

An Orthodox Way to Teach Math

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For many, an article about an Orthodox way to teach math may seem rather ridiculous. What can be Orthodox, or non-Orthodox, about teaching math? Does not $2 + 2 = 4$ no matter how this fact is taught?

Let us start to address these questions by relating an experience of many years ago. We were looking for a math curriculum to use in our school and found one that advertised itself as “Christian Math.” We found that an interesting description, but a description which raised questions similar to those noted above. How is “Christian Math” different from “regular math?” Despite our questions, we bought the curriculum, and saw that it was called “Christian Math” because every other page of the workbook had a quote from the Scriptures. Beyond that, the curriculum was just as dry, boring, and skill oriented (rather than understanding oriented) as any secular math curriculum we had ever seen. We used it for the year and renewed our search again for a better curriculum.

Yes, $2 + 2 = 4$, and $7 \times 6 = 42$ in all math curricula. However, in teaching math, it is crucial that we consider not only *what* we are teaching, but also *whom* we are teaching. Human beings, in this case children, are created to learn in a certain way. Many math curricula do not correctly take into account how children learn. They have correct information, but do not present it in a way that is consistent with how children, and adults, learn. In this lies the difference between “Orthodox math” and “non-Orthodox math”, that is, the difference is not in the facts, but in the presentation of those facts. With this introduction, let us begin.

Archimandrite Sergius (Bowyer), the abbot of St. Tikhon Monastery in Pennsylvania, in his book, *Acquiring the Mind of Christ*, makes a simple, yet profound, point.

The Church’s mind is the mind of Christ. The way the Church thinks is the way we need to learn to think about God, each other and the world.”

That we should strive to think the way the Church thinks is a goal which would be difficult to gainsay. This simple observation, however, has a corollary that Orthodox teachers should consider. Would not thinking as the Church thinks include teaching as the Church teaches? We all acknowledge the importance of knowing *what* the Church teaches; perhaps we should also study *how* the Church teaches.

Most Orthodox educators are familiar with the saying of St. Theophan the Recluse, “**Of all the holy works, the education of children is the most holy.**” (*The Path to Salvation*, pg. 208). This word of encouragement from one of our modern day saints is a treasure to all Orthodox parents and other teachers who struggle to educate children.

However, there are probably many Orthodox teachers who are not familiar with another teaching of St. Theophan, who says that,

It should be placed as an unailing law that every kind of learning which is taught to a Christian should be penetrated with Christian principles, more precisely, Orthodox [principles]. Every branch of learning is capable of this approach, and it will be a true kind of learning only when this condition is fulfilled. (*The Path to Salvation*, pg. 64)

These words of instruction and caution concerning the education of our children are found in the same book as the words of encouragement, namely St. Theophan's book, *The Path to Salvation*.

Although this second quote is not so widely known, it is actually the foundation of the first quote, and is found earlier in St. Theophan's book. If we put the meaning of these two quotes together, we see that the education of our children is holy, not automatically, but if it is penetrated with Orthodox principles. What are these Orthodox principles? Where can we find them?

Another modern saint, St. John of Kronstadt, has given us a wonderful clue in our search for Orthodox educational principles. In his book, *My Life in Christ*, St. John writes,

The Church, through the Divine temple services, acts upon the entire man, educates him wholly; acts upon his sight, hearing, smelling, feeling, taste, imagination, mind, and will, by the splendor of the icons and of the whole temple, by the ringing of the bells, by the singing of the choir, by the fragrance of the incense, the kissing of the Gospel, of the cross and the holy icons, by the prosphoras, the singing, and the sweet sound of the reading of the Scriptures. (*My Life in Christ*, pg 401)

Although a quote from St. John of Kronstadt about Orthodox liturgical life may seem rather odd in an article about teaching math, please note that St. John sees the Divine services as an *educational* experience. Hopefully by the end of this talk, we will make clear the connection between this quote and teaching math.

Let us consider some things about our Orthodox services. We can surely agree that the Orthodox Church acknowledges that the design of its services is a work of the Holy Spirit. The liturgy which we celebrate most of the year was written by St. John Chrysostom, but we consider this writing by St. John in a way similar to the way we consider the writing of the Gospel. That is, it was written by the hand of a man, under the inspiration of the Holy Spirit. Simply put, we believe that our Divine services were designed by God, not by man. That is why we do not change the Divine Services.

Another consideration is that, in the Gospels, Christ tells us that, "The Sabbath was made for man, not man for the Sabbath." (Mark 2:27) Is it not also true that Orthodox services were

made, or designed, for our benefit? Liturgical services have many functions, all of which are designed for our salvation, but at this time we are considering Divine services from a perspective that St. John of Kronstadt has called “educational.” Both St. John and St. Theophan use the word “education” in their writings, but what they mean by this word far exceeds the teaching of facts. They both see education as a process of rightly forming the soul, not simply informing the brain.

Since we have all participated in Orthodox services many times, let us see if we can discern in them patterns of design which reveal Orthodox principles of education. We could then apply these principles to the teaching of math. I would like to ask you a few questions, which should be easy to answer, based on your experience in Orthodox liturgical services. Please, do not try to be profound in your answers because the answers are actually very simple. The first thing that comes into your mind will probably be perfect.

Principles of Orthodox Divine Services to be used in teaching math

The Use of Images

Pretend that you are walking into an Orthodox church for the first time. What is the first thing you see? The answer is most likely “the icons,” or “images”, or “pictures.” Yes, icons. The church is filled with religious images, or icons. Why are these images so prominent? What is the purpose, the use, the function, of these images?

The Orthodox Church uses icons (the Greek word for *images*) to teach us the faith, to teach the life of Christ, to teach us what is even beyond our ability to understand with the mind alone, to teach that which is ineffable, beyond words.

St. John of Kronstadt tells us that, **“Imagery or symbols are a necessity of human nature, in our present spiritually sensual condition.”** (*My Life in Christ*, pg. 395). What St. John means by “in our present spiritually sensual condition” is that, before the fall, Adam and Eve had a far more direct contact with reality than we do today. They did not need their imaginative faculty, but perceived reality directly, without images as an intermediary. However, we who are living after the fall need images to understand reality.

The use of images is one of the primary “teaching techniques” of Orthodoxy. Our Lord used this “technique” when He taught in parables. He knew that the listeners would be forming images in their minds as He spoke. These images are not an end in themselves, but are used as a means to bring us to an understanding of something far greater than the image. Icons are called a “doorway to heaven” because they are concrete representations of what is, “in our present spiritually sensual condition” very abstract realities. Icons, or images, are the means to help us understand reality.

St. Theophan the Recluse, in his description of the intellectual aspect of the soul, speaks of the imagination and memory, which he refers to as the “lower powers of the soul.” He describes these “lower powers” as capabilities that stand at the transition point between the activity of the body and that of the soul (*The Path to Salvation*, pg. 53). He writes,

... nothing can enter the soul without the imagination and memory... Thus, the entire intellectual aspect of the soul is imaginative... The imagination and the memory do not think. They are the unskilled labor force, the backbone.

(The Spiritual Life, pg. 49) (Italics not in the original, but placed here for emphasis)

A little reflection on how children think is sufficient to realize that they first think in concrete terms (based on their concrete experiences), and then gradually (very gradually) proceed to think more abstractly. Contrary to actual experience and contrary to an Orthodox world-view, modern educators often glory in abstract thinking, without appreciating the fact that the foundation, the bedrock, of **accurate** abstract thinking is actually very concrete thinking, that is, in thinking founded on concrete experience. Teaching in a way that bypasses, or allows little time for, the concrete experience stage, results in shallow thinking and a lack of real understanding.

While it is true that some children can learn a lot of rules about mathematics and seem to understand, they need to know far more than the *rules of math*. They need to understand the *whys of math*. This is the function of manipulatives.

Having taught math for more than thirty years, we have encountered far too many children who had been taught abstractly, that is, either with only rules, or with very little time in the concrete stage. By about third or fourth grade, when the mathematical concepts being taught require actual thinking, many children, who were simply taught “the rules” without the **experience** of those rules, suddenly have great difficulty.

Their shallow understanding of place value is revealed; they are terrified of story problems; they have no idea how to deal with multi-step problems. And please, don’t even ask about what happens later when they are presented with algebra! The reason for the breakdown is that they were never given a firm, concrete foundation. Does this remind anyone of the scriptural warning not to build a house upon sand?

The Use of the Senses

Now for our second question. How many of our senses are engaged in Divine Liturgy? We have all experienced what St. John describes in the quote from *My Life in Christ*. All of our senses are engaged in Orthodox services, even our sense of smell. To some, the idea of multi-sensory education is a new development, but the Church has been using all the senses for education for many, many centuries. Consider St. John’s observation of Divine Liturgy, in which all of our senses are engaged. Using the senses in teaching gives children an opportunity to understand what they doing when they “carry” in addition, or “borrow” in subtraction. They see the process.

Using manipulatives is a way of applying these two principles - the use of images and the use of the senses - to the teaching of mathematics. Manipulatives, which are three dimensional, visual images of abstract concepts, are very important if a child is to understand the mathematical concepts being taught. The sense of sight is obviously engaged, but the sense of touch and the appreciation of weight are engaged as well.

This may be a good time to explain that while the images which the Church uses, i.e. icons, are two-dimensional, the images used in teaching math should be three-dimensional. In icons, there is no attempt to portray a third dimension by using linear perspective. Many icons even portray various events which happened at different times. In this case, time, a fourth-dimension, is not a concern in icons. The reason is that it is not the purpose of icons to teach us about this world, a world of space and time. Icons are windows into heaven, not mirrors, reflecting the physical world.

Since math describes events of this three-dimensional, physical world, the manipulatives used in teaching math should reflect the qualities of this physical world, a world of space, time, weight, etc. Pictures can be helpful in teaching math in certain situations, such as when illustrating a story problem, but solid, three-dimensional manipulatives which the children can handle are far more functional and effective in most cases.

The Use of Repetition

For the third principle, here is another question. When the deacon, (or priest if there is no deacon), starts a small litany during Divine Liturgy, or during Vespers, or Matins, there is a good chance that he will say what? Yes, every small litany, or ectenia, is exactly the same, and starts with “Again and again ...” Many of the petitions of the longer litanies start with “Again let us pray...” There is a lot of repetition, a lot of repeated prayers.

Another example of repetition is seen in the Orthodox liturgical calendar. All major feasts, save one, have forefeasts and afterfeasts. In Orthodoxy, we stay with a theme for a while. We first prepare ourselves for the major feasts, sometimes by a fast, but at least by references to the feast in the liturgical readings. Having been prepared, we celebrate the feast itself. Then we have a period of an afterfeast, often a week, (but for Pascha, for forty days!), in which the readings continue to refer to the feast. In Orthodoxy, no feast is celebrated for one day only, except the feast of the Circumcision. So, the third Orthodox principle of education is repetition.

This principle of repetition gives us an opportunity to deepen our understanding of the feasts. The Church knows that we do not “get it” right away. The Church realizes that it takes times for us to think about, to understand, the realities presented to us. Therefore, we are given time to digest, and therefore make part of ourselves, the realities of each of the feasts. The situation in the classroom is the same. It takes times for children to digest, and make part of themselves, which means to understand, what they are being taught.

We often refer to teaching, or education, as instruction. The word instruction comes from two Latin words, *in*, meaning “inside”, or “within”, and *strucere*, meaning “to build.” When we teach children, we are building something inside them. We are first building a general form and then, gradually, adding details to that form. In any construction project, a house for example, a strong foundation is crucially important. Without a firm foundation, a house, no matter how ornate on the outside, is bound to fall. This building of a firm foundation requires time and repetition. A lot of concrete is required for the foundation of a house. Many pieces of lumber of the same size must be cut for the walls. Each wall must be solid and well secured to the others

before the roof is added. We are sure you get the idea. The time spent on the basics is well spent.

The Orthodox principle of repetition is unappreciated in today's educational culture. Under the guise of "academic excellence," modern publishing companies produce textbooks which present to the students far more material than they can comprehend in the time allowed. This puts pressure on those using the textbooks, including home-schooling parents and other Orthodox teachers, to present all this to their children within a limited time-frame.

The publishing companies claim that they have fulfilled their responsibility because they produced textbooks which include all these mathematical concepts. The teachers claim that they have fulfilled all their responsibility because they have presented to the students all these mathematical concepts. Yet the students are, far too often, are left uneducated, because they were not given the opportunity to deeply learn and understand what was presented to them. They were not given the chance to be educated in a way which was "penetrated with Orthodox principles," that is, in a way that is consistent with how we human beings learn.

For example, I recently tutored two Orthodox children, who were attending public schools, in algebra and geometry. The geometry textbook for the sophomore in high school was over 900 pages long, not including the glossary, index, and other non-instructive pages. Given a 180 day school year, the student needed to complete at least five pages a day. This may not seem like too much until you realize that the students did not have a math class everyday and that very little of the book was repetition of earlier instruction. In other words, the students were expected to completely understand the subject matter immediately. If a student did not get it right away, too bad.

Not only was the Orthodox principle of repetition ignored, neither of these students had been taught with the Orthodox principle of images, which in math means manipulatives. They had some (very vague) "rules" in their heads, but had no idea when to apply these rules because they had no understanding of the concepts they had been taught. Story problems, which are an attempt to imitate real life situations, were incomprehensible to them because they had been taught in an abstract way, not in a concrete way.

Many home-schooling parents use the same curricula as the public schools and are therefore faced with the same dilemma of teaching abstractly, and feeling the pressure to finish the whole book in a certain period of time. Whatever curricula you use, make sure that you use it, rather than it using you.

Combining information with delight

Let us continue to the fourth principle of teaching. This principle is a bit more difficult to put into words, but we have certainly all experienced it. The questions for this principle are, "Do you love to sing in Church? Do you love to be a part of the beauty of the Divine services? Do you love to have a sense of unity with those around you in Church?"

Certainly, we can all say “yes” to these questions because the Divine services are designed to give us this opportunity of unity, and we have all partaken of it. We may arrive at Church as individuals, but as the service progresses, we are brought into unity. For example, shortly before we sing, or recite, the Symbol of Faith, the Creed, the deacon says, “Let us love one another, that with one mind we may confess...” We are called to proclaim our faith not only as individuals, but also together as one body.

Although Orthodox services are filled with information, they not primarily aimed at the intellectual part of our soul. While touching our hearts with the beauty of song, or the beauty of the icons, it is also teaching us the faith, or the lives of the saints. If we listen to what is sung during the services, namely, the various troparia, the stichera sung at vespers and during the canon of matins, we will learn the both tenets of the faith and the lives of the saints who lived, and died, for that faith. The liturgical texts of the services are very informative, yet this information is never given as raw data. It is never given as a textbook, but rather clothed in beauty, in delight.

In writing about the Psalms, St. Basil the Great makes an interesting observation that pertains to this subject. He writes,

When, indeed the Holy Spirit saw that the human race was guided only with difficulty toward virtue, and that, because of our inclination toward pleasure, we were neglectful of an upright life, what did He do? The delight of melody He mingled with the doctrines so that by the pleasantness and softness of the sound heard we might receive without perceiving it the benefit of the words, just as wise physicians who, when giving the fastidious rather bitter drugs to drink, frequently smear the cup with honey. (*St. Basil the Great, Exegetic Homilies, Homily 10*)

In both in Divine services and in the Psalms, information/doctrine is clothed in beauty, enjoyment, delight. This joyful clothing does not obscure the information, but actually makes it more available. This principle, applied to a classroom situation, means “games.”

This may seem strange at first, but please consider, what child does not delight in playing a game? When a child is playing a game, they are attentive, that is, their will is engaged and therefore, in a mental attitude open to learning. (We would all do well to have such an attentive attitude during Divine Services.)

Another way of approaching this principle of combining academics with delight, does not come from Orthodoxy per se, but rather from the ancient language of Latin. The Latin word *ludus* means both “game” and “school.” This seems to be a strange combination of meanings since, for a child, the word “game” is associated with the words “joy” and “fun.” The word ‘school’, however, is not always blessed with those sentiments.

We have found games to be very helpful in teaching children math, as well as many others subjects. The late Dr. Karyn Purvis, director of the TCU Institute of Child Development, also found games and play to be very instructive. She writes on her website,

Scientists have recently determined that it takes approximately 400 repetitions to create a new synapse in the brain—unless it is done with play, in which case, it takes between 10 and 20 repetitions! (Dr. Karyn Purvis)

Although we can not cite the exact study which resulted in this conclusion, we can attest to the truth of it from our experience in the classroom. Games not only fulfill the principle of combining academics with delight, but also fulfill the principle of repetition. What child can play a game only once?

Let us review what has been presented.

1) St. Theophan teaches that teaching children is a holy work, but he also some places conditions on this holiness (wholeness). He tells us that every kind of learning should be penetrated with Orthodox Christian principles.

2) In what better place can we find these Orthodox teaching principles than in our Divine services. We read St. John of Kronstadt's view of these services in which he sees them as educational, and as engaging all of our soul and senses. This we have all experienced.

3) We found four main principles of teaching in Orthodox Divine services.

i. **The use of images**, which in teaching math means using three-dimensional manipulatives.

ii. **The use of the senses**, which in teaching math is also fulfilled by the use of manipulatives, since the children handle them, and play with them and even experiment mathematically with them.

iii. **The use of repetition**, which in teaching math means giving children time and plenty of experiences in the basics, thereby building a firm foundation.

iv. **Combining academics with delight**, which in the classroom means playing educational games.

May our Lord, Jesus Christ, bless your efforts in teaching.