Simply Charlotte Mason presents

Mathematics

An Instrument for Living Teaching

by Richele Baburina

Put life into your math studies!

Mathematics: An Instrument for Living Teaching explains step by step how Charlotte Mason taught math in a practical and life-related way from first grade through twelfth, from beginning numbers through algebra and geometry.

In this ground-breaking handbook, Richele Baburina reveals what every parent-teacher wants to know about Charlotte's approach to teaching math. The detailed explanations are based on extensive research—information gathered from several sources that were used by Charlotte's teachers and parents, then meticulously compared and compiled with Charlotte's own words.

Using Charlotte Mason's methods outlined in this book you will be able to

- Teach math concepts in a hands-on, life-related way that assures understanding.
- Encourage daily mental effort from your students with oral work.
- Cultivate and reinforce good habits in your math lessons—habits like attention, accuracy, clear thinking, and neatness.
- Awaken a sense of awe in God' s fixed laws of the universe.
- Evaluate and supplement your chosen arithmetic curriculum or design your own.

It's time to make math an instrument for ***living*** teaching in your home school!

Simply Charlotte Mason .com

Mathematics
An Instrument for Living Teaching

by
Richele Baburina

Excerpts from Charlotte Mason's books are accompanied by a reference to which book in the series they came from.

Vol. 1: Home Education
Vol. 2: Parents and Children
Vol. 3: School Education
Vol. 4: Ourselves
Vol. 5: Formation of Character
Vol. 6: A Philosophy of Education

Mathematics: An Instrument for Living Teaching

ISBN 978-1-61634-201-2 printed
ISBN 978-1-61634-202-9 electronic download

Cover Photo: Oleg Baburin
Cover Design: John Shafer

Published by
Simply Charlotte Mason, LLC
P.O. Box 892
Grayson, Georgia 30017-0892

SimplyCharlotteMason.com

Contents

Mathematics,
An Instrument for Living Teaching

"I need not touch upon the subject of Mathematics. It is receiving ample attention, and is rapidly becoming *an instrument for living teaching* in our schools" (Vol. 3, p. 236).

Introduction

In my reading of Charlotte Mason's Original Homeschooling Series, I noticed Charlotte used words I had never applied to the study of mathematics—words like joy, beauty, truth, and awe. Disturbingly, Charlotte also seemed to be describing my son, who was "becom[ing] a good arithmetician, applying rules aptly, without seeing the reason of them," although at the time we were using a math curriculum touted as "CM-friendly."

Thus, as a student of Charlotte's philosophy of education and as a mom wanting what is best for her children, this handbook was born. My hope is that you will meet both the profound and the practical in these pages, that any mystery or misunderstanding surrounding Charlotte's thoughts on the study of mathematics will be cleared, and that you will gain assurance in applying Charlotte's methods, whether teaching mathematics yourself or choosing a textbook or curriculum.

Of course, my highest hope is for our children, that they would experience the joy, beauty, truth, and awe found in mathematics. As born persons, they are not empty sacks just waiting to be filled with any number of subjects, even one as worthy as mathematics, but have come into the world with "many relations waiting to be established." Accordingly, this handbook is intended to be a ready reference—a place where you will find Charlotte's methods, words, and ideas gathered together for your convenience—and is not meant to take the place of her complete writings.

May mathematics become an instrument of living teaching in your home!

In His service,
Richele

Part 1

The Importance of Mathematics

Chapter 1
Importance and Educative Value

Notes

"How are plans coming for Anna's first year?" Jeanne asked as she poured her friend Erin a glass of iced tea at the kitchen island.

Taking her organizer out of her bag, Erin smiled in reply, "I don't know which of us is more excited. Using living books to impart ideas is what drew me to Charlotte Mason's method of education, and I've chosen *Heidi* as our literature selection for Term One. It was my absolute favorite when I was a girl and I dreamt of reading it with my children even before I became a mother." Erin's smile began to fade, "Math on the other hand is another story. I've read reviews of the CM-friendly math curricula but they all look so different, and math never was my strongest subject . . ."

Sensing the fear creeping into her friend's voice, Jeanne sat down and smiled in encouragement. "What if I told you that math has a lot in common with *Heidi*, your treasured book from childhood?"

"What could math possibly have to do with my little Swiss heroine?" Erin asked, looking doubtful but intrigued.

Jeanne continued, "Do you remember how Heidi passed her days in the sunshine and fresh air of the mountains? Climbing to the high meadows with her friend, Peter, they frolicked among the birds, flowers, and animals, where Heidi grew so strong and healthy that 'nothing could ail her.' Well, Charlotte Mason called mathematics a mountainous land, every bit as vigorous, delightful, and health-giving to the climber as the Swiss Alps were to Heidi. Just as you were excited to learn how great literature breathes life into subjects like history and science, I believe the more you know of Charlotte's ideas surrounding mathematics, the more you will enjoy the same mountain perspective."

Charlotte's Thoughts on the Importance and Educative Value of Mathematics

Habit Training

1. Though the practical value of arithmetic in daily life was not discounted by Charlotte, a higher value was placed on the study of arithmetic for its direct use in the training of both mental and moral habits.

"The practical value of arithmetic to persons in every class of life goes without remark. But the use of the study in practical life is the least of its uses. The chief value of arithmetic, like that of the higher mathematics, lies in the training it

Notes

affords to the reasoning powers, and in the habits of insight, readiness, accuracy, intellectual truthfulness it engenders" (Vol. 1, p. 254).

"We divest ourselves of the notion that to develop the faculties is the chief thing, and a 'subject' which does not rise out of some great thought of life we usually reject as not nourishing, not fruitful; while we retain those studies which give exercise in habits of clear and orderly thinking. Mathematics, grammar, logic, etc., are not purely disciplinary, they do develop (if a bull may be allowed) intellectual muscle. We by no means reject the familiar staples of education in the school sense, but we prize them even more for the record of intellectual habits they leave in the brain tissue, than for their distinct value in developing certain 'faculties' " (Vol. 3, p. 174).

See also Volume 2, pages 230 and 231.

"Some Intellectual Habits.— …*Accuracy*, which is to be taught, not only through arithmetic, but through all the small statements, messages, and affairs of daily life" (Vol. 3, p. 120).

"Another realm open to Intellect has an uninviting name, and travelling therein is difficult, what with steep faces of rock to climb and deep ravines to cross. The Principality of Mathematics is a mountainous land, but the air is very fine and health-giving, though some people find it too rare for their breathing. It differs from most mountainous countries in this, that you cannot lose your way, and that every step taken is on firm ground. People who seek their work or play in this principality find themselves braced by effort and satisfied with truth. Intellect now and then calls for the aid of Imagination as he travels here, but not often. My Lord Attorney-General Reason is his chosen comrade" (Vol. 4, Book 1, p. 38).

"Also, there is great joy in standing by, as it were, and watching our own thought work out an intricate problem. There is on record a case of a mathematician who had gone to bed perplexed by a problem, with pencil and paper beside him. He slept, as he believed, soundly all through the night; but, behold, beside him when he awoke, was the problem worked out in the clearest way. He must have done it *[sic]* his sleep" (Vol. 4, Book 1, p. 63).

The mathematician referred to may have been Maria Agnesi, known for her contributions in calculus as well as her devotion to God and efforts to help the poor and sick. Occasionally staying up late to work on a particular math problem, she would go to bed leaving the problem unsolved only to find the solution written in her own handwriting the next morning. Maria Agnesi lived from 1718 to 1799 in Milan, Italy.

2. By means of Charlotte's methods—including carefully graduated lessons, daily mental effort, and short word problems within the child's understanding—arithmetic becomes a means of training intellectual and moral habits. In contrast, careless, slipshod teaching, offering crutches, and failing to pronounce sums wrong fosters habits of carelessness in the child.

"Carefully graduated teaching and *daily* mental effort on the child's part at this early stage may be the means of developing real mathematical power, and will certainly promote the habits of concentration and effort of mind" (Vol. 1, p. 257).

"The practical value of arithmetic to persons in every class of life goes without remark. But the use of the study in practical life is the least of its uses. The chief value of arithmetic, like that of the higher mathematics, lies in the training it affords to the reasoning powers, and in the habits of insight, readiness, accuracy, intellectual truthfulness it engenders. There is no one subject in which good teaching effects more, as there is none in which slovenly teaching has more mischievous results. Multiplication does not produce the 'right answer,' so the boy tries division; that

again fails, but subtraction may get him out of the bog. There is no *must be* to him; he does not see that one process, and one process *only*, can give the required result. Now, a child who does not know what rule to apply to a simple problem within his grasp, has been ill taught from the first, although he may produce slatefuls of quite right sums in multiplication or long division" (Vol. 1, p. 254).

"Arithmetic is valuable as a means of training children in habits of strict accuracy, but the ingenuity which makes this exact science tend to foster slipshod habits of mind, a disregard of truth and common honesty, is worthy of admiration! The copying, prompting, telling, helping over difficulties, working with an eye to the answer which he knows, that are allowed in the arithmetic lesson, under an inferior teacher, are enough to vitiate any child; and quite as bad as these is the habit of allowing that a sum is *nearly* right, two figures wrong, and so on, and letting the child work it over again. Pronounce a sum *wrong*, or right—it cannot be something between the two. That which is *wrong* must remain *wrong*: the child must not be let run away with the notion that wrong can be mended into right. The future is before him: he may get the next sum right, and the wise teacher will make it her business to see that he *does*, and that he starts with new hope. But the wrong sum must just be let alone" (Vol. 1, pp. 260, 261).

"Therefore his progress must be carefully graduated; but there is no subject in which the teacher has a more delightful consciousness of drawing out from day to day new power in the child. Do not offer him a crutch: it is in his own power he must go" (Vol. 1, p. 261).

"Give him short sums, in words rather than in figures, and excite in him the enthusiasm which produces concentrated attention and rapid work" (Vol. 1, p. 261).

"Let his arithmetic lesson be to the child a daily exercise in clear thinking and rapid, careful execution, and his mental growth will be as obvious as the sprouting of seedlings in the spring" (Vol. 1, p. 261).

Some Habits Developed by the Study of Mathematics Referred to in Charlotte's Writings

Intellectual Habits
Insight
Readiness
Accuracy
Imagining
Intellectual truthfulness
Attention
Concentration
Rapid work
Clear thinking
Careful execution

Notes

Notes

Ordered Thinking
Effort
Effort of mind
Neatness
Deftness

Moral Habits
Truthfulness
Honesty

Beauty and Truth

3. Charlotte's philosophy of education does not allow separation between the intellectual and spiritual life of children. Accordingly, it is the beauty and truth of mathematics—that awakening of a sense of awe in God's fixed laws of the universe—which allows the study of mathematics its rightful place in the curriculum.

"Never are the operations of Reason more delightful and more perfect than in mathematics. Here men do not begin to reason with a notion which causes them to lean to this side or to that. By degrees, absolute truth unfolds itself. We are so made that truth, absolute and certain truth, is a perfect joy to us; and that is the joy that mathematics afford" (Vol. 4, Book 1, pp. 62, 63).

"If the use of words be a law unto itself, how much more so the language of figures and lines! We remember how instructive and impressive Ruskin is on the thesis that 'two and two make four' and cannot by any possibility that the universe affords be made to make five or three. From this point of view, of immutable law, children should approach Mathematics; they should see how impressive is Euclid's 'Which is absurd,' just as absurd as would be the statements of a man who said that his apples always fell upwards, and for the same reason. The behaviour of figures and lines is like the fall of an apple, fixed by immutable laws, and it is a great thing to begin to see these laws even in their lowliest application. The child whose approaches to Arithmetic are so many discoveries of the laws which regulate number will not divide fifteen pence among five people and give them each sixpence or ninepence; 'which is absurd' will convict him, and in time he will perceive that 'answers' are not purely arbitrary but are to be come at by a little boy's reason" (Vol. 6, p. 152).

"The question of Arithmetic and of Mathematics generally is one of great import to us as educators. So long as the idea of 'faculties' obtained no doubt we were right to put all possible weight on a subject so well adapted to train the reasoning powers, but now we are assured that these powers do not wait upon our training. They are there in any case; and if we keep a chief place in our curriculum for Arithmetic we must justify ourselves upon other grounds. We take strong ground when we appeal to the beauty and truth of Mathematics; that, as Ruskin points out, two and two make four and cannot conceivably make five, is an inevitable law. It is a great thing to be brought into the presence of a law, of a whole system of laws, that exist without our concurrence,—that two straight lines cannot enclose a space is a

John Ruskin was a prominent nineteenth-century writer, art teacher, and critic, as well as a renowned social and educational reformer in England.

Euclid, fl. 300 B.C., was an Alexandrian Greek mathematician often referred to as the "Father of Geometry." Euclid often used proof by contradiction or* reductio ad absurdum*. Simply put, when wishing to prove something true, it is assumed not true in order to show that the consequences of this leads to an absurd conclusion.

"This is what the LORD says: 'If I have not made my covenant with day and night and established the fixed laws of heaven and earth, then I will reject the descendants of Jacob and David my servant' " (Jeremiah 33:25, 26, NIV).

fact which we can perceive, state, and act upon but cannot in any wise alter, should give to children the sense of limitation which is wholesome for all of us, and inspire that *sursum corda* which we should hear in all natural law" (Vol. 6, pp. 230, 231).

"By degrees children get that knowledge of God which is the object of the final daily prayer in our beautiful liturgy—the prayer of St. Chrysostom—'Grant us in this world knowledge of Thy truth,' and all other knowledge which they obtain gathers round and illuminates this" (Vol. 6, p. 64).

"Where science does not teach a child to wonder and admire it has perhaps no educative value" (Vol. 6, p. 224).

4. Good teachers take the time to introduce the inspiring ideas and living truths found in mathematics while also being careful not to cloud their teaching with excessive explanations.

"Mathematics depend upon the teacher rather than upon the text-book and few subjects are worse taught; chiefly because teachers have seldom time to give the inspiring ideas, what Coleridge calls, the 'Captain' ideas, which should quicken imagination" (Vol. 6, p. 233).

"I have said much of history and science, but mathematics, a mountainous land which pays the climber, makes its appeal to mind, and good teachers know that they may not drown their teaching in verbiage" (Vol. 6, p. 51).

Proportion in Curriculum

5. The study of mathematics is necessary but should not be given undue importance, especially at the expense of a full and generous curriculum.

"Mathematics are delightful to the mind of man which revels in the perception of law, which may even go forth guessing at a new law until it discover that law; but not every boy can be a champion prize-fighter, nor can every boy 'stand up' to Mathematics. Therefore perhaps the business of teachers is to open as many doors as possible in the belief that Mathematics is one out of many studies which make for education, a study by no means accessible to everyone. Therefore it should not monopolise undue time, nor should persons be hindered from useful careers by the fact that they show no great proficiency in studies which are in favour with examiners, no doubt, because solutions are final, and work can be adjudged without the tiresome hesitancy and fear of being unjust which beset the examiners' path in other studies" (Vol. 6, pp. 152, 153).

"We would send forth children informed by 'the reason firm, the temperate will, endurance, foresight, strength and skill,' but we must add resolution to our good intentions and may not expect to produce a reasonable soul of fine polish from the steady friction, say, of mathematical studies only" (Vol. 6, p. 153).

"Again, integrity in our dealings depends largely upon 'Mr. Micawber's' golden rule, while 'Harold Skimpole's' disregard of these things is a moral offence against

Notes

Sursum corda ***is Latin for "Lift up your hearts," an invitation found in Christian liturgy to lift one's heart to God.***

Excerpt from "She Was a Phantom of Delight" by English poet William Wordsworth (1770–1850).

society. Once again, though we do not live on gymnastics, the mind like the body, is invigorated by regular spells of hard exercise" (Vol. 6, p. 231).

"But education should be a science of proportion, and any one subject that assumes undue importance does so at the expense of other subjects which a child's mind should deal with. Arithmetic, Mathematics, are exceedingly easy to examine upon and so long as education is regulated by examinations so long shall we have teaching, directed not to awaken a sense of awe in contemplating a self-existing science, but rather to secure exactness and ingenuity in the treatment of problems" (Vol. 6, p. 231).

"In a word our point is that Mathematics are to be studied for their own sake and not as they make for general intelligence and grasp of mind. But then how profoundly worthy are these subjects of study for their own sake, to say nothing of other great branches of knowledge to which they are ancillary! Lack of proportion should be our *bête noire* in drawing up a curriculum, remembering that the mathematician who knows little of the history of his own country or that of any other, is sparsely educated at the best" (Vol. 6, p. 232).

"At the same time Genius has her own rights. The born mathematician must be allowed full scope even to the omission of much else that he should know. He soon asserts himself, sees into the intricacies of a problem with half an eye, and should have scope. He would prefer not to have much teaching" (Vol. 6, p. 232).

"To sum up, Mathematics are a necessary part of every man's education; they must be taught by those who know; but they may not engross the time and attention of the scholar in such wise as to shut out any of the score of 'subjects,' a knowledge of which is his natural right" (Vol. 6, p, 233).

"First and chiefest is the knowledge of God, to be got at most directly through the Bible; then comes the knowledge of man, to be got through history, literature, art, civics, ethics, biography, the drama, and languages; and lastly, so much knowledge of the universe as shall explain to some extent the phenomena we are familiar with and give a naming acquaintance at any rate with birds and flowers, stars and stones; nor can this knowledge of the universe be carried far in any direction without the ordering of mathematics" (Vol. 6, p. 254).

Questions to Ask about the Importance of Mathematics

- Do I recognize the value of mathematics in the training of good habits?
- Am I sure to pronounce sums wrong?
- Am I offering crutches to my child through continual prompting, telling, and helping over difficulties in the arithmetic lessons?
- Do I recognize that there is both beauty and truth in mathematics?
- Do I place either too little or not enough importance on the study of mathematics?
- Am I sure to give the study of mathematics its rightful place in our curriculum?
- Do I allow my gifted child a wider scope in the study of mathematics?

Notes

Wilkins Micawber is a fictional character from Charles Dickens' 1850 novel,* David Copperfield*, who, though poor, always remained optimistic. Micawber's golden rule of living within one's means is based upon his experience that "Annual income twenty pounds, annual expenditure nineteen and six [i.e., six pence less than twenty pounds], result happiness. Annual income twenty pounds, annual expenditure twenty pounds ought six [i.e., six pence more than twenty pounds], result misery."

Harold Skimpole was a major character in Charles' Dickens' novel,* Bleak House*. Known as an irresponsible idler, he had neither the desire nor the ability to conduct financial or business transactions. Feigning naivete he sponged off his friends and was bent on enjoying life rather than facing any of its challenges. Using Dickens' well-known characters, Charlotte showed the great worth of mathematics outside of those reasons most commonly given for its study.

The French phrase* bête noire *translates literally to "black beast" and is used figuratively to describe an idea or person that is abhorred and to be avoided.

For more of Charlotte's thoughts on children's gifts, see chapter 8 of* Parents and Children, *Volume 2.

Part 2

The Teaching of Mathematics

Charlotte Mason Math
Grade by Grade

The chart below outlines which branches of mathematics were included in Charlotte Mason's curriculum at each grade level. Specifics will be detailed in the chapters ahead.

	Form I			Form II			Forms III & IV			Forms V & VI		
	IB	IA		IIB	IIA							
Approximate U.S. Grade	1	2	3	4	5	6	7	8	9	10	11	12
Approximate U.S. Age	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18
	Elementary Arithmetic				Arithmetic							
	Elementary Geography/ Out -of-Door Geography				Practical Geometry		Geometry					
	Paper Sloyd						Introduction to Elementary Algebra		Algebra			

Chapter 2
Arithmetic

Notes

Melissa walked happily into her sunroom. It was spring and the blue coneflowers had recently sprouted. As the tender green leaves smiled at her from their warm, brown bed, her thoughts turned to her son's growth in mathematics this year.

Just as she and her family had looked at the glorious variety of seeds available to them at the nursery, Melissa had gone through Charlotte Mason's writings to discover what needed planting in the windowsill of her child's mind. It was amazing to see what could grow with patience and carefully graduated lessons. Like the unfurling of a seedling, Melissa had noticed her son's development of understanding, concentration, and accuracy.

Flower seeds cannot merely be scattered on top of the soil, Melissa mused, *they must be planted to the correct depth and placed in a warm, well-lit space in order to grow. Likewise, the way in which I teach math is crucial. Short math lessons with interesting oral problems are so motivating. Using manipulatives to convey ideas really helps my son grasp mathematical principles and formulate rules himself.* She shook her head in wonder—her son actually understood the common sense of memorizing multiplication tables, so worked at them with enthusiasm.

As Melissa took care to water her seeds often, so she made sure her son put forth daily mental effort with small, interesting problems. She knew that her tender seedlings could not be transplanted until they had grown at least two "true leaves." Similarly, Melissa needed to be content to go slowly with her son, not moving on to a new rule until he had truly grasped the idea of the first and felt at home working problems with it.

Looking around the sunroom, Melissa was so happy they had taken the time to start seedlings inside; doing so would ensure stronger plants, and she looked forward to the bloom of blue coneflower that would line their walkway this summer. In the same way, having taken the time to put Charlotte Mason's methods into practice, Melissa was preparing the soil for true mathematical thinking and intellectual development in her son.

Arithmetic in Charlotte's Schools

We've seen that Charlotte valued the study of arithmetic primarily for its use in the training of both intellectual and moral habits. Though its use in daily life and business was important, it was the "beauty and truth" of mathematics—that awakening of a sense of awe in God's fixed laws of the universe—that afforded its study a rightful place in Charlotte's curriculum. Now let's take a look at *how* arithmetic was taught in Charlotte's schools because without living teaching, that sense of wonder would not be awakened nor would the desired habit training take place.

Charlotte's students were in school six days per week. See the chart on page 97 for a timetable.

Elementary arithmetic spanned the first four school years and was characterized by thorough, careful work in which the children made discoveries for themselves. Grades 1–3 had daily lessons in "Number": five 20-minute lessons and one

Notes

Information compiled from PNEU Programmes and Examinations, http://www.amblesideonline.org/library.shtml#pneuprogrammes and Charlotte Mason Digital Collection, http://www.redeemer.ca/charlotte-mason.

Quotes cited* Stephens *refer to Stephens, Irene. "The Teaching of Mathematics to Young Children. The Teaching of Mathematics in the United Kingdom Being a Series of Papers Prepared for the International Commission on the Teaching of Mathematics." London: Wyman & Sons, 1911. No. 11, pp. A2-19. Print. Gutman Library Special Collections.

In 1911, Miss Irene Stephens, a resident of Madras, India, was a guest lecturer in Mathematics at Ambleside. During this visit her paper, "The Teaching of Mathematics to Young Children," was published. Available for purchase in the PNEU office in booklet form, it was used by teachers in both Forms I and II. The paper was also included as a special report in* The Teaching of Mathematics in the United Kingdom by the Board of Education *(Wyman & Sons, London).

10-minute lesson per week, including rapid mental work for the first year and grades 2 and 3 being exercised on tables (e.g., the multiplication table) for 5-minutes daily.

In fourth grade the five arithmetic lessons increased to 30-minutes in length, including five minutes of mental math. Grades 5 and 6 had only four 30-minute lessons in arithmetic per week with daily mental math, as practical geometry was added to their study. With the addition of formal geometry to the schedule, grades 7 and 8 had three 30-minute arithmetic lessons and three 10-minute sessions of mental arithmetic each week. Grades 9–12 had two 30-minute lessons in arithmetic weekly in which they studied business math, such as profit and loss and simple and compound interest.

The study of junior and senior level arithmetic did not mean a departure from Charlotte's methods. Constant oral practice was given and when sums were written, careful arrangement and neatness was required. Lessons remained carefully graduated; interesting problems of a realistic nature were given with long, tedious calculations omitted.

Elementary Arithmetic

1. Charlotte did not urge any special training or preparation for mathematics in the early years of childhood other than that which occurs in a natural way. The deliberate teaching of elementary arithmetic began in the classroom no earlier than age six.

"I do not think that any direct preparation for mathematics is desirable. The child, who has been allowed to think and not compelled to cram, hails the new study with delight when the due time for it arrives" (Vol. 1, p. 264).

"Taking as our working definition that 'education is an atmosphere, a discipline, a life,' it follows that we realize that education must surround and be a part of the child from his infancy; but until he is ready for school at the end of his sixth year it is to be an education by means of his senses, of his unstudied games, by means of his natural and not of an artificially prepared environment.

"The conscious teaching then of number, as of other definite lines of thought, is to be begun in the schoolroom with a pupil whose age is not less than six years" (Stephens, 1911, p. A2).

2. Elementary Arithmetic in Form I, our approximate grades 1–3, was known as* Numbers *or* Sums*, referring to the thorough analysis of numbers presented in a measured, deliberate way.

"Therefore his progress must be carefully graduated; but there is no subject in which the teacher has a more delightful consciousness of drawing out from day to day new power in the child. Do not offer him a crutch: it is in his own power he must go. Give him short sums, in words rather than in figures, and excite in him the enthusiasm which produces concentrated attention and rapid work. Let his arithmetic lesson be to the child a daily exercise in clear thinking and rapid, careful

execution, and his mental growth will be as obvious as the sprouting of seedlings in the spring" (Vol. 1, p. 261).

"Nothing can be more delightful than the careful analysis of numbers and the beautiful graduation of the work, 'only one difficulty at a time being presented to the mind' " (Vol. 1, p. 262).

3.* Numbers *followed Charlotte's basic principles of short lessons with concentrated attention. The lessons, which were twenty minutes in length, were taught daily. To ensure adequate rest for the child's mind after the required mental effort, an easier lesson followed in the daily schedule.

"We insist also upon concentration of thought throughout the lessons which range in duration from 20 minutes at first to 25 minutes in the last year; during that time attention and concentrated thinking are required; the children generally have an easy lesson, such as handicrafts or writing, to follow so that their brains are rested after the effort expended" (Stephens, 1911, p. 18).

4. Elementary Arithmetic begins with the concrete—that is, the manipulation of real objects—with the child progressing to the imagining of objects and mental operations using real-world problems before advancing to pure number and written sums.

"A bag of beans, counters, or buttons should be used in all the early arithmetic lessons, and the child should be able to work with these freely, and even to add, subtract, multiply, and divide mentally, without the aid of buttons or beans, before he is set to 'do sums' on his slate" (Vol. 1, p. 256).

"To every teacher of this subject it is now clear that the historical presentation of the subject is the easiest and most natural, *i.e.*, that it is to be presented to the child as it presented itself to the race; beginning with the concrete and working back to the abstract generalisation; and having as far as possible a practical bearing on matters of everyday life" (Stephens, 1911, p. 18).

5. Lessons in* Numbers *are begun with the thorough exploration of the numbers* one *through* nine*, hallmarked in a Charlotte Mason education by the unfolding of ideas in the child's mind.

"We generally find that the children, when they enter school, are able to count, but know nothing of the properties of numbers" (Stephens, 1911, p. A2).

"The number one is taken during the first lesson; the children point out to the teacher one window, one fireplace, one piano; in fact, everything in the room which exists singly; then the symbol for one is learnt. Whenever we see a stroke 1 we know that it stands for one of something. The children pick out the ones from groups of figures, and finally learn to write one; getting it as straight and perfect as possible" (Stephens, 1911, p. A2).

"The next number to one is two, as the child probably knows; he learns then to write '2,' first on his board, and then in his book; picks out 2 from a group of figures, and does little sums involving the number 2. Three is taken in the same

Notes

Numbers ***refers to the analysis of numbers in the teaching of elementary arithmetic; i.e., the child's investigation of each number by working out addition and subtraction sums involving its use. In Charlotte's lessons, this was initially done with the aid of manipulatives, proceeding to oral or mental work with the writing of sums used very sparingly.***

Charlotte's timetables from 1891 and 1908 both have Swedish Drill, Dancing, or Sol-fa (a singing technique) immediately following the Numbers lessons.

For a thorough exploration of math manipulatives as an aid in Mason's philosophy of education, please refer to chapter 3, "Manipulatives."

Notes

way; and then four, which the pupil must realise is made up of two twos, or of 3 and 1, by very simple little problems such as will readily suggest themselves to any teacher. He learns to count up to 4, and backwards from 4; thus realising slowly the idea of a series of symbols denoting a series of quantities whose magnitudes continue to grow greater. The idea of an *order* of things, which is conveyed by a number, is perhaps grasped most easily by counting a series of things; and that of the relative magnitudes represented by numbers by the little sums in addition and subtraction" (Stephens, 1911, pp. A2–2).

6. Problems within the child's grasp are given.

"Engage the child upon little problems within his comprehension from the first, rather than upon set sums" (Vol. 1, p. 254).

7. As the numbers that the child works with grow larger, the combinations grow more plentiful and a natural overlap with the operations of subtraction and multiplication occurs.

"In this way all the numbers from one to nine are learnt, the examples becoming more numerous as the numbers grow larger, and involving, besides simple subtraction, simple factors such as two threes make six, and three threes make nine" (Stephens, 1911, p. 2).

8. Again, the first lessons are worked with the aid of manipulatives. These are then put away and the subsequent lesson is worked without their use.

"Each number is begun from a concrete set of things, beads, &c., and several questions are asked and answered with the help of the beads. Then these are put away, and for the next lesson work is done on the number without the aid of the concrete" (Stephens, 1911, p. 2).

9. Writing of numbers is done on a small blackboard and then in a notebook with grids.

"The children have a small blackboard and piece of chalk each and on these they first write the numbers; afterwards a book ruled in ¼ inch or ½ inch squares and a lead pencil are requisitioned" (Stephens, 1911, p. 2).

10. The signs +, -, and = are explained after several numbers have been learned.

"When several of the numbers have been learnt the meanings of the signs +, –, and = are explained to the child; + means 'is added to,' or 'is put together with,' – means 'is taken away from,' and = means 'is the same thing as' " (Stephens, 1911, p. 2).

11. Children simultaneously work out addition and subtraction tables by use of the concrete, giving the idea that subtraction is the counterpart to addition.

"He may arrange an addition table with his beans, thus—

0 0 0 = 3 beans

0 0 0 0 = 4 "

0 0 0 0 0 = 5 "

and be exercised upon it until he can tell, first without counting, and then without looking at the beans, that 2+7=9, etc.

"Thus with 3, 4, 5,—each of the digits: as he learns each line of his addition table, he is exercised upon imaginary objects, '4 apples and 9 apples,' '4 nuts and 6 nuts,' etc.; and lastly, with abstract numbers—6+5, 6+8.

"A subtraction table is worked out simultaneously with the addition table. As he works out each line of additions, he goes over the same ground, only taking away one bean, or two beans, instead of adding, until he is able to answer quite readily, 2 from 7? 2 from 5? After working out each line of addition or subtraction, he may put it on his slate with the proper signs, that is, if he has learned to make figures. It will be found that it requires a much greater mental effort on the child's part to grasp the idea of subtraction than that of addition, and the teacher must be content to go slowly—one finger from four fingers, one nut from three nuts, and so forth, until he knows what he is about" (Vol. 1, pp. 256, 257).

12. Once the signs have been defined, the children will, on occasion, write sums in their books. As a rule, the work is done orally with the writing of sums considered a real treat—to be done only when the children are working well and during the final lesson on a number.

"Now we have the added joy of being able to write sums in our books. This is always considered a privilege, and is only indulged in on mornings when the children are working well, and during the final lesson on some particular number. Writing is still a laborious effort, and is apt to take attention away from the most important matter in hand. The sums are of course always worked orally first, and then written down, *e.g.*, if your little sister is two years old now, how old will she be in two more years? When the answer 4 has been obtained the children write in their books 2+2=4; then they read it; two years added to two years make four years. This writing of sums, however, is very sparingly used, and all the work is oral" (Stephens, 1911, p. 2).

13. The act of writing at this stage still takes great effort and thus should be used sparingly so as not to overshadow the true significance of the lesson.

"Writing is still a laborious effort, and is apt to take attention away from the most important matter in hand" (Stephens, 1911, p. 2).

14. At this stage of learning, and when children are eager and cheerful, simple work with pure number can be attempted with the aim to nurture in them a comfort with numbers.

"During this stage too we give occasional examples dealing with pure number; there are mornings when the little ones are bright and eager, and more than ever anxious to do innumerable sums; this is an opportunity to be seized by the teacher; let us leave the boxes of beads and counters alone, let us even leave out sheep and motor cars, and have nothing but numbers. 'How much left if you take 3 from 5?' 'How much to be added to 4 to make 7?' and so on, quick question and

Notes