustrated in Figure 1.2.

This type of activity utilizes the power of implicit learning. As the students work through choosing their sheet, adding a color key for each possible answer, and then writing the equations in each space so the colors chosen make sense, they are repeating the equations unconsciously over and over, typically way more times than if they were asked to work on this task in another manner. Then, when they trade their sheets and work on the one they receive, they are again repeating the equations in their minds. And finally, at the end, they get their own sheets back to check their friend's work, once again reviewing the equations silently. The sheer number of times the students repeat the equations over the course of this activity is amazing, but because it is a silent part of a novel task, the skills become embedded in memory with little notice. This type of approach can be useful for any rote task that needs to be placed in memory in a quiet manner. For example, teaching spelling

SPELLING ACTIVITY

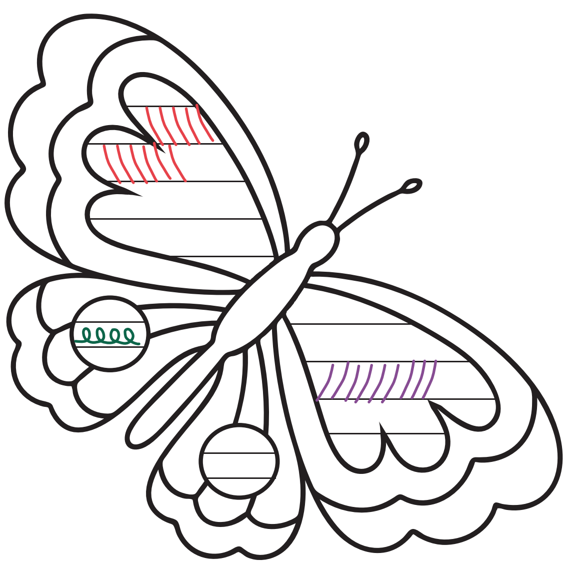


Words Repeated While…

1. Trying to create the puzzle
2. Creating the definition and answer sheet
3. Working a peer's puzzle
4. Checking their own puzzle once their friend is finished

Figure 1.3. Think about how to take rote memorization tasks and embed them into games that will maintain students' interest and encourage effortless repetition.

WRITING STROKES



Add lines to any coloring sheet, and then have the children fill in each section with a writing stroke they are trying to master. Have them complete the task using fine-tip colored markers or colored pencils in the color of their choice.

They will quickly learn that the pictures look best when the strokes are completed close together. This will encourage them to repeat the stroke many more times than can be encouraged using a worksheet.

Figure 1.4. Even the most tedious activity, like practicing handwriting strokes, can be embedded in engaging lessons.

words with meaningless drills can be modified to become a more engaging task that involves the creation of crossword puzzles, as shown in Figure 1.3.

And, using a variety of strokes to "color" pictures, as seen in Figure 1.4, is a wonderful way to integrate cursive handwriting practice into a fun art activity.

In the early childhood classroom, this type of implicit learning episode supports not only preacademic or academic skills but also behavior and classroom function concepts.

For example, placing an outline of small feet around the sand table can encourage appropriate self-space instantly and often without any additional directions from the teacher. Most children will automatically walk up and step on top of a pair of footprints without thinking. If for some reason a child is not responding, an incidental cue, such as the teacher saying, "Oh, so sorry! My foot was moving off my space!" and then looking down and moving into position, will be enough of a reminder to encourage every child who is present to check their

TRY IT!

Begin by writing your first and last name in cursive. It must be in cursive, not print.

First and Last Name

This will be your baseline to compare to your second signature. If you are right-handed, do the following:

Right-Handed Writers:

1. Cross your *right leg* over your *left knee.*
2. Rotate your *right foot* at the ankle *counterclockwise for 20 seconds.*
3. While still circling your foot, write your name in cursive again.

If you are left-handed, do this instead:

Left-Handed Writers:

1. Cross your *left leg* over your *right knee.*
2. Rotate your *left foot* at the ankle *clockwise for 20 seconds.*
3. While still circling your foot, write your name in cursive again.

How does your first signature compare to your second try?

Figure 1.5. The retrieval of a memory can be disrupted easily. Just because an individual knows information does not mean they can express it.

own location. This is a nonintrusive way to provide an implicit memory cue that the students will use to internally remind themselves of a behavior and is such a powerful tool that it will be explored again in both the classroom function chapter (Chapter 6) and the behavior support chapter (Chapter 7).

UNDERSTANDING VERSUS EXPRESSION

Knowing how to create robust, long-lasting memories is very important, but teaching would fall short unless educators knew which type of skills needed to be taught. This is where the concept of understanding and expression comes in. Before this concept is explained, try the short activity described in Figure 1.5.

What were the results of this writing exercise? Some people manage this task fairly well, especially if they have experience playing sports or a musical instrument. Those activities strengthen a person's ability to complete motor tasks that cross hemispheres, and writing falls within this category. But, for most people, retrieving the memory of how to write their name was hindered, at least to a slight degree, making it difficult to write the name again. Some people manage the problem by stopping and starting the circling of their foot. What they are doing is creating a mental traffic officer in their brain. First, one task is addressed (circling foot) and then the other (producing part of the signature). Back and forth the brain goes until the whole name is finished. The result might not be stellar, but the signature is on paper. Other people, though, just crash and burn. The signature they produce in no way resembles their baseline product.

This set of results requires serious reflection for a moment. Here is a situation where people have a skill in memory; they *understand* how to write their name. After all, they have signed their name thousands of times before. But, for some strange reason, many people have difficulty showing or *expressing* that same skill during this task. This struggle has a more extensive explanation, and it will be further illuminated in Chapter 8 when processing disorders are discussed (hint: this is a simulation of the condition known as dysgraphia), but for now, just realize that understanding and expression are two separate parts of the learning process.

So, how would most educators respond if they saw a student struggling with writing their name? What would they do? Well, they would teach it to them! They would go over the letters, maybe review how the child should hold the pencil, provide models, give them hands-on experiences in sand or clay so they could form the letters properly, or even create little songs to help the child remember the sequence of letters. But was that the problem if you struggled with this simulation? No, writing a name is something that most people have in memory; the problem was with expressing the signature. This is an important difference. This means that the best teach-someone-how-to-write-their-name curriculum on the planet is not going to help produce a better result because the process of writing the name is already known. This difference is also reflected in students' performance as well. If the student already understands a skill but is unable to express it, no amount of "teaching" will help them,

UNDERSTANDING PROBLEM

One day, a 5-year-old child was helping the family cut corn off the cob. The child was placing the finished cobs in the trash bin but stopped suddenly and exclaimed, "Hey, that looks like corn in a can!" Perplexed, the parent started to respond, but the child continued excitedly, "I get it! The people in the factory cut the corn cobs, and then they put it in a can. Corn-on-the-cob is corn-in-a-can. I wonder about green beans?"

Figure 1.6. Sometimes children, especially very young children, can rotely express information that they do not fully understand. Consider how this fact may impact assessments.

EXPRESSION PROBLEM

A student was reading a story about a panda who went to a roller-skating party. The student appeared to follow the storyline and laughed about the panda doing the Hokey-Pokey. However, the child did not complete any of the follow-up activity that tested reading comprehension. When questioned, it became clear that the student could totally recall the story. When asked why none of the questions had been answered, the student replied, "I couldn't tell you a panda did all of that. Everyone knows that pandas can't really roller skate!"

Figure 1.7. There are many reasons children fail to express information that they truly know. When in doubt, asking some probing questions to determine the exact cause of the problem will help an educator determine the true nature of the learning discrepancy.

and if attempted repeatedly, both the teacher and the student will just end up frustrated. The skill does not need to be taught; it needs to be enabled.

This difference, the difference between understanding a skill and being able to produce, or express, it, is critical. If an educator targets the wrong side of the skill, the best methods can be used but few results will be seen. Peter and Marian Hainsworth, the husband and wife team who ran one of the longest federally funded early intervention research projects during the 1980s and 1990s, fully explored this concept as a foundational part of their Early Recognition Intervention Network (Hainsworth & Hainsworth, 1993). Other authors have also explored these categories, but the focus was often on the receptive and expressive qualities of language rather than general neurological processing. For this reason, the Hainsworths' work serves as the perfect historical foundation for other concepts that will be addressed later from more contemporary authors.

Understanding Versus Expression of Skills

The best way to explore this concept in early childhood is to examine a couple of examples. Figure 1.6 serves as a wonderful example of a young child who is having difficulty with an understanding skill.

This example shows how easily young children can speak about concepts and use terms but still have an incomplete idea about what they really mean. In this scenario, the child knew about "corn on the cob" and "corn in a can" but for some reason had never connected the two concepts. Clearly, children can express concepts even if they do not fully understand them.

Just as a child may be able to express concepts or skills that they don't understand, they may also appear to understand concepts but not really have the ability (or desire) to express them. An example of this problem is described in Figure 1.7.

In this case, the student truly understood the story and should have been able to complete the comprehension exercise perfectly. The student, however, was not willing to express this knowledge because the panda in the story was roller skating and doing the Hokey-Pokey, a concept that the child felt was just too incredulous to even discuss. There are many reasons why a child may understand information but be unwilling to use it, and the logic of a child is one of those reasons. It is very important for educators to realize that the lack of expression, whether it involves completing tasks, answering questions verbally, or completing assessments, should not automatically be construed as meaning the child lacks understanding. This type of error can result in inaccurate assessment data and will be further explored in the assessment chapter, Chapter 12.

As can be seen, understanding and expression are key concepts to keep in mind. Unless a teacher examines both sides of the learning process, the risk of using wonderful techniques in very poor ways can occur. However, it is also important to realize that there are some tendencies in the education field that make discerning the difference between understanding problems and expression problems a bit harder than it should be.

Assumptions About Understanding and Expression

When teachers problem-solve how to work with a child who is having difficulty, they tend to make certain assumptions. With most academic or academically related subjects, they tend to assume the child does not understand the concept or skill. For many children, however, their true difficulty lies with expression. Maybe it's shyness, fear, confusion, or a processing issue, but regardless of the source of the problem, many children fully understand, and no amount of additional teaching is needed. It is a common mistake to view any issue with an academic or functional skill as an understanding problem when it really may be an expression problem. Instead of teaching the skill, what teachers really need to do is to find a better way for the child to express what they already know.

The reverse misconception, automatically labeling an expression problem as an understanding problem, occurs most often in relation to behavior issues. Teachers are likely to assume that the student is not cooperating when they ask them to clean up, complete their work, study, and so on. Teachers are convinced that students know perfectly well what they should be doing but are choosing an inappropriate behavior, but that is not always the case. Many children lack behavior skills, and until those skills are taught, the teacher will continue to see misbehavior. For example, many students must be taught how to keep their bodies quiet in circle or group activities, control impulses, reduce aggressive play, use language that is respectful to others, and any number of other behaviors. The environment and the home do not do as good of a job teaching those skills in daily life as in the past. Strategies to combat these emerging problems will be included in Chapter 7.

An important task for teachers, then, is to figure out the nature of the student's difficulty—understanding or expression. If educators do not take the time to analyze this issue right from the beginning, they are setting both the child and themselves up for failure. This error causes many teachers to use wonderful teaching strategies overall, but since they are not the right ones for that particular student, the strategies are not effective. When teachers ignore the concept of understanding versus expression, the same outcome will result: a child's frustration and disengagement from the learning process.

So what are "understanding" and "expression," and how can these strategies be used with children? If a child has understanding, they have formed basic mental concepts of the topic or skill. They recognize its pattern and can use the information with increasing skill to mentally manipulate and solve problems. Eventually, they will be able to generalize the concepts to new situations. Expression works in tandem with understanding for *most* children. Expression is the showing or using of a concept in a tangible way. Some children express skills through their hands, others in their speech, and still others by the way they emotionally respond to something or someone. In most situations, children readily express what they know, but this is not always the case, as was seen in the earlier example with the roller-skating panda.

Regardless of which issue is of concern, it is important that teachers take a moment to explore exactly why a student is not showing us a skill. Yes, maybe it is an understanding problem, and in that case, further teaching is needed. But, in many cases, the problem is more retrieval than knowledge, and without assistance to improve retrieval, the child will not be able to fully express what they actually do know. How to manage both understanding and expression problems will be discussed in more depth, but first, another piece of the neuroscience puzzle must be put into place so the techniques to be used are fully understood.

GENERAL CLASSROOM DESIGN AND THE IMPACT ON MEMORY

The goal of the teaching process in early childhood classrooms is to establish a memory that lasts long enough to influence a student's function in later years. These early experiences also set the conscious and unconscious tone for how the students will go on to perceive the world. These early educational experiences will help the students determine whether learning is enjoyable, whether authority figures should be trusted, and

LEARNING ENVIRONMENT

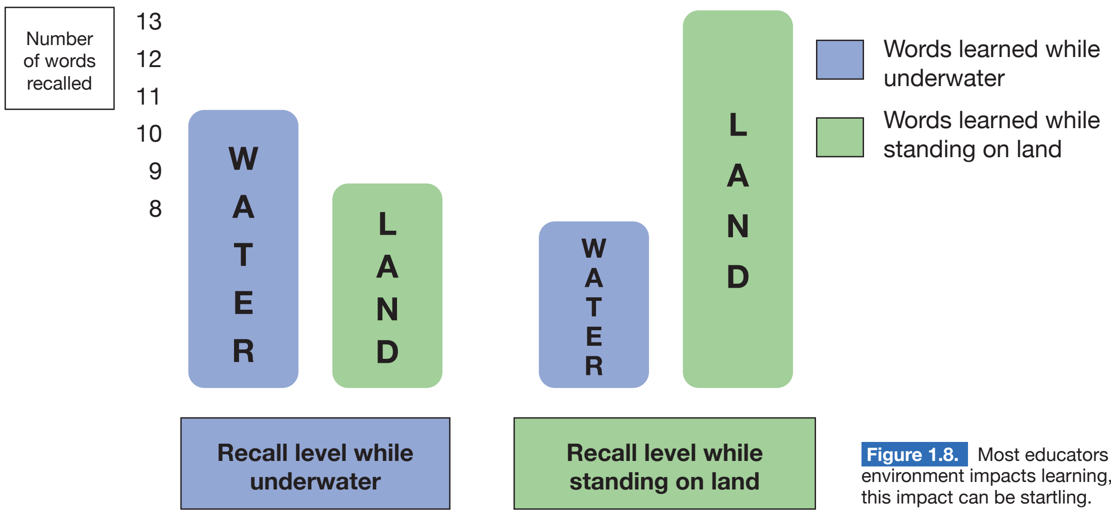


Figure 1.8. Most educators understand that the environment impacts learning, but the degree of this impact can be startling.

how the world will respond to both success and error. In short, early childhood teachers are wiring students' brains for the rest of their lives. It is important, then, to make sure the memories are good ones!

Learning Environments and Memory

Over the years, teachers have attempted to create a wonderful learning environment, and in the process, the field of education has seen many curriculum designs come and go. In some eras, classrooms were very structured and educational activities did not vary, often to the point of being painfully boring. In other eras, classrooms were open and activities freely chosen by the students, either in part or whole. The most important thing to realize is that memory is influenced by the design of the environment, so historical differences in classroom structure are part of the students' memories. It may be an implicit memory, unconscious in nature, but it is there. How much does this environmental design influence the memories produced? It is definitely present, but the *degree* to which it influences later memory recall is a bit open to debate.

For example, early studies linked the learning environment not only to memory development but also to recall. For example, a study in 1975 showed that words learned in a specific environment, in this case underwater or on land, were remembered best if the recall event occurred in the same environment (Godden & Baddeley, 1975). The results in that particular student showed a very strong response to learning modality, as shown in Figure 1.8.

While this study showed a strong influence of environment on memory, later studies produced a variety of results. For example, one study explored the impact of alternative learning environments, such as tutorial rooms, on surgical procedures, skills that require a high level of accuracy. The impact of the overall physical environment proved to be minimal, however. The targeted concepts were learned well in both a tutorial setting and the surgical theatre setting (Coveney et al., 2013). Later studies continued to explore this concept and also found that variations in the purely physical environment, on their own, had minimal learning impact, and if there was an impact, it was immediate in nature and did not appear to change expression of learned material in a significant manner (Schumacher et al., 2000).

What does this mean for the field of early childhood education and the discussion about understanding, expression, and memory? Does this mean that the environment has no impact? Well, there was one key factor that began to emerge that did have a great impact, and that was the emotional aspect of experiences, including those in educational settings. Situations that include intense emotion are remembered longer and with more clarity than situations that are boring or neutral. This means that the level of engagement of the learner is paramount to the learning process, and the physical environment and activities are the catalyst for this emotional engagement (Tyng et al., 2017).

This fact is especially crucial for learning environments associated with the education of young children. The classroom environment can produce excitement if constructed well. If memory is positively influenced by high emotion and engagement and the physical environment is the catalyst for these positive emotions, early childhood professionals must recognize that classroom design in itself can enhance memory as much as the instruction within that environment. The emotional engagement of the children is the factor related to both of these variables and should be addressed equally. This is why material design and modification will be addressed so thoroughly in this book.

While stimulating environments can enhance memory from a purely emotional standpoint, there are several mitigating factors that must be taken into account to achieve the best student response. For example, an environment may be interesting to students, but if the children are not ready for the information, even if exciting and engaging, the activity will produce little growth (Sousa & Tomlinson, 2018). In other words, emotion can enhance learning but only if it is developmentally and individually appropriate for the student. It is also important to note that memory and engagement will not *automatically* transfer into knowledge that is usable long term in the real world. These connections must be purposefully fostered (McDowell, 2020) and should be considered as part of the planning process. In other words, creating a wonderful learning environment is critical, but if the teaching is not occurring simultaneously, the power of that environment will be lost.

Some researchers have also found that the response to the environment is not simply contingent on readiness; they suggest that it is also a factor of genetics. The activities and learning environments that may be motivating to one student may be overstimulating and discouraging to another, so variations in learning rate may be more inherent to the child's physiological makeup than first realized (Kova et al., 2013). Other factors that fall outside of the school environment, including sleep habits, nutrition, and physical activity, will also influence how the student functions in the classroom and the rate of learning that is possible under those conditions (Collins, 2019), so creating a lovely learning atmosphere is more than just determining age-appropriate materials. It must be responsive to the individual needs of the students who are using that environment.

This is why it is important for teachers to review the students' responses to both the physical environment and the style of instruction in order to provide the best learning experience for all children. It is not enough to follow pedagogy trends just because they are the current mode of operation that will theoretically create the "best" learning environment. What is considered "best" and likely to enhance memory is a fluid definition that changes historically. Anyone who has taught for a long period of time will be happy to share stories about the pedagogy-go-round that most teachers have experienced.

No, the techniques and materials must be analyzed for how they interface with the group of students who are present that year, separate from the overarching curriculum trends of the moment. This can seem like a daunting task, though, because it requires a teacher to modify and analyze in real time. To help in this task, suggestions will be made in Chapter 3, Leveraging the Power of Materials and Environmental Design, so the task does not become overwhelming. There are ways to adjust the teaching approach for diverse groups of students without having to totally replace a set of strategies each year.

Curriculum Design and Long-Term Behavioral Patterns

Another interesting point to ponder has to do with the overall conceptual memory of the students' learning experience. As mentioned earlier, there are implicit memories that form that are unconscious in nature. This means that there are also hidden memories being created in students that stem from the curriculum design itself, especially if that design is very pure and the students do not experience other ways of learning. A lack of diversity in teaching approach can produce inherent learning expectations that could be problematic down the road. These include the following.

Curriculum That Is Totally Student Driven

If a student is in complete control of their learning at all times (i.e., the student chooses the topic, time, and method for all learning episodes), they are placing into the memory the direction of the flow of the learning process used by that curriculum. These students may be at risk in later classrooms where there is a standards-driven or curriculum-driven set of objectives that is used by the classroom teacher to set the day's schedule. These students are used to setting their own agenda and deciding which tasks will be completed and which will be skipped. When this choice is not permitted, the student will often disengage.

Overemphasis on Discovery Learning

Students who are encouraged to rely completely on discovery learning may consider their own perception to be the only source of knowledge. They may view teachers as being planners of environments and a source of resources, but they will not necessarily view them as people who can directly provide information. These students can carry this attitude forward into later childhood and adolescence, discounting the advice, experiences, or perceptions of others, including the adults and teachers around them. They insist on figuring things out on their own through direct experience, have no use for historical or experiential knowledge of others, and feel compelled to defend their own understanding of situations, even when that understanding is limited.

Total Teacher Control of Curriculum

Students who have little choice about learning activities can become overreliant on authority. They can lose the impulse to experiment and are less intrinsically motivated to learn material, especially if that material is not directly assigned by an authority figure. These students will come to expect that only material provided by the teacher needs to be learned and then only if it is mandated. The student's judgment of an adequate or inadequate performance is strongly linked to the perception of the authority figure who is providing the curriculum, in most cases, the teacher. As a result, self-guided learning, motivation, and self-assessment are weak.

None of these strategies are completely inappropriate for young children. There is a reason and time for each approach. The key is to have a balance of activities and learning opportunities in the classroom, and surprisingly, this includes a variety of demands as well. There are variations in how students will respond to each curriculum design. Some students will feel more stress when provided with an open learning environment or when faced with choices because they love structure. Other students will respond with the opposite emotion. These students are most comfortable in learning environments that are open-ended and self-driven, and when given a structured activity that is not of their choosing, they may feel contained and burdened by expectations. It is important to understand that there are lessons to be learned in each set of circumstances. The key is to watch the students' responses to each learning event to gain insight into how they perceive the learning environment and whether it is improving or hindering memory (O'Mahony, 2021).

It is also important to understand how curriculum trends make assumptions about how all students prefer to learn, ignoring the fact that a discarded approach may have been considered the best design in the historical past, at least for a short period of time. It will be important for educators to fully reflect on curriculum and environmental design that is currently being promoted by the field, but it can also be useful to reflect on designs that have been used in the past. This full-spectrum view will help inform personal practice in a holistic manner, providing a rich framework that will support a multitude of strategies that are just perfect to meet the needs of the diverse population that make up most of today's classrooms.

CLOSING THE LOOP

This brings the topic of enhanced memory, the process of understanding and expression, and the structure of classrooms most likely to produce learning full circle. To summarize, learning requires the development of understanding and expression, and it is so important of a concept that it will be considered Tool #1 for the rest of this book. Only by fully analyzing the understanding and the expression of a student's response to a learning activity can the teacher fully determine whether teaching strategies are appropriate and that the assessment data being accrued are fully accurate.

Next, if a teacher develops activities that include many modes of learning, they will automatically widen the memory engram, meaning that each student is more likely to have an opportunity to learn using their particular processing strengths. By default, the engram will be expanded and the activity more appropriate for many children. There is a neuroscience-based reason for hands-on and multisensory learning.

In addition, learning must also be examined for whether it is triggering implicit and/or explicit memories. Educators must continue to use explicit tasks to teach since they make up the majority of the activities, but exploring how to embed implicit learning can be powerful and enjoyable. This memory strategy definitely should be considered during the planning process.

Finally, these activities should be integrated into a brain-responsive curriculum, and the design of this setting must be planned as thoroughly as the learning episodes themselves. This process of exploration will be like packing a toolbox. Each tool has a purpose, and that purpose must be fully understood in its entirety or potential opportunities to use that tool will be missed. However, each tool, while useful, is limited to a degree by the situation at hand. A screwdriver will not help much when a hammer is needed. Yes, you can try to use it, but the results are likely to be less than stellar. So, too, the students demand different tools at different times, so a teacher must fully understand each possible tool that can be used in the classroom.

Now that Tool #1, Understanding and Expression, has been explored, it is time dive further into the neurological components of memory for individual concepts and skills in the next chapter. The goal of our teaching is to create a comprehensive approach to education that surrounds each student with techniques that are tailored to their individual needs. One way to visualize this process is to think about teaching as a cube, as illustrated in Figure 1.9

One side of the cube has already been introduced in this chapter (Tool #1: Understanding and

CUBED PLANNING

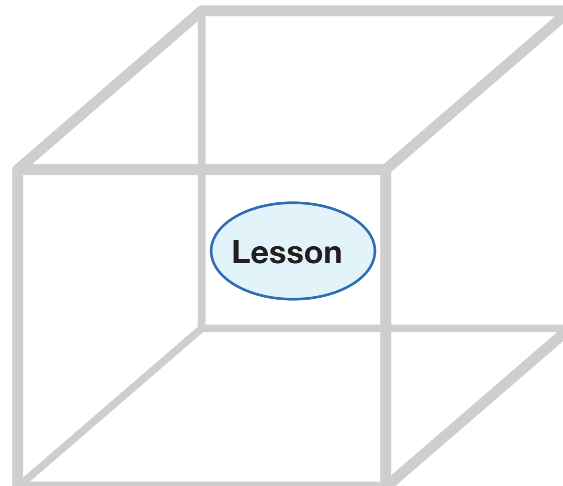


Figure 1.9. Teaching visualized as a cube.

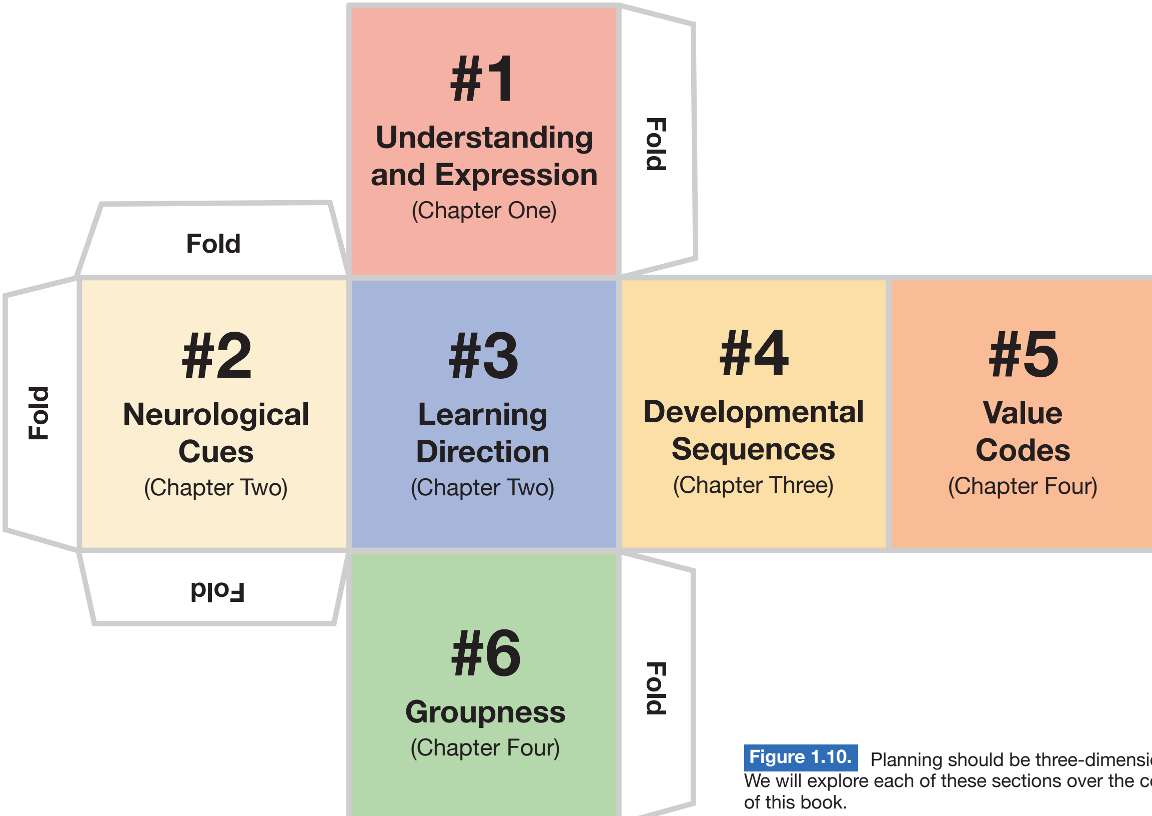


Figure 1.10. Planning should be three-dimensional. We will explore each of these sections over the course of this book.

Expression), but one side is not sufficient for our purposes. There are five more tools to explore to fully complete the cube shown in Figure 1.10.

We will continue our journey towards fully cubed teaching by exploring Tool #2, Neurological Cues, in the next chapter. Tool #2 will help with the expansion of the memory engram to its widest possible dimensions. In that chapter, Tool #3, Learning Direction, will also be introduced. This tool will help us enhance the learning environment so the memories being produced are both enjoyable and robust.

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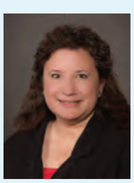

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