

# Assignment 3: Children's Literature and Mathematics

One Grain of Rice: A Mathematical Folktale.

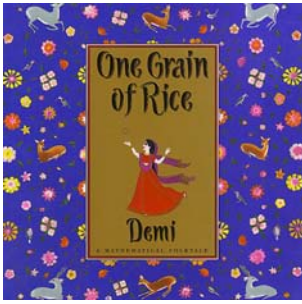
Friday, February 6, 2009.

Dr. Daniel Jarvais

EDUC 4274: Mathematics Education (Primary Junior)

PJ 2

Ashley Kendall and Julia Boschetto.



Summary of the Story.

“One Grain of Rice: A Mathematical Folktale.” by Demi.

ISBN: 0-590-93998-X

The raja of India believes himself to be a very wise and just man who wants only the best for his people. In an attempt to ensure that his people will be safe from famine, the raja collects all of the rice in India and stores it in the royal store houses. When famine does strike, the raja becomes greedy and refuses to share the rice with his people. It is up to a young village girl, Rani, and her intellect to save the country and feed the people.

Grade Level: Grade 6.

Curricular Math Strand: Patterning and Algebra.

Curricular Expectations:

6m59 Grade 6 SQC2005 Mathematics Patterning and Algebra Patterns and Relationships – determine the term number of a given term in a growing pattern that is represented by a pattern rule in words, a table of values, or a graph (Sample problem: For the pattern rule "start with 1 and add 3 to each term to get the next term", use graphing to find the term number when the term is 19.);

6m60 Grade 6 SQC2005 Mathematics Patterning and Algebra Patterns and Relationships – describe pattern rules (in words) that generate patterns by adding or subtracting a constant, or multiplying or dividing by a constant, to get the next term (e.g., for 1, 3, 5, 7, 9, ..., the pattern rule is "start with 1 and add 2 to each term to get the next term"), then distinguish such pattern rules from pattern rules, given in words, that describe the general term by referring to the term number (e.g., for 2, 4, 6, 8, ..., the pattern rule for the general term is "double the term number");



**Direct Instruction Planning Format  
2008-2009**

<b>1. Lesson Plan Information</b>	
<b>Subject/Course:</b> Mathematics	<b>Name:</b> Ashley Kendall and Julia Boschetto
<b>Grade Level:</b> Grade 6	<b>Date:</b> Friday February 6, 2009.
<b>Topic:</b> Patterning and Algebra – “One Grain of Rice: A Mathematical Folktale” by Demi.	<b>Time and Length of Period:</b> 2 <sup>nd</sup> period; 10:00am to 10:50am.

<b>2. Expectation(s) and Learning Skills</b>
<b>The grade 6 students will:</b>
-Determine the term number of a given term in a growing pattern that is represented by a pattern rule in words, a table of values or a graph. <b>6m59.</b>

-Describe pattern rules that generate patterns by adding or subtracting a constant, or multiplying and dividing by a constant to get the next term then distinguishing such pattern rules from, given in words that describe the general term by referring to the term number. **6m60.**

**Today, students will:**

Use their base of mathematical skills and knowledge as well as their problem solving strategies to complete a rich problem activity drawn from the book “One Grain of Rice: A Mathematical Folktale.”

**3. Pre-assessment**

**A. (i) Students can:**

- use estimation skills to make predictions about the outcome of mathematical problems.
- understand the concept of doubling and have a thorough understanding of how to apply this concept to mathematical problems.
- identify patterns in a mathematical context (ie. see the pattern in numbers as opposed to physical patterns made with shapes.)
- successfully apply mathematical formulas to rich problem solving activities and use these formulas to come to a reasonable conclusion.

**(ii) Differentiation of content, process, and/or product (may be accommodations and/or modifications)**

J and M will require monitoring to stay on task. Ensure they are not in the same group so as to avoid distractions.

As per the IEP of T.L, I will wear the microphone for the read aloud and to present the activity.

**B. Learning Environment**

Students will gather at carpeted area for the read aloud and for instructions.

Students will work in groups of four to apply problem solving skills to a rich mathematics problem stemming from the book. They will be asked to present their solution to their peers.

**C. Resources/Materials**

- “One Grain of Rice: A Mathematical Folktale” by Demi.
- Manipulatives – pattern blocks; grains of rice.
- Chart paper
- Markers
- Calculators
- Pencil
- Eraser
- Loose leaf paper for rough work.
- Copy of table worksheet based on table in book.
- Box of Rice

**4. Content (The What)**

**Teaching/Learning Strategies (The How)**

**A. Introduction (motivational steps/hook/activation of students' prior knowledge)**

Introduce students to the book.

Have students make predictions about what the book is about.

Show students a jar full of rice. Ask students to estimate how many grains of rice are in the jar. How many jars of rice would it take to feed a whole village?

Ask students would they rather have \$10,000 dollars all at once or would they rather receive one penny today and then double the amount of pennies it every day for thirty days. Ask students to explain their answer.

Have a small discussion about Indian culture. Ask students what they know about this culture.

**B. Content for New Learning**

1. Before Reading.  
*Introduction to the book and the topic of the book.*
  
2. During Reading.  
*Ask students questions to recapitulate prior knowledge and to get them to think about what is being read in a mathematical context.*
  
3. After Reading.  
*Continue to ask questions to add to existing knowledge and to recapitulate important concepts from the book.*

**B. Teaching/Learning Strategies for New Learning**

1. Recapitulate the title of the book. Ask students why they think the book might be entitled "One Grain of Rice: A Mathematical Folktale?" Facilitate a small group discussion about what a folk tale is.  
  
Ask students:  
What would you do with one grain of rice? Why?  
How would you use that one grain of rice to feed an entire village?
  
2. Example questions:  
After page 11: "Ask me for anything, you shall have it." If you were Rani what would you ask the Raja for as a reward? Keep in mind that Rani is unselfish girl who is trying to feed herself and her village,  
  
After page 15:  
Can you explain Rani's method of getting enough rice for the village  
Is this similar to your strategy/to what you would have done? Why or why not?
  
3. How many grains of rice did Rani receive on the first day? How many did she receive on the second day? How many did she receive on the third day?  
  
What type of mathematical concept can be applied to the process in which Rani received the rice?  
(Doubling)  
Explain how this process works. (Each day, the total from the previous day is doubled. )

### 5. Consolidation/Recapitulation Questions (Check for understanding/scaffolded practice)

After Reading.

**Retell:** In this book, we learned how Rani used the concept of doubling to get enough rice from the Raja to feed the village. She began with only one grain of rice on the first day. Today we will be working with what we know about doubling and about patterning to determine how many grains of rice Rani received each day and how many grains of rice she received in total.

### 6. Application (Moving from guided, scaffolded practice to increasingly independent practice and understanding / gradual release of responsibility)

Have students return to their desks. The students will be working in groups that have been pre-arranged based upon the group they sit with at their desks in the classroom.

Designate one student as the task manager. This person is responsible for getting the supplies that the group needs. This student will gather the chart paper, markers, manipulatives and calculators required for the task.

Students will be asked to come up with a mathematical formula that explains the process and concept Rani used to collect the rice for her village. They will be reminded she was given one grain of rice on the first day, and each subsequent day was given an amount of rice equal to twice as much as she was given the day before. This will be written on chart paper and displayed in an area of the classroom where all of the students will be able to see it. I will provide the answer for the first four days so as to allow the students to have some information to base their strategy on. They will be given manipulatives to work with to model the equation and chart paper to record their answer on. Loose leaf can be used for rough work. Ask students to estimate first, and then use mathematical concepts to compare their estimation with a number achieved through the application of a formula. Students will be given 25 minutes to work through this rich problem.

Have a student recapitulate what has been asked of them.

When the time is up, students will be asked to present their solution to the class. Remind students that the solutions may vary and that there are no right or wrong answers. The answers depend upon how the group approached the problem.

When students have done this, they will be given a copy of the worksheet that is based on the table from the book and asked to fill in the numbers.

Then, students will be asked to use their calculators to determine the total amount of rice Rani received after 30 days.

### 7. Lesson Conclusion

Have students discuss any problems they had while working in their groups to solve this rich problem. (This does not mean discuss disagreements they may have had with other group members, but rather discuss any problems they encountered while trying to reach a conclusion.) Have student hang their chart paper up on the blackboard. Ask them to note any similarities or differences present in the ways in which the different groups solved the problem.

Present students with a homework problem:

Show the students a box of rice purchased from the store. Give students the cost, in dollars, for the box of rice. Ask students to estimate how many grains of rice they think are in the box. Based on this estimation, have students determine how much one single grain of rice would cost. Using the price for

the individual grain of rice, have students calculate how much it would cost to feed Rani's village.

### **8. Assessment (collection of data) / Evaluation (interpretation of data)**

Students will be assessed using a check list. They will be evaluated on their group dynamic (the teacher will circulate to ensure students stay on task.) They will be evaluated on the process and not the product. Things the teacher will look for:

- estimations
- use of algebraic formulas
- explanation of process.

\*During the next lesson, students will be required to complete a journal entry. They will be asked to compare and contrast the plan they devised with their group to the plan Rani used. Some questions to consider are:

- Which plan do you think is better, yours or Rani's?
- Which plan would feed more people?
- How many more grains of rice did Rani get than you would have received at the end of the 30 days?
- Can you think of another bargain that you could have made with the raja to get enough rice to feed the village?

### **9. Teacher Candidate's Reflections on the Lesson**

#### **(ii) Next Steps for Student Learning Related to Lesson Expectation(s)**

Students will write a journal entry. They will be asked to evaluate whether or not Rani's plan was effective. They have to use a mathematical explanation to justify their response. How would they have approached the problem? Would their approach be similar to Rani's? Why or why not?

Have students create a plan as effective as Rani's but it cannot be the same as Rani's.

### Accuracy.



The story presented sound and accurate mathematical principles. The story focuses on the concept of doubling and artistically and skilfully weaves that concept throughout the entirety of the book. It provided a number of opportunities for the development of mathematical formulas using basic mathematical operations like addition and multiplication. It successfully incorporates the concept of doubling into the story by demonstrating how Rani's amount of rice increased each day based on how much she had received the day before. It also introduces the concept of proportionality, represented by the increasing amounts of rice based upon the increasing number of days as well as the changing form and size of the animals used to deliver the rice. The problem presented in the book allows for numerous interpretations and as such allows students to utilize any number of strategies to arrive at a conclusion. The story is not consumed with mathematics, but instead lends itself to practical problem solving involving a multitude of individual strategies and concepts.

### Visual and Verbal Appeal.



The visual and verbal aspects of this book are both very strong. The illustrations are vivid and visually appealing to look at. The use of rich colours in the design of the illustrations of the book draws the reader's attention to the pictures, which in turn enhance and graphically represent the text. The language used to tell the story is simple yet engaging. It is easy to understand and easy to follow and moves the story along at a pace that engages the reader without boring them. The story is presented in the traditional manner of a folktale and, in doing so, is presented with descriptive text that easy to follow, easy to internalize and in turn, makes the story more enjoyable. It prevents the book from being written solely as a mathematical parody that presents a rich problem and allows it to be enjoyable both as a mathematical tool and as a quality piece of children's literature.

### Connections.



This story allows students to make connections between mathematics and the "real" world. While it may not relate to the lives of the students in an extremely personal way, it allows the students to see the use of mathematics in everyday situations and allows students to understand how mathematics and the understanding and use of mathematical concepts have been used for centuries in the everyday lives of people just like them. It introduces students to another culture and allows them to learn a little about that culture's history and their manner of storytelling. The book utilizes an interesting way to allow students to think of mathematical ideas as a way of linking concepts and building connections between different concepts, content and interests.

### Audience.



The story has the potential to appeal to a broad audience. It may appeal to younger children because it is a folktale. It has certain elements of classic storytelling (the concept of the king, the concept of the unlikely hero) that younger children can relate to as a result of traditional children's stories and the use of fairytales and folktales in media directed at children. (ie. movies, television shows). These children will appreciate the book not for its mathematical relevance but for the story it presents. For older students, the book presents a problem that engages the children in the story telling. The rich details in the illustrations and the manner in which the concepts are presented are

easy for them to understand and may be somewhat enjoyable to work through. How the problem is presented, in a story format, may prove to be beneficial in the engagement of the students. It takes away the focus from “solving the mathematics problem” and shifts it to the idea of using problem solving skills to solve a problem presented in the story. Even adults may enjoy this book because of the rich detail put into the actual illustrations of the book but also because of the challenge it presents in solving the actual mathematical problem.

**“Wow” Factor.**



This book ranks relatively high in terms of the “Wow” factor. It allows student to realize that mathematics can be integrated into everyday situations and that mathematics problems and problem solving strategies do not need to come from a math textbook. It uses a story-telling methodology to present a rich problem to the student and in not providing exact answers or outlining the methodology used in the process of solving the problem, allows students to make their own connections to the book and to use their own knowledge and understanding and mathematical strengths to effectively problem solve. The concept behind the story is unique and is not necessarily something students would associate with mathematical applications. For these reasons, the book is entirely unique and in that finds the merit to rank so highly in terms of the “Wow” factor.

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Overall, this book would be an excellent resource to be used for developing rich-problem type questions. It presents a complex mathematical problem in a unique, fun and interesting way that engages students. The problem is presented in a manner that allows for interpretations on many levels and for a number of strategies to be used for the actual solving of the problem presented. It demonstrates how mathematics can be used beyond the classroom and in a variety of ways. The language is simplistic yet engage, the illustrations are beautifully illustrated and enhance the text of the book. It appeals to a wide variety of students at all age and grade levels and is overall a high quality piece of children’s literature to be used in mathematics learning.

**Total Rating of “One Grain of Rice: A Mathematical Folktale”: 27/30.**

Grade: 18/20.

We assigned our group a mark of 18/ 20 because we believe that we could not give ourselves a perfect mark because there are more than likely a number of areas that could have been improved on. We could have gone into greater detail and elaborated more in regards to the book critique. We feel that the lesson plan is sound and will provide students with ample opportunity to utilize critical thinking and problem solving skills in an exploratory manner. However, the lesson might be too detailed in its requirement and is ideal for a class with very little differentiation. We have based the lesson on the assumption that the students will be able to work through the problem in an efficient manner but have neglected to consider that some students may have more difficulties with the work involved. It may be a lengthier process than intended and we have not accounted for any extra time that may be required. However, we feel confident in the problem and the manner it was presented and fully believe that it is something students will enjoy working through.

# FROM ONE GRAIN OF RICE TO ONE BILLION



Each day Rani received double the amount of rice as the day before. Using your mathematic equation calculate and fill in the missing amount of rice for the appropriate day!

Day 1 <b>1 Grain of rice</b>	Day 2	Day 3 <b>4 Grains of rice</b>	Day 4	Day 5 <b>16 Grains of rice</b>	Day 6 <b>32 Grains of rice</b>
Day 7	Day 8 <b>128 Grains of rice</b>	Day 9 <b>256 Grains of rice</b>	Day 10 <b>512 Grains of rice</b>	Day 11	Day 12 <b>2,048 Grains of rice</b>
Day 13 <b>4,096 Grains of rice</b>	Day 14	Day 15 <b>16,384 Grains of rice</b>	Day 16	Day 17 <b>65,536 Grains of rice</b>	Day 18 <b>131,072 Grains of rice</b>
Day 19	Day 20	Day 21 <b>1,048,576 Grains of rice</b>	Day 22 <b>2,097,152 Grains of rice</b>	Day 23 <b>4,194,304 Grains of rice</b>	Day 24 <b>8,388,608 Grains of rice</b>
Day 25 <b>16,777,216 Grains of rice</b>	Day 26 <b>33,554,432 Grains of rice</b>	Day 27	Day 28 <b>134,217,728 Grains of rice</b>	Day 29 <b>268,435,456 Grains of rice</b>	Day 30

To find out how many grains of rice Rani received, add all of the number together!

Rani received : \_\_\_\_\_ which is more than a  
\_\_\_\_\_ grains of rice!