1997

Teaching fractions through the multiple intelligences

Lisa K. Freese
University of Northern Iowa

Teaching fractions through the multiple intelligences

Abstract

Fractions are frequently used in daily life. However, many students have difficulty learning fraction concepts. In addition, some students begin the study of fractions with negative impressions.

The writer of this article uses Howard Gardner's theory of multiple intelligences to address the difficulties students face in learning fraction concepts. Dr. Howard Gardner, the creator of the Theory of Multiple Intelligences (MI Theory), believes that it is unfair to teach all students in the same way. Students need opportunities to solve relevant problems that are meaningful to their everyday lives. Rather than concentrating on singular viewpoints and exclusive answers when studying concepts, allowing for a variety of perspectives and numerous solutions tends to engage more children in active thinking and learning. It needs to be accepted that authentic education cannot be carried out in a homogeneous setting when, in fact, all people learn differently.

The activities developed in the created unit incorporate MI approaches, allowing students to make choices about the way they learn fractions and to explore and discover connections between concepts and real life applications.

TEACHING FRACTIONS THROUGH THE MULTIPLE INTELLIGENCES

A Graduate Journal Article

Submitted to the

Division of Elementary Education

Department of Curriculum and Instruction

in Partial Fulfillment

of the Requirements for the Degree

Master of Arts in Education

UNIVERSITY OF NORTHERN IOWA

by

Lisa K. Freese

June 1997

This journal article by: Lisa K. Freese

Titled: Teaching Fractions Through The Multiple Intelligences

has been approved as meeting the research requirement for the

Degree of Master of Arts.

6/24/97
Date Approved

Mary J. Selke
Graduate Faculty Reader

6/24/97
Date Approved

William Waack
Graduate Faculty Reader

7/3/97
Date Approved

Greg Stefanich
Head, Department of Curriculum and Instruction

1910 Tilbury Road
Waterloo, Iowa 50701
June, 1997

William F. Losito, Editor
Julie K. Biddle, Associate Editor
School of Education Publications Office
University of Dayton
Dayton, OH 45469-0510

Dear Mr. Losito:

I would appreciate your consideration of the enclosed manuscript for publication. I have produced "Teaching Fractions Through The Multiple Intelligences" in partial fulfillment of the requirements for a Master of Arts in Education of the Gifted from the University of Northern Iowa. The activities in the article were developed out of my experiences working with fourth grade students during the past eight years. The article was written to demonstrate how Howard Gardner's Multiple Intelligence Theory can be implemented to help make a difficult concept, such as fractions, more enjoyable and less threatening for students.

The manuscript is 3539 words (21 pages) long including the title page, abstract, text, references, and table. Throughout the manuscript, I have followed the Publication Manual of the American Psychological Association, Fourth Edition.

If you have any questions or concerns regarding this manuscript, you may contact me at the address above or by telephone (319-236-3855).

Thank you for your attention to this manuscript.

Sincerely,

Lisa K. Freese

Lisa K. Freese
encl.

TEACHING FRACTIONS THROUGH THE MULTIPLE INTELLIGENCES

Lisa K. Freese

BA University of Northern Iowa

MAE (in process) University of Northern Iowa

June 1997

Work Address:

Immaculate Conception School

311 16th Avenue

Gilbertville, Iowa 50634

(319) 296-1089

Home Address:

1910 Tilbury Road

Waterloo, Iowa 50701

(319) 236-3855

word count: 3539

ABSTRACT

Fractions are frequently used in daily life. However, many students have difficulty learning fraction concepts. In addition, some students begin the study of fractions with negative impressions.

The writer of this article uses Howard Gardner's theory of multiple intelligences to address the difficulties students face in learning fraction concepts. Dr. Howard Gardner, the creator of the Theory of Multiple Intelligences (MI Theory), believes that it is unfair to teach all students in the same way. Students need opportunities to solve relevant problems that are meaningful to their everyday lives. Rather than concentrating on singular viewpoints and exclusive answers when studying concepts, allowing for a variety of perspectives and numerous solutions tends to engage more children in active thinking and learning. It needs to be accepted that authentic education cannot be carried out in a homogeneous setting when, in fact, all people learn differently. The activities developed in the created unit incorporate MI approaches, allowing students to make choices about the way they learn fractions and to explore and discover connections between concepts and real life applications.

Have you heard groans from students when the word "fractions" is mentioned? Or is it their facial expressions that send you delving into books and other resources to find interesting ways to teach this concept? Classroom teachers are constantly seeking ways to improve student attitudes toward fractions and easing the "fraction blues." Because of negative student perceptions of learning about fractions, a proactive teacher might ask: What are critical considerations for designing a curriculum to enhance student enjoyment and discovery of fraction concepts?

In many classrooms there is a diverse range of student abilities and intelligences. Offering a variety of activities that deal with fraction concepts may interest even reluctant learners. A possible solution to the "fraction blues" is to implement the Multiple Intelligence (MI) theory to help students understand and internalize these skills in meaningful ways. This article provides some practical suggestions for implementing Howard Gardner's Multiple Intelligence Theory as a procedure to help students explore fraction concepts. With the many diverse strengths, talents, and skills children possess, providing activities that meet these individual needs may bring about a better understanding or comfort level when dealing with fraction concepts. Teachers might even see students having some fun while learning fractions in this way!

Multiple Intelligence (MI) Theory

Dr. Howard Gardner, a developmental psychologist and professor at Harvard University, created the Theory of Multiple Intelligences (Gardner 1993; 1983). Originally he defined seven intelligences that he feels are as fundamental as those traditionally considered in standard IQ scores. He believes that schools and society need to shift their thinking from *how smart are*

children to *how children are smart*. Gardner views intelligence as the ability to solve problems, the ability to pose new problems, and the ability to fashion a product or provide a service which is valued in one or more cultural settings (Gardner,1993). This view does not quantify intelligence but rather points out that intelligence is highly contextual.

The theory of multiple intelligences supports the idea that individual differences are important. It also recognizes and respects the different ways in which individuals learn and each person's special interests and God-given talents (Jasmine, 1996). The MI theory is described more as a philosophy of education and an attitude toward learning rather than a "set program of fixed techniques and strategies" (Armstrong, 1994, p. x). Thus, educators are offered opportunities to adapt the principles in creative ways to any type of educational setting.

Armstrong (1994) identifies four key points to the MI model that are important to keep in mind. The first point he makes is that each person has aptitude in all seven intelligences. The MI theory does not propose that we were born with a certain potential for intelligence. Instead, the theory alludes that each person has capacities in all seven intelligences. The intelligences function together uniquely for each person. Some people may function at very high levels in most or all of the intelligences. Others may function at low levels in most or all of the intelligences. Most people fall between these opposite ends of the continuum for each of the seven intelligences.

The second point is that most people can develop each intelligence to a proficient level of competency. Gardner posits that almost anyone has the

ability to develop all seven intelligences to a fairly high level of performance if given appropriate instruction, encouragement, and enrichment.

Armstrong suggests that intelligences are always interacting with each other. Gardner points out that intelligences do not exist by themselves (except possibly in savants and brain injured individuals). Otherwise, intelligences usually work together in intricate ways. Armstrong (1994) provides one example of this interaction: "To cook a meal, one must read the recipe (linguistic), possibly divide the recipe in half (logical-mathematical), develop a menu that satisfies all members of a family (interpersonal), and placate one's own appetite as well (intrapersonal)" (p. 12).

The final key point suggests there is a variety of ways to be intelligent within each category. There are no set characteristics a person must possess to be considered intelligent in a certain area. A person who is unable to read may be highly linguistic because he or she is able to tell a story orally using quite a range of vocabulary. A person may not be able to sew dresses or create wood-working products but may be kinesthetically intelligent on the football field or at dancing. The MI theory stresses the variety of ways in which a person shows his or her talents within the intelligences.

Gardner has identified seven intelligences at this point. The table below (see Table 1) summarizes the name of each intelligence and its traits. Armstrong has constructed sample teaching activities and instructional strategies for each intelligence.

Insert Table 1 about here

MI Fractions: An Approach

The strategy selected to teach the MI fraction concepts was the learning center. This type of approach provided students ownership of their learning and allowed them to work at their own pace. It also gave me facilitation time as the students worked in the centers. I worked with individuals and small groups to give help. This also was a time for me to evaluate progress of students and record observations.

Seven learning centers were created with the following fraction objectives in mind:

* fraction of a whole
* fraction of a set
* equivalent fractions
* comparing fractions

These seven centers provided students learning activities engaging the seven intelligences.

The selected activities can be presented in a variety of ways. They can be introduced separately and taught with the respective fraction objectives, or they can be set up as centers. Students could choose the centers in which they would learn about fraction concepts or they could rotate around to each center with the teacher using a bell to indicate when it is time to move. In my fourth grade classroom, students chose the centers in which they wanted to work.

Each of the fraction objectives was taught before the centers were introduced. The lessons involved manipulatives, stories and activities, kinesthetic activities, and thought provoking questions.

I found two important factors that must be addressed in setting up multiple intelligence activities in a center-based environment. The first factor is to be sure the activities are well-managed and organized . Special care should be taken to assure that there are enough materials in each center. With students working at their own pace and moving from center to center, it is important to have materials readily available. The second factor is the positive benefits that accrue from providing students with an introduction to the MI theory. If students are not aware of the MI theory it should be introduced to them before starting the fraction activities.

Each of the seven multiple intelligence activities was introduced intermittently throughout the week before the actual MI fraction centers were made available. A bulletin board was displayed with the specific directions and MI symbols relating to the intelligences being used. Being reminded of what to do also helped students when it came to doing the activities within each center, especially since students progressed through the centers at their own rates.

Each student kept a daily log to keep track of progress and any questions he or she encountered each day. Students were encouraged to ask questions or make comments about their activity that were not addressed during center time. The logs also helped me to know how far students had progressed in the activity or activities that particular day. I answered by writing notes to the individual about what had been observed on that day and answered questions that student may have asked.

Learning Centers

Each of the seven math centers was associated with one of Gardner's intelligences. The title, or name of each center matched the seven different

intelligences. The centers were set up around the classroom in order for students to work independently or in cooperative groups. Students chose which center or centers to work in each day. Each center contained the materials needed and the directions for students to follow.

Linguistic Fractions

Materials needed: Fraction number line, sticky notes, newspapers

Hang up a paper number line in the classroom. Divide it up into four equal sections. Label each line: 1/4 1/2 3/4

Directions: Read through newspaper articles. Circle all the fractions that you find. On sticky notes, write down the individual sentences that contain the fractions. Go to the fraction number line and decide where that sticky note should hang by looking at the fraction in the sentence. (Students also looked at percentages and decimals and plotted these on the number line.)

Kinesthetic Fractions

Materials needed: Paper to trace the chosen item, which will act as the "ruler", record sheet

Directions: Artists use fractions to help them to draw.

> Leonardo da Vinci, an Italian artist who lived from 1452-1519, used fractions to make body measurements. He found that his arm was four hand lengths long. Like Leonardo, you can invent a fraction of your own.
>
> (Houghton Mifflin, 1991, p.160)

1. Use a body part or an item in the room to create your own "ruler". **Estimate** how many (item) tall you are. What fraction of your height is your item?

2. Now make a paper "ruler" of your item. Measure your height with it. How tall are you using your created "ruler?"

3. Compare your fraction with others who used the same part of the body or item to make the ruler. What can you say about how a person's body part or item compares with that person's height? Explain what you've found. Measure other things in the room with your creative ruler. Do not forget to **estimate** first, then get the true measurement. Write a fraction of how that "ruler" compares with the item you measured. Record information on the provided student record sheet.

(Used and adapted with permission from Houghton Mifflin, 1991, p. 161)

Logical Fractions

Materials needed: Written clues to help identify the mystery fractions.

Directions: Identify the mystery fractions by matching these fractions to the clues given. Some of the fractions will not be used. Reveal the hidden identities.

Example: My numerator is between 7 and 12. My denominator is less than 12 and is a multiple of 3. I am greater than 2/3. What is my name? _____

1/3 8/9 9/10 3/4 5/6 3/6

Spatial Fractions

Materials needed: Geometrical shapes, colored construction paper, scissors, glue

Directions: Use many different geometrical shapes. Trace them on black, white, or both colors of paper. Cut them out. Decide what fractional unit you will divide them into equally (eighths, thirds, tenths, etc.). You may need to fold your pattern first to see if the parts are truly equal. Carefully cut these shapes apart into the equal fractional parts you decided on. Now arrange them on a colored background paper to create a picture. Then glue on these pieces the way you like best. Tell no one how you divided them. We will have to figure that out for ourselves by looking at your picture. Shhhh! Do not tell a soul!!

These pictures will be hung up with an index card below. You will look at the pictures and decide how all the shapes are equally cut. Write down your guess on the index cards.

Musical Fractions

Materials needed: Sticks, bells (or other rhythmic instruments), record sheet

Directions: Using what you have learned in music class about eighth notes, quarter notes, half notes, and whole notes create a rhythmic beat. This activity should be in 4/4 time. Remember each measure gets four counts. You can use either the sticks or the bells to play your rhythmic beat. Create many different beats. Add words to make it more creative. You may even add a scale and create your own tune! Record your creation.

Interpersonal Fractions

Materials needed: Cookbooks, paper for taking notes, 8 oz. jars with labels taken off and no measurement increments, paper cut to the height of the jars, spoons that are equal to 1 tsp.

Directions: Work with three or four other people on this project. Look through cookbooks for a recipe to make. It must contain many fractional measurements within it. After deciding which recipe your group would like to make, get your teacher's approval. Decide who will bring which ingredients and necessary bowls, spoons, etc. You do not need to bring measuring cups or measuring spoons.

In order to make your recipe, you'll need to measure out ingredients. To do this you may only use the container given to you by your teacher. There will be no measurements on it. You only have plain white pieces of paper that are the height of your container. The height of your container is equal to one cup. Your group will have to decide how you can measure your ingredients with just those items available. The spoons available are all equal to one teaspoon. Your group will need to problem solve if there are measurements smaller or larger than that. This is the only measurement tool available when it comes to measurements using teaspoons or tablespoons. Discuss what it is you will need to do before you start to make your recipe. Be sure to listen to each other's ideas about what to do. Read the recipe directions carefully.
(Teacher Note: Students need to figure out that, by folding the paper cut to the height of the jars, they will be able to measure ingredients accurately. For example, if the measurement is 1/3, the students problem solve together by

folding the paper into thirds. They would hold the paper up to the jar and pour the appropriate ingredient into the jar up to the first fold.)

Intrapersonal Fractions

Materials needed: Paper stapled together or small notebooks

Directions: You don't have to look very far for fractions. Keep a journal this week. Record any fractions that you see. Where did you see them? How were fractions used? What was the most interesting example of fractions that you found? This can be shared with class members at the end of the week.

Student Responses/Teacher Reflections

Once students completed the fraction unit of study, they journaled about the multiple intelligence approach to learning concepts. All of the students commented on the enjoyment they felt when working at the different center activities. Some mentioned they liked doing things with their hands. Others stated that it gave them a chance to explore and discover how fractions were used in many ways. One child had the revelation that it gave him the chance to try things with which he sometimes has trouble. Another child felt it gave her the chance to get to know more about her friends. A few children commented that they liked the idea of going to a center and using their strengths and abilities to create a product. The students made the connection that fractions are everywhere you look. Some even noted that they learned about what they were able to do well.

From a teacher's perspective, the students learned fraction concepts and had fun at the same time. They also learned about the MI theory and the many

ways that they are intelligent. Students seemed to realize that we are all blessed with many intelligences but may not be adept at all of them. It may take time and experiences to develop their intelligences.

In retrospect, the MI approach to mathematics education provides opportunities for both students and teachers to develop their intelligences. Students become directly involved with each of their intelligences as they work with each MI mathematics activity. They have the opportunity to develop an intelligence of their choice, while concurrently exploring the fraction concepts. Because they have the opportunity to learn concepts in seven different ways, each child has a better chance of absorbing what is being learned (Campbell, 1992). As teachers strengthen their own intelligences by pulling together a myriad of activities as they plan, they become creative thinkers as they develop activities for the variety of perspectives within the classroom. They are also allowing numerous solutions that will engage more children in active thinking and learning. This is of great importance, for as Howard Gardner (cited in Jones, 1996) says: "MI education is about providing children with those crystallizing experiences that connect them to something that engages curiosity and stimulates further exploration." (p.29)

Finally, through the process of connecting MI theory to teaching of a basic mathematical concept, the teacher can achieve the goal of children's awareness of how they learn, as well as what they are learning. Such connections require creativity, flexibility, and commitment. Rogus (as cited in Nuzzi, 1996) says:

> Teaching is a highly complex activity. In the ideal form, it is the selfless art of helping others cultivate their gifts and talents.

> It requires discipline and creativity as well as a commitment to continue developing different instructional approaches until each student achieves (p. vii).

Each person has been blessed with different God-given talents, abilities, and skills. All people have a sense of self-worth and dignity that deserves to stay intact. There are unique and distinct qualities within all humans that have their roots in God. To provide experiences for students to enhance, or even bring about recognition of these talents, abilities, and skills brings praise to God (Nuzzi, 1996). Integrating applications of MI theory into classroom practice is one way to provide these experiences for all children.

References

Armstrong, T. (1994). Multiple intelligences in the classroom. Alexandria: Association for Supervision and Curriculum Development.

Campbell, B. (1992). Multiple intelligences in action. Childhood Education, 68 (4), 197-201.

Gardner, H. (1983). Frames of mind: the theory of multiple intelligences. New York: Harper and Row.

Gardner, H. (1993). Multiple intelligences: the theory in practice. New York: Basic Books.

Hancock, L. (1996). Why do schools flunk biology? Newsweek, 127 (Feb. 19, 1996), p.58-59.

Hoerr, T. (1996). Apply the theory, avoid the traps. Learning: Successful Teaching Today, 24 (1), 69-71.

Jasmine, J. (1996). Teaching with multiple intelligences. Westminister: Teacher Created Materials, Inc.

Jones, D. (1996). More than one door to learning: the theory of multiple intelligences. Today's Catholic Teacher, 30 (3), 27-29.

Korff Wilkens, D. (1996). Multiple intelligence activities (grades K-4). Huntington Beach: Teacher Created Materials, Inc.

Lazear, D. (1994). Seven pathways of learning: teaching students and parents about multiple intelligences. Tucson: Zephyr Press.

National Professional Resources, Inc. (1996). How are kids smart? multiple intelligences (MI) in the classroom. Port Chester: Author.

Nuzzi, R. (1996). Gifts of the spirit: multiple intelligences in religious education. Washington: National Catholic Education Association.

Table 1. The Summary of the Seven Intelligences denotes the name of each intelligence. It also describes the traits, teaching strategies, and instructional strategies for each intelligence.

Table 1
Summary of the Seven Intelligences

INTELLIGENCES	TRAITS	*TEACHING ACTIVITIES	*INSTRUCTIONAL STRATEGIES
Linguistic	Ability to use words effectively, whether orally or written.	lectures, discussions, word games, storytelling, choral reading, journal writing	read about it, write about it, listen to it
Logical-Mathematical	Ability to reason and distinguish patterns.	brain teasers, problem solving, experimenting, mental math, number games, critical thinking	quantify it, think critically about it, conceptualize it
Spatial	Ability to perceive the world precisely, manipulate and transform perceptions.	visual presentations, art projects, imagination games, mind-mapping, visualization	see it, draw it, visualize it, color it, mind-map it
Bodily-Kinesthetic	Ability to use the body to problem solve and communicate.	hands-on learning, drama, dance, sports that teach, tactile activities, relaxation exercise	build it, act it out, touch it, dance it
Musical	Ability to recognize pitch, rhythms, melody, and tones.	rapping, songs that teach	sing it, rap it, listen to it
Interpersonal	Ability to understand other people.	cooperative learning, peer tutoring, simulations, community involvement.	teach it, collaborate on it, interact with respect to it
Intrapersonal	Ability to know and understand oneself.	individualized instruction, independent study	connect it to personal life, make choices with regard to it

* Teaching Activities and Instructional Strategies drawn from (Armstrong, 1994) p.52.

Appendix

important topics.

■ To provide supporting research in Catholic education practice and purpose.

■ To nourish the ministerial role of educators by providing material for deepening their personal faith life and reflecting on its relationship with their role as educators.

■ To support the positive contributions of Catholic education and challenge educators to rethink positions — based on research of their own institutions and unique traditions.

■ To provide Catholic educators at all levels with a document that helps them create a new vision of Catholic education by viewing topics from a variety of perspectives (e.g., philosophical and theological tradition of Catholic education, interdisciplinary, researcher, practitioner, scholar).

CATHOLIC EDUCATION

The first issue of *Catholic Education* will be published in fall 1997. The editors welcome submissions on all aspects of Catholic education: research, practice and reflection.

Manuscripts should be submitted on 8 1/2 x 11 paper, double-spaced, with all authors' names, current addresses, phone numbers, fax numbers and e-mail addresses on a separate sheet. Papers should be 15-20 pages in length, but shorter reflective pieces and longer essays will also be considered. All works cited in the text must be included in a reference list using the style of the *Publication Manual of the American Psychological Association*, 4th edition.

Please submit five hard copies to:

William F. Losito, Editor
Julie K. Biddle, Associate Editor
School of Education Publications Office
University of Dayton
Dayton, OH 45469-0510
937-229-4517 FAX: 937-229-3199

William F. Losito, Editor

Dr. Losito is professor of educational philosophy in the University of Dayton department of teacher education. He has presented and published papers nationally and internationally on a variety of topics related to the philosophy of education. A major responsibility of Dr. Losito's is doctoral teaching and inquiry pertinent to the ethical dimension of educational leadership. He has served on the education committee of the U.S. Catholic Conference, where he participated in the development of several educational documents and policies. Of particular scholarly interest to him is the role of religion in democratic education. Prior to his appointment at the University of Dayton, Dr. Losito was Heritage Professor of Education at the College of William and Mary.

Julie K. Biddle, Associate Editor

Dr. Biddle is director of the publications office in the University of Dayton's School of Education. She also serves as co-editor of the *Journal for a Just and Caring Education*. She was a teacher and administrator in a private urban school for more than a decade. She is a former AERA/Spencer fellow and has special interests in teaching and research on programs and policies for young children and their families. Dr. Biddle is committed to strengthening relationships among the church, schools, and community social services agencies and actively participates on several community advisory boards.

CATHOLIC EDUCATION

of Inquiry and Practice

The editors welcome manuscript submissions on all aspects of Catholic education: research, practice and reflection. Manuscripts should be submitted on 8 1/2 x 11 paper, double-spaced, with all authors' names, current addresses, phone numbers, fax numbers and e-mail addresses on a separate sheet. Papers should be 15-20 double-spaced pages in length. All works cited in the text must be included in a reference list using the style of the *Publication Manual of the American Psychological Association*, 4th edition. Five hard copies should be submitted to:

William F. Losito, Editor
Julie K. Biddle, Associate Editor
School of Education Publications Office
University of Dayton
300 College Park
Dayton, OH 45469-0510

In the coming months visit our Web site at:
www.udayton.edu/edu/services/publications/cathed.html

TO SUBSCRIBE fill out the following information and mail to: *Catholic Education*
SOE Publications Office
University of Dayton
300 College Park
Dayton, OH 45469-0510

Name _____

Address _____

City/State/Country/Zip _____

Phone _____ FAX _____