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Jigsaw Strategy for Sixth Grade Math Lesson
Comparing Parts of a Whole

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The *Jigsaw* method is not a new strategy designed for multiple intelligences and diverse learning styles. Originally, it was developed in Austin, Texas, in 1971, by Elliot Aronson (2006) as an attempt to smooth tense relationships within newly desegregated classrooms. Carol Tomlinson, author of several texts dealing with differentiated instruction, uses the *Jigsaw Strategy* as a viable part of an ever-expanding toolbox. As a Special Education teacher performing Inclusionary practices, I have limited opportunity for setting up classroom lesson formats. I have used the *Jigsaw* method in Scout Leader Training courses, however, for introducing the key principles of the Leave No Trace Program which advocates making minimal or no impact on the environment.

Normally, in these Boy Scouts of America sponsored training sessions, there are seven or eight groups of six or more people working together to solve a jigsaw puzzle which is assembled upside down. Some pieces have clues on the back, some do not. One piece of each of the several puzzles is maintained by the instructor; one is somewhere in the other puzzle piles belonging to other groups. One participant from each group may interact with like designees at a specified meeting point away from all puzzles to seek their missing piece. Players are told ahead of time that when all else fails, one person from each group may seek assistance from the instructor. The instructor answers queries in short phrases that must be true, but has no idea which piece he or she has. The instructor picks a piece randomly and suggests it be tried, but invites the player back if a trade is needed. Group members have to assemble the pieces using eye contact and appropriate gestures – only those designated as intermediaries are allowed to speak, and they only with other group representatives and the instructor. Besides leading to principles of conservation and minimal environmental impact, the game builds cooperation, teamwork, and

responsibility. Once the puzzle is complete, players flip them over and have to determine which of the seven principles of Leave No Trace is displayed by their puzzle. A spokesperson is designated and shares the group findings with the greater assembled group. Alternate discussions of how the puzzle was solved leads to various strategies for problem-solving.

In his final video discourse, Dr. Silver (Laureate, 2004) outlines the basic principles and phases of the *Jigsaw Strategy*. Among key components are collaborative communication, individual and group accountability, clearly defined roles for both teacher and students, and a means for assessing student performance and assignment outcome. Teams of students break into discreet "expert" groups to research information and put together mini-lessons for sharing their information with their team. Once everyone has shared out, students synthesize what they have learned and process the overall information through reflection and assessment. The process is further explained in Silver's text (2003), which describes *Jigsaw* as "a gaming technique designed to increase students' sense of responsibility for their learning by making them "experts" in one part of an instructional unit (p. 191)."

The decision to use the *Jigsaw* strategy, according to course materials, involves considerable thought and planning. Consideration has to be given to class makeup, the content being covered, and any resource materials that might be available. Sliva (2004) points out that any viable classroom program should "focus on students taking responsibility for their own learning (p.99)." Tomlinson (2001) considers *Jigsaw* to be a worthwhile "cooperative learning strategy (p.52)" building upon student interest to promote accountability and active engagement in sharing responsibility and developing collaborative partnership skills. She advocates (1999) teaching students how "to get help" from others by calling upon "experts of the day who have the …skills necessary to provide guidance (p.102)". According to Silver (2003), experts

"investigate their subtopic, plan, design, and construct the lesson and activities (p. 192)" they use to instruct their Team.

As an Inclusion teacher, I have limited opportunity to conduct full classroom instruction. If I could borrow a sixth grade math class for a day or so, I might be tempted to employ this strategy for reinforcing the relationships between fractions, ratios, decimals, and percents in terms of being parts of a whole in accordance with the six grade mathematics Texas Essential Knowledge and Skills (TEKS, 2006).

I would conduct a brief PowerPoint review of fractions, ratios, decimals, and percents and challenge students to develop a comprehensive chart displaying benchmark equivalents. The class would be divided into collaborative learning groups made up of "experts" in each area: benchmark fractions, equivalent fractions, ratios, decimals, and percentages.

Concept area experts would have to define their specialty and demonstrate how to derive one from the other. They would need to know how to explain their concept and equate it to benchmarks on a number line ranging from zero to one. Each group of experts would gather all the information they need to develop a teaching plan and then share their knowledge with their own *Jigsaw* Team. The desired outcome would be a Team's ability to define benchmark fractions, equate those benchmark fractions to equivalent decimals, express them as proportionate ratios with 100 as their denominator, and finally be able to convert decimal benchmarks to percents. Combining all Team members' data through a synthesis model, the final product should be a completed equivalency chart for all benchmarks ranging from sixteenths to one whole.

Student notes from previous lessons, classroom resource material, and Internet websites from a teacher-prepared list would provide all the information students should need to complete

the assignment. When experts break from their Jigsaw groups to meet, plan, and develop their individual mini-lessons, any specific questions or concerns should be dealt with as a collaborative effort. My role as teacher would be to monitor progress and provide clues on an as needed basis. In their expert groups, there should be enough information in student notes to recall the pertinent information required for them to create a worthwhile plan.

As an example for dividing a class into groups, the following outline describes how group membership is aligned for both Jigsaw groups and Expert groups:

Student Jigsaw Groups –

- Group A: Student 1A, 2A, 3A, 4A and 5A
- Group B: Student 1B, 2B, 3B, 4B and 5B
- Group C: Student 1C, 2C, 3C, 4C and 5C
- Group D: Student 1D, 2D, 3D, 4D and 5D

Individual students are more or less selected randomly to form heterogeneous groups, but a few changes here or there by the teacher would ensure a more equitable distribution. It is important that no one group is placed at a disadvantage due an overload of poorly performing students. Equally important would be to ensure that no one team has a clear advantage by being comprised mostly of above average performers. Students need to learn from each other in this strategy, but also feel comfortable in communicating freely. All students with a number 1 form focus, or Expert, group 1 and are given the same concept to master. Students with number 2 form focus group 2 and are given a different concept to master. Likewise, similar Expert groups are formed by students with numbers 3, 4, and 5.

Student Expert Groups –

- Focus Group 1: Benchmark Fractions divisible by 2
- Focus Group 2: Benchmark Fractions divisible by 3
- Focus Group 3: Conversion of fractions to decimals
- Focus Group 4: Expressing Benchmark fractions as ratios with 100
- Focus Group 5: Conversion of decimals to percents

These temporary focus groups become experts in their particular focus area. Experts must develop a strategy for explaining their understanding to their original lettered group. When everyone has shared their information, Jigsaw groups develop their list(s) of benchmark numbers. The eventual outcome should be a comprehensive chart displaying how one concept equates to the others. In order for that to happen, each group needs to see how the jigsaw pieces fit into the big picture. Unfortunately, some fractional parts are divisible by two, others by three, and sometimes both. This can be confusing to sixth grade students. By relating some parts of a whole to standard linear measurements and others to metric scale, the standard classroom ruler can be used as a manipulative for hands-on learning. Similarly, increments of a measuring cup might be useful for realizing the importance of those numbers divisible by three.

- Parts of an inch on a standard ruler: increments of 1/16, 1/8, 1/4, and 1/2
- Parts of a standard one cup measuring cup: increments of 1/4, 1/3, and 1/2
- Parts of a metric ruler: increments of 1/10, 1/5, 1/2

The *Jigsaw Strategy* brings a fully developed concept home when the various expert and jigsaw groupings successfully combine their specialized information into a worthwhile outcome or synthesis project. In this example, students would combine their various parts of a whole into a single chart for comparing or contrasting different expressions for incremental parts of a thing:

fractions, ratios, decimals, and percentages. Additionally, all of the students become accountable for the full body of knowledge, not just their discreet specialization. Each expert group compiles a few questions specific to their specialization area; and upon review by the teacher, these become an evaluation of total understanding. For example, the following questions could represent student input for the development of equivalent parts of a whole by which they would be evaluated on their interpersonal and cognitive skills:

1 – Which benchmark increments are not well represented by either edge of a ruler?

2 – Would using a yardstick allow you to demonstrate all the benchmark increments?

3 – The decimal system uses exponential powers of what number? Explain.

4 – What is meant by place value; and what, if any, differences occur either side of the decimal point?

5 – Compare and contrast ratios and fractions.

6 – Explain an advantage for expressing comparisons in percents rather than by fractions.

7 – Convert randomly selected fractions to decimals and percents.

These and similar questions would require students to engage in conceptual thinking beyond raw knowledge and rudimentary understanding. Showing the ability to respond to this type of questioning combined with the production of a comprehensive chart useful as either a notebook copy or classroom reference sheet would indicate considerable awareness of the concept.

Is the *Jigsaw Strategy* doable? Certainly, it is. Is it something to be used frequently? The responsible answer is - probably not. This particular strategy takes considerable planning and preparation. Used in conjunction with other classroom instructional methods, *Jigsaw* should work to produce thorough understanding of previously presented material. In this instance, the chart which follows would indicate mastery of the concept.

Standard Equivalent Parts of a Whole				
Increment Name	**Fraction and Fractional Equivalents**	**Decimal (to 4 places)**	**Ratio (as parts of 100)**	**Percentage**
sixteenth	1/16	0.0625	6/100	6%
twelfth	1/12	0.0833	8/100	8%
tenth	1/10	0.1000	10/100	10%
eighth	**1/8** = 2/16	**0.125**0	13/100	13%
sixth	**1/6** = 2/12	0.1666	17/100	17%
three sixteenths	3/16	0.1875	19/100	19%
fifth	**1/5** = 2/10	**0.20**00	20/100	20%
fourth	**1/4**=**2/8** =3/12 =4/16	**0.25**00	25/100	25%
three tenths	3/10	0.3000	30/100	30%
five sixteenths	5/16	0.3125	31/100	31%
third	**1/3** = **2/6** = 4/12	**0.3**333	33/100	33%
three eighths	**3/8** = 6/16	**0.375**0	37/100	37%
two fifths	**2/5** = 4/10	**0.4**000	40/100	40%
five twelfths	5/12	0.4166	42/100	42%
seven sixteenths	7/16	0.4375	44/100	44%
half	**1/2**=**2/4**=**3/6**=**4/8**=**5/10**=6/12=8/16	**0.5**000	50/100	50%
nine sixteenths	9/16	0.5625	56/100	56%
seven twelfths	7/12	0.5833	58/100	58%
three fifths	**3/5** = 6/10	**0.60**00	60/100	60%
five eighths	**5/8** = 10/16	**0.625**0	63/100	63%
two thirds	**2/3** = **4/6** = 8/12	**0.6**666	67/100	67%
eleven sixteenths	11/16	0.6875	69/100	69%
seven tenths	7/10	0.7000	70/100	70%
three fourths	**3/4** = **6/8** = 9/12	**0.75**00	75/100	75%
four fifths	**4/5** = 8/10	**0.8**000	80/100	80%
thirteen sixteenths	13/16	0.8125	81/100	81%
five sixths	**5/6** = 10/12	**0.83**33	83/100	83%
seven eighths	**7/8** = 14/16	**0.875**0	88/100	88%
nine tenths	9/10	0.9000	90/100	90%
eleven twelfths	11/12	0.9166	92/100	92%
fifteen sixteenths	15/16	0.9375	94/100	94%
one whole	**1/1** = 2/2 = 3/3 = 4/4 = 5/5 = 6/6 = 8/8 =10/10 = 12/12 = 16/16	**1.0**00	100/100	100%
Bolded fractions may be considered to be **BENCHMARK Fractions** and should be memorized.				

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