Anno's Mysterious Multiplying Jar

Purpose:

This is an activity based on the picture book *Anno's Mysterious Multiplying Jar.*

Achievement Objectives:

NA4-1: Use a range of multiplicative strategies when operating on whole numbers.
AO elaboration and other teaching resources
NA4-8: Generalise properties of multiplication and division with whole numbers.
AO elaboration and other teaching resources

Specific Learning Outcomes:

1. Students will construct model to illustrate their understanding of factorials.
2. Students will be able to explain the power of the operation of multiplication and contrast it with addition.

Description of mathematics:

1. Factorial describes the mathematical relationship within finding the product of the sequence of numbers from 1 to *n*. For example 4! (said as 4 factorial) is the product of 4 x 3 x 2 x 1 or 24.
2. Factorials can be used to demonstrate the power of multiplication as an operation and how quickly large products are generated with multiplicative patterns.

Required Resource Materials:

Anno's Mysterious Multiplying Jar by Masaichiro Anno and Mitsumasa Anno
Modeling materials such as lego, counters, buttons, rice
Large pieces of paper and felt pens

Activity:

Factorial Worlds Inside Multiplying Jars
This activity is based on the picture book *Anno's Mysterious Multiplying Jar.*

Author: Masaichiro and Mitsumasa Anno
Illustrator: Mitsumasa Anno
Publisher: Penguin Putman (1999)
ISBN: 0-698-11753-0

Summary:
This is a simple and colourful demonstration of the concept of factorials within a fantasy world inside a single jar. The first part of the book takes the reader on the journey through the world and the second part explores the mathematics in a systematic and dramatic illustration. There are further notes to support exploration of combinations and using factorial to solve problems.

Lesson Sequence:

1. Prior to reading, put the following statement on the board and ask students in small groups to debate and come to a consensus about an opinion and be prepared to give evidence in their share back. **Multiplication is the most POWERFUL of the four operations. Agree or Disagree and provide evidence**
2. Ask students to record their opinion and evidence on a sheet of paper and share back with the larger group. Play the "devil's advocate" in their share back by questioning and probing their understanding of the operations. For example if they make statements such as: "Multiplying always gives a larger answer" probe with "What about multiplying by/dividing by/subtracting/adding 1?" or "What about multiplying by a fraction?"
3. Share the book with your students. Move through the first part with few pauses to let the flow of the pattern develop. Pause at the jar where the answer for 10! Is revealed. Repeat the question *How did there come to be so many jars (3,628,800)?*
4. Share the next section where the factorials are modeled with dots arranged in arrays. Ask a student to record the multiplication statements on the whiteboard as the pattern is developed.

5. Pause on the page illustrating 8!. Ask
   What do you expect on the next page?
   How will they have to do illustrate 9!?
6. Finish the book and ask students to work in small groups of 3 or 4 to create their own factorial world. Explain they are to create a context (for example space or microbiology, or ocean) and then a model to demonstrate their understanding of factorials. They can either create a concrete model using materials or a 2-D representation in drawings. Challenge them to demonstrate the power of the operation as the pattern progresses. So for example if they decide to represent 6! They will have to devise a way of having a set of 720 items to illustrate the last step.
7. As follow up students can be asked to revisit the opening debate statement and revise their answers and list exceptions.