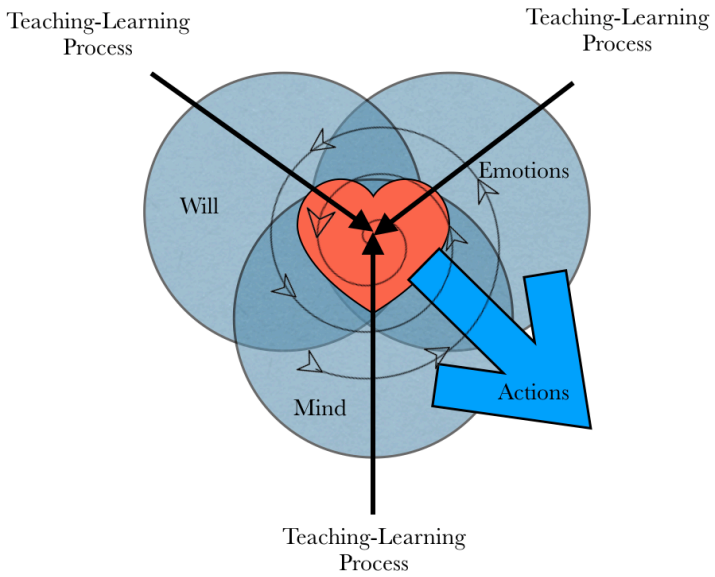
Part 1: The Science Behind the Model

In my years of research, I have discovered and implemented elements of several main methods of education, which align well with the Biblical view of the educational model outlined in Deuteronomy 6. These implementations have become the foundation of the method that I use in my math series, *Math Lessons for a Living Education* and my history series, *America's Story 1-3* and *The World's Story 1-3*. This method is scientifically and relationally based.

The first and most important element of my method, which was developed by my friend, Dr. Gary Newton, is a model depicting the journey that true education takes through the level of the student's understanding, as it moves down towards their heart. He outlines his groundbreaking research and work in his book *Heart-Deep Teaching - Engaging Students for Transformed Lives*. Secondly, I have extensively experimented with implementing certain elements of the Charlotte Mason method, using them, with amazing results, in conjunction with Dr. Newton's Heart-Deep Teaching method. Also interwoven throughout my educational method, are research-based activities and approaches determined by my discovery of how the human brain develops, grows, and processes. Integrally important to rounding out of my method, are the elements of Biblical leadership training. It is important to note that this "method" is not complete; it is, instead, a living method, as it is continually growing and deepening as experiences and research illuminate another area of the human ability to learn and grow.

Because the heart of my educational approach is based on Dr. Newton's Heart-Deep Teaching model, I am going to start by showing his graphic, which depicts how the journey of true education begins in the mind and is completed deep in the heart of student. It is from the heart that actions and behaviors are determined by the knowledge that has become wisdom. To understand the concept of heart-deep teaching, we must first understand the meaning of the word "heart" in this context. The majority of people might define "heart" as their emotional center. But how does the Bible define the word?



In the Old Testament, the Hebrew view, as referenced in the *Shema*, literally and metaphorically refers to the whole person. In the New Testament, Jesus expounded on the OT viewpoint of the heart. He taught that faith needed to be heart-deep, not just outward appearances. Dr. Newton explains: *Throughout the Sermon on the Mount, Jesus explained this deeper level of spirituality as an inner transformation affecting outward lifestyle. His teaching focused on the transformation of the heart." (Matt 5:28).*

As Christian homeschool parents, we desire to reach the heart of our children. We instinctively know that if we do not have their hearts, we do not have them at all. We know that if we do not disciple them at a heart level with the truth of the Gospel, their lives will not follow a good path. Many of us wonder how we can facilitate an education that not only reaches the academic standards needed to be useful citizens, but to point our children's hearts towards Christ with the hope that they will choose to pursue a relationship with Him. The answer is in heart-deep teaching and learning, which is accomplished through the four domains of learning.

These domains are the **Cognitive Level** [referring to the knowledge and intellectual skills], the **Affective Level** [referring to the emotions and attitudes], the **Dispositional and Volitional Level** [referring to values and tendencies to act] which intersects with all of the other domains, and the **Behavior Level** [referring to physical skills and habits]. Although it is helpful to separate these out for the purpose of study and research, it is important to note that they are interrelated and holistic in practice.

Dr. Newton's model of Heart-Deep Teaching and Learning shows how true learning takes place. The straight arrows running through each domain, Mind, Emotions, and Will, are better thought of as ladders, descending deeper into the person, ultimately reaching their heart. Dr. Newton explains it this way: [Because the process is indeed interrelated and holistic in practice], *the spiraling arrow depicts the journey which travels progressively deeper into the depths of the person as the Holy Spirit acts as a catalyst in each of the areas of a person's heart. His role is to initiate and direct the whole range of learning as people respond to the principles of God's Word. Working together with a teacher, fellow learners, and the environment, the Holy Spirit initiates and directs the process of heart-deep learning. Thus the Holy Spirit acts as a primary agent of teaching and learning in the process of discipleship in each of the domains.*

Most of us are most familiar with the Cognitive domain of learning. Benjamin Bloom's basic taxonomy of learning breaks the Cognitive domain into six levels of learning. These levels begin with knowledge and move through comprehension, application, analysis, synthesis, and evaluation. Dr. Newton adds to these, the level that the Bible calls wisdom - the highest [or deepest] level of thinking which is related to putting knowledge into practice in making decisions. *From a Christian perspective in line with a Hebraic way of thinking, the highest level of thinking*

always relates to practical application of knowledge. Thus the cognitive journey to the heart could be said to begin with knowledge and end with wisdom. Dr. Gary Newton, Heart-Deep Teaching, pg. 46

According to Bloom's taxonomy , the first level of learning in the Cognitive domain is the gathering of knowledge. The knowledge stage is simple learning, the "taking-in" stage. All of the subsequent stages of learning depend on this level as the foundation. The second level of learning is the Comprehension and Application level. This is the largest category of intellectual abilities and skills, in which the student begins to make the knowledge more personal and meaningful on an individual basis. Next comes the Analysis, Synthesis, and Evaluation stages. These stages move the knowledge gathered, comprehended and applied, towards the final step which Dr. Newton has added to the taxonomy of learning: Wisdom.

In Luke 2:52, it says that *Jesus grew in* ***wisdom and stature****, and in favor with God and man*. This means that He grew in applied knowledge, as well as in favor with God and man, which indicates maturity in social behaviors and skills [indicated by the blue arrow in the Heart-Deep Model graphic above]. As Christ-followers, **wisdom lived** is the ultimate goal. According to Dr. Newton, "Wisdom [when knowledge reaches the heart of the student and comes out as action], the highest [and deepest] level of thinking always relates to practical application of knowledge." (page 46, paragraph 2) It is important to remember that each level of learning is important to the whole process. The rudimentary levels of gathering basic knowledge is a necessary step in creating a foundational future building towards wisdom.

Let us break down each of these levels of learning, aligning them to my educational model and method. The first level, the Knowledge taking-in stage, is when the student takes in the information. Unfortunately, many of the available curriculum choices focus on this gathering stage, skimming or skipping the following understanding, application, analysis, and synthesizing steps. The focus is urging the student to keep the information in their short term memory just long enough to spit it back out on a quiz or test. Because the secular education model dictates the goal of high standardized test scores, the method is educational bulimia - take in and spit out.

Part 2: The Science Behind the Method

The method of education used in the Knowledge level of education is extremely important, as it sets the physical and emotional tone for the student's learning - many times, for the rest of their lives.

It is at this foundational level that the use of neuroscience-backed, whole-fact, right brain approach, like that used in the *Math Lessons for a Living Education* series, is more effective than the left brain, "bits-and-pieces," traditional approach. According to Dr. Jill Bolte Taylor,

neuroanatomist, author, speaker, and national spokesperson for the Harvard Brain Tissue Resource Center, our right hemisphere develops first, while the left hemisphere does not come completely "on-line" for a number of years. Because the brain and its functions are so extremely crucial to the early learning process, I would like to take a few moments to touch on some of the data that research has uncovered in recent years.

Dr. Bolte explained it this way in her TED talk, which she gave in 2008 at the TED Talk Conference: *Our right hemisphere functions like a parallel processor. It's all about this present moment…Right here, right now.* ***The right hemisphere thinks in pictures****, learns kinesthetically through movement of our body, and through sensory information, which streams into it simultaneously. The right hemisphere then makes a huge collage of all that sensory input, connecting us to our surroundings and to each other.* [This is whole-fact, whole-picture, right-brain thinking.]

Our left hemisphere functions like a serial processor. It thinks linearly and methodically. Our left hemisphere is all about the past, and it's all about the future. It does not process or relate to the here and now. The left hemisphere is designed to take the collage of all the present moment, which was created by the right hemisphere and ***pick out details and more details about those details****. Then it categorizes and organizes all of that information, associates it with everything we have learned in the past and looks to the future at all of our possibilities.* ***The left hemisphere thinks in language****. It's the hemisphere that creates the internal chatter that connects my internal world to my external world. It's the part of us that separates us from others.*

Because the hemispheres process things differently, they think about different things, care about different things, and have different "personalities." They do communicate with one another through the corpus callosum, which is made up of some three hundred million axonal fibers(which are actually electrical pulses, not physical fibers), but other than that the two hemispheres are completely separate. [TED Talk Conference - 2008]

In young children, whose right hemispheres are more developed than their left, learning ***takes the form of playing***. As they play and interact with their world, their right hemisphere is busy taking it in, making a huge collage of whole-picture information from the sensory input, and building synapsis, in preparation for the left hemisphere to come completely "on-line" so it can break it down, determine details, and organize and categorize the information for future use. During these formative years, the right hemisphere is busy being in the moment and has little interest in anything else.

Now that we understand a little about how our physical brain hemispheres function, let me move into the interaction between how our physical brain and our emotional mind work together in the learning process. This is where science and relationship merge. Dr. Jo Boaler is an education author and professor of Mathematics Education at the Stanford Graduate School of Education. In her excellent book, *Mathematical Mindsets*, she talks about the negative mindset that many people have towards math in particular. Throughout the first chapter of her book, she

says that the current secular viewpoint of learning has created a severe and crippling dichotomy in the world of education, especially where the teaching and learning of math is concerned. She challenges the practice of approaching students as "math minded" or "non-math minded." She writes that **mindset** has far more to do with the ability to learn math than natural "math-ability." The Bible says it this way in Proverbs 23:7: For as [a person] thinks in his heart, so *is* he.

This is a clear example of how the "academic and non-academic" categorizing of students is mostly a consequence of not understanding how the human brain actually works. Because of the focus on standardized test scores, many teachers and students approach the study of mathematics with fear and trembling. These negative messages come from the left hemisphere that is taking in and categorizing the (faulty and negative) information from the right hemisphere and building a monumental file of "I'm bad at math" brain chatter. We are literally training our minds and our children's minds to be bad at something we can all learn to do. Dr. Boaler says this: *Students also receive and absorb many indirect messages about mathematics through many aspects of math teaching, such as the questions they work on in math class, the feedback they get, the ways they are grouped, and other aspects of mathematics teaching*… This is the bad-brain math approach that is so prevalent in our culture's educational model, and ***science does not support it***.

In the last ten to fifteen years, research scientists have used technology to access the inside story of what happens in a brain during the learning process. Their biggest discovery…the plasticity of the brain. Dr. Boaler says this about it: *It used to be believed that the brains people were born with could not really be changed, but this idea has now been resoundingly disproved. Study after study has shown the incredible capacity of brains to grow and change within a really short period…When we learn a new idea, an electric current fires in our brains, crossing synapses and connecting different areas of the brain.* These are the sensory information collages made by the right hemisphere and broken down into details, categorized, and filed by the left hemisphere.

Remember, the right hemisphere is the part of the brain that brings in the world around us. ***When that information speaks truth to the child, approaching them like the whole person that they are, it is taken by the left hemisphere and categorized and filed, eventually becoming positive "brain chatter."*** The Apostle Paul, under the influence of the Holy Spirit put it this way in Romans 12:2, *"Do not conform to the pattern of this world, but be transformed by the renewing of your mind. Then you will be able to test and approve what God's will is—His good, pleasing and perfect will."* [NLT]

Let us move into the Comprehension Level, the next level in the Cognitive Realm. The Comprehension Level is the largest level of learning because it includes both comprehension and application. In this level, students begin to think through given information in "concrete

terms related to immediate context." (page 48, para 1) ***This is the first step in the left hemisphere's work, as it begins to sort through and draw details out of the right-brain collage of information. The more natural, fluid, full-picture, and whole-fact the information was taken in by the right hemisphere, the clearer, more detailed, and complete the information collage is and the easier it is for the left-hemisphere to do its job of categorizing, organizing, and making connections.***

An example of this level of learning would be the student putting a concept in their own words, beginning to interpret observations and draw personal conclusions. This level is crucial to all other subsequent levels of learning as it is the personalizing and connecting-to level. **In the *Math Lessons for a Living Education curriculum series*, this level of learning is engaged through the oral narration process and the show-and-tell presentations.**

Oral narration requires the student's left hemisphere to pick out details, organize them and draw conclusions about them. ***This is why oral narration is so much work for young students.*** Understanding and comprehending requires complete engagement at the brain level. Because the MLFLE student has had concepts and information presented to them in a whole-fact, in-context, complete manner, the left hemisphere has a complete picture with which to work.

The next level of the Cognitive Learning domain is Application. This level works hand in hand with the previous level, Comprehension, yet follows it in sequence. ***Where Comprehension is like recognizing someone you have met in their usual context, Application is like recognizing them out of context. Application is the ability to correctly use a principle or concept in a new situation that is not related or rehearsed.*** After the principle or concept is taken in through the right hemisphere and made into a collage (or part of a collage), then sent over to the left hemisphere, where it is interacted with and some of the main details organized and personally connected with in its original context, the left hemisphere takes it and compares it to past or possible future contexts to see if it fits anywhere. This is quite a fascinating process, and one that is still being studied, but we do know that as the brain studies the information, connects to it, categorizes and files it, the elements and connections of the concepts becomes more permanent in the student's memory.

In Dr. Newton's model, this process is indicated by the circular arrow which spirals down deeper and deeper towards the heart. The knowledge is making its way towards wisdom. Dr. Newton explains, *In this way it is easy to see how learning could move from a simple cognitive domain to 'doing.' As we will see in every category, the deeper we get in the journey towards the heart, the more integrated learning becomes.* [Pg 48, 2nd para] The more integrated learning becomes, the more divergent* the student's thinking capability becomes.

*divergent refers to the ability to think creatively - this takes acute critical thinking and creative thinking working together.

In *Math Lessons for a Living Education*, application is seen throughout the course in various ways. Because the curriculum is strong in the previous (yet simultaneous) levels, Knowledge and Comprehension, Application is a natural extension of the process. For example: the child is taught the concept through stories which show the whole concept/principle in context. Next, the child is walked through the steps of learning how to do the concept themselves in a hands-on fashion, which reinforces the story - the Knowledge taking-in stage completed by the right hemisphere.

After some work with these concepts through continued hands-on and simple written practice, the student moves into the Comprehension level by working out an oral narration presentation, still using their hands-on element of manipulatives. Next, the student is encouraged to move what they are learning into a more unrehearsed setting, Application. The *MLFLE* student does this by doing a project that takes the content/principles they have been learning in their story and book-work and moving it into another area of life in the form of sewing, cooking, measuring, and creating something tangible and unrehearsed. These activities set the stage and help the child prepare for using these concepts in real life in ways that will become a permanent part of who they are. The knowledge has made yet another spiral down through the levels of mind, emotions, and will, reaching deeper into the heart of the student.

Next in the Cognitive learning journey are the Analysis, Synthesis, and Evaluation levels. Like the levels before them, these three work together almost inseparably. They are slightly different than the Knowledge (take-in) level, and the Comprehension and Application levels; while those three levels are actual steps taken in the learning process, the Analysis, Synthesis, and Evaluation levels are more like tools used once the student gains the ability to comprehend and apply. We can think of them as tools of trade for the deeper levels of learning. It is through using them that the student moves the knowledge down into their hearts where it becomes wisdom. These three tools are left hemisphere functions.

Analysis is the constant studying and identifying parts and connections in order to organize the materials being taken into the mind. Analysis focuses on the way the parts of the material are broken down and also on the organization of their relationships. Initial Analysis involves three subcategories: Identifying the various elements in the learning experience, identifying the relationships, interactions, and connections between the elements [think cause and effect type analysis] and recognizing the organizing principles, which hold the parts together. Analysis is crucial in discovering major principles and why they work. There is a final organizing identification that "completes the picture through action."

In the *Math Lessons for a Living Education curriculum series*, the use of analysis is seen in the way the student is encouraged to study the relationship between concepts presented. For example, multiplication and division are taught almost simultaneously because these concepts are closely related to one another. By taking in the information in a whole-concept, in-context right hemisphere fashion, the student is seeing the whole picture together: multiplication and division are not to abstract, distantly related concept-cousins; they are mirror-image twins that are always together no matter where you find them. This approach to teaching math concepts naturally walks the student through each of the tree subcategories of the Analysis level.

It is important to note that each individual human processes through the levels of learning at their own God-made speed. It is absolutely imperative that students be encouraged to work through the analysis stage (and all of the other stages) at their speed, not a speed dictated by an arbitrary grade level or standardized test. ***This is where the principle of Skill Level Math verses Grade Level Math is most crucial***, as it is in learning to use these tools that will enable all of us to rework our thinking concerning the learning process. Unfortunately, I have witnessed many children being convinced that they are "bad at math" because their teacher or curriculum demands that they move too quickly (or slowly) through these levels of thinking and learning. This is how we need to facilitate an education that fits the child.

Next in our journey towards the heart and the ultimate goal of wisdom, are the Synthesis and Evaluation "levels." Again, these are more like tools than levels, and they are used, in many ways, simultaneously with the Analysis. Synthesis is really the opposite function of Analysis. Where Analysis studies the parts of the whole and the relationship between them and whole, ***Synthesis focuses on the putting together of elements and parts so as to form a whole. This is where the student applies a unique element of creativity in pulling together what has been learned in the production the original application of the facts, concepts, principles, and understanding learned up to that point.*** Like Application, Synthesis is a left hemisphere function.

This stage could be considered a culmination of learning up to this point and it involves sequencing what has been learned in a unique way to reflect the nature of both the subject material and the learner. On Dr. Newton's model, this stage is the next to last spiraling circle indicating the journey of knowledge down to the heart of the student.

Evaluation is the last circle in the journey to the heart of the student. This level is also where the Cognitive, Emotional, and Dispositional domains meet on Dr. Newton's model. Evaluation is the making of judgments about the value, for some purpose, of ideas, solutions, methods, materials, etc. By this stage, the informational knowledge that the right hemisphere

took in to create a big, colorful collage, has been broken down into multiple levels of detail, each studied closely, connections made, organized and reorganized, filed and added onto, made into new and different material, applied to situations rehearsed and non-rehearsed, and sifted through to find the most important part to be turned into wisdom…knowledge lived. Thus is the journey of knowledge to wisdom.

Part 3: The Elements of the Charlotte Mason Method Used in the Method

This is how the Heart-Deep model is applied to the ***Math Lessons for a Living Education*** **Series through three important elements of the Charlotte Mason method: short, quality lessons, application-based learning, and right-brain learning.**

Short, Quality Lessons…

Charlotte Mason recommends that the attention span of the child be grown and built upon, not completely ignored or fought against in their educational process. This means that the lessons of a child should not be substantially longer than that child's ability to focus on the learning. This growing of the attention is done by using short lessons that focus on using quality over quantity. This type of lesson builds the habit of attention by teaching the child to pay attention to the details, make connections, and process the concepts thoroughly through play and hands-on activities.

Honestly, if we adults would stop and think about this concept of meeting a child where they are developmentally and allowing and encouraging them to continue to develop as God intended, we would recognize that it is simply common sense. After all, we cannot yank on a plant to make it grow, and we cannot "help" a butterfly escape from its chrysalis without maiming it for life. This law of nature applies to our children as well.

Charlotte Mason's **short, quality lessons meet the criteria outlined in the model for heart-deep learning and teaching in the following ways.**

- They address the actual mind of the individual child, not some hypothetical (and mythical) "average" model that "most children this age" should for some strange reason.
- They do not overwhelm a child emotionally. Instead they connect with the child on an emotional level, reassuring them that they are loved by their teacher and by God.

- They do not foster boredom or rebellion against their lessons, teacher, or God. Instead, they teach the child that they *can* become the master of their wills through the growing of their habit of attention.
- As the teaching and learning through short lessons circles down through the levels of learning, it reaches and teaches the child at a heart-deep level, building confidence and joy in the process. Their actions will come from that heart-place.

Application based learning …

We all learn better when the concepts to which we are being introduced are given to us in their context. We have learned how the context helps our brains make connections. When concepts are presented in an aesthetic fashion, we connect with it more readily because our brains, senses, and emotions are working together. This is why movies and plays, where there are plentiful visuals and sounds being used to relate a story, have the power to move us. When we connect with something at this level, our brains are completely engaged.

An educational method that uses application based learning teaches concepts in their natural context as much as possible and encourages the child to bring the concept out of the lesson and into their world. It encourages the child to connect with the concept using as many senses as possible and gives them plenty of opportunity to play with those concepts in order to internalize them.

Application based learning meets the criteria outlined in the model for heart-deep learning and teaching in the following ways.

- It engages the mind of the individual child by showing them the concept in context and then encouraging them to apply it to their own unique personal world.
- Application based lessons reach the child on a level that is much deeper than formulaic level learning does. It engages the child as a whole, encouraging them to engage and connect on a personal and applicable level.
- As the child connects to and applies the concepts being learned, knowledge becomes wisdom. The child grows in their concentration and determination to connect with the world around them in academic and nonacademic ways. Their whole lives are affected by their growing ability to make the connections.
- As the teaching and learning through application based lessons circles down through the levels of learning, it reaches and teaches the child at a heart-deep level by building layer after layer of applied knowledge. Their character grows and their actions and behaviors mature.

Right-brain learning…

One of the ways I have discovered in encouraging children to engage in what I call right brain learning (especially in the discipline of mathematics) is by employing the whole fact approach. In Math Lessons for a Living Education, I call it right-brain math. In essence, it is the practice of showing the child the *whole fact or concept in context* as much as possible.

By doing this, the child's brain is able to grasp it as a whole instead of in fragments. The logical left side of the brain says, "Yes, this makes sense. It is a concept in which I can see the separate parts that make it up as a whole." And the artistic right side says, "Yes, this makes sense. Nothing is missing. It is a whole picture." In that moment, both sides of the brain can recognize and begin to digest the concept or fact.

If a child is taught in this way, approaching complex subjects in a complete and cohesive way that makes sense and connects the critical thinking and the creative thinking abilities of that child, they will be able to move into that divergent thinking much more easily.

The tradition searching-for-the-answer (before seeing/learning the concept in context) method of education is what creates stress in a child's brain - the kind of stress that inhibits the learning process and builds major distrust in their own ability to learn, as well as begins to build a learning-resistant mindset.

Right-brain learning meets the criteria outlined in the model for heart-deep learning and teaching in the following ways.

- Right-brain, whole concept teaching addresses the whole brain in a cohesive way. The child's mind is nurtured as it is learning.
- Right-brain teaching and learning addresses the emotional needs of a child by not frustrating them by expecting them to understand fragmented, out-of-context information.
- Right-brain teaching and learning gives the child confidence by working with their natural ability not against it. When a child has this confidence, they are much more willing to push through even extremely difficult concepts.
- A child who has been taught in a whole picture (right-brain) approach, will understand connections and will develop the ability to think divergently and inventively. This will show in their actions, behaviors, and school work.