Making Connections: Expanding the Bridging Question Strategy

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Abstract

The authors present a sequel to their original article that appeared in the Fall 2007 issue of *JPACTe*. The Bridging Question Strategy (BQS), as presented in that previous article, is a constructivist strategy for activating prior ordinary concepts and knowledge and connecting them to new concepts and knowledge in mathematics. This article expands on the concept with other examples.

Overview

Making Connections: Expanding the Bridging Question Strategy

The author's analysis of the BQS expands the strategy from the domain of secondary mathematics to other levels and other domains. This article reviews the BQS, presents another illustration from secondary mathematics, continues with some from elementary mathematics, and examines some from kindergarten, and history. Some illustrations make suggestions for classroom strategies. However in order to have room for a variety of illustrations, most only sketch the main ideas involved. Some of these are developed in papers in the Constructivist Learning Section of on our website. Look for papers that have 'Bridging' as part of their title.

A Review of the Bridging Question Strategy (BQS)

The basic BQS is the process of connecting ordinary knowledge that is not especially content-related to an upcoming content-related topic. The general bridging question asks, “What is going on here?” in reference to some activity or situation. This is an open-ended question, which calls for more than a simple description. BQS begins with knowledge of an everyday activity or situation. It bridges from this to a topic that is related via some easily understood concept or principle. In the original article the BQS used the concept of wrapping and unwrapping a package to bridge to concepts and processes used in solving equations; it also discussed how deciding on what new car to buy can be related or bridged to classifying polygons. The activity of taking money from one account and putting it in another is analogous to the translation of a conic. The previous article presented the process for implementing the BQS. These steps, in abbreviated form, are:

(1) Present a bridging activity to bring the concept or topic into focus.

(2) Fully activate the bridging question by using group work, using different modes, and having students develop their own bridging questions.

(3) Bridge to a more remote concept. This can be done by having students predict the relationship between the bridging question and the more remote concept. This may also involve the teacher applying coaching techniques.

An Illustration from Social Studies: Bridging from Perspectives on Ordinary Discords to those on Societal Conflicts

Principle: Familiar ordinary discords help us to understand societal conflicts.

As one delves into understanding societal events, the importance of using bridging questions becomes more important. Such understanding involves not only knowing facts and dates. Rather it requires understanding multi-faceted concepts. This is where the BQS comes into play. Viewed simplistically, conflicts may seem to have winners and losers. However in many situations it is easy to take a broader perspective. This can be used to bridge to a broader perspective on broader societal conflicts. By activating a concept that is to the student, the teacher builds the foundation for enabling the student to construct a conceptual framework for understanding societal conflicts. Similar bridging can be applied to most topics in social studies.

Example: For a specific example, consider World War II. While on the surface it appears as if the Allies won the war, the historian Richard Overy (1995) reminds us of a broader perspective:

> *When people heard that the title of my next book was to be 'Why the Allies Won', it often provoked the retort: 'Did they?' There are many ways of winning. With the passage of time it has become possible to argue that none of the three major Allies-Britain, the United States and the Soviet Union-won a great deal. Britain lost her empire and her leading world role; the United States that they traded one European enemy for another.*

Overy's quote points out that the concept of winning is very complex; it is imperative that the teacher in teaching about World War II had to activate the thinking scheme necessary to understand a concept such as winning a war. One way in which a teacher can do this is through a class discussion. The teacher can relate how he and a friend liked the same girl, and the girl chose him, but in the end he lost a friend. Another example could be choosing to go to dinner with a business associate on the day you were suppose to go out with a friend or spouse or a relative. In accordance with the BQS, a teacher must coach students to thoroughly “dig deep under the surface” so this concept can be activated.

An Illustration from Secondary Mathematics: Bridging from the ordinary distinction Zero Value vs. No Value to Zero Slope vs. No Slope

Principle: There is a distinction between the concepts of “zero” and “no value.”

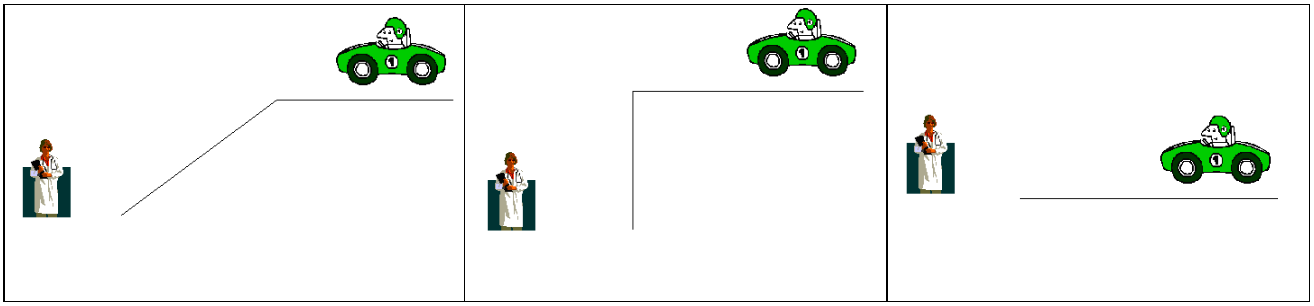
The underlying common conceptual distinction for this illustration involves one between a quantitative concept of ‘zero’ and the concept of ‘no value’ as in nothing or impossible. Its ordinary instances can be use to bridge to more remote instances that involve zero and undefined in mathematics. While mathematicians freely use these concepts they are not highly activated in most the secondary students. The following activities use concepts already held or easily developed by the student to connect to the more remote concepts of ‘zero’ and ‘undefined’.

Example: In connecting to these concepts, the teacher could come to class early and attach one of those small nerf ball basketball nets to the ceiling of the room. To start class, the teacher tries to dunk the nerf ball, but to no avail. The class discussion focuses on the fact that it is probably impossible for the teacher to dunk the basketball. This is followed by a discussion about a basketball player trying to dunk the ball, but slamming it too hard and missing the shot. The teacher can now lead a discussion comparing the two events. The first event can be connected to the concept of undefined as in nothing happened, while the second event can be connected to the concept of having zero value; i.e. the player scored “zero” points for this try. Again, using BQS strategies, the teacher asks students to come up with their own examples that demonstrate the distinction between zero value and no value. A more ordinary but less dramatic example would be comparing a student who has an excused absence from a test (no possible grade) to a student who took the test and got all the answers incorrect (a score of zero). After working with students on constructing their own examples, the teacher can now bridge to the concept of vertical lines and horizontal lines. Students struggle to understand that a vertical line has no slope (undefined) and a horizontal line has a slope of zero. Now that students have bridged to the concepts of zero and undefined, they now can bridge that understanding to vertical and horizontal lines.

Activity: Looking at the first picture below, ask the students what will happen if the racecar driver tries to drive the car down the side of the hill to meet his wife. A number of observations might be made, such as “With good brakes and great traction, the driver should manage.” Have students imagine some other slopes with more or less difficulty. Quantify the notion of slope.

Looking at the next picture, ask the students what will happen if the racecar driver tries to drive the car down the side of the vertical hill to meet his wife. Then have the class compare that to the case of the teacher trying to dunk the ball; here the class is bridging to the concept of undefined.

Now, consider the last picture example. Coach the students to discuss that the driver will be able to reach his wife (a defined value), and has no resistance (value of zero).



An Illustration from a Kindergarten Reading Class:

Bridging from Criteria for Familiar Choices to Criteria for Choosing what to Read

Principle: We have and can articulate criteria for choices we make.

One important construct in developing kindergartener's reading ability is for them to learn how to choose the correct books for themselves. In using the BQS in this situation one can bridge from the concept of 'the right fit' to the concept of the 'right book to read'; the concept of what book to read is dependent on the developmental level and interests or purposes of the reader. The paragraphs below illustrate how a teacher can bridge to these concepts.

Example: The bridging process begins with the idea of what shoes a child should wear. In terms of a fit, a child cannot wear their father's shoes because the shoes are too big. The teacher can coach the students to connect this idea to the concept of developmental fit. Next, the teacher can ask students if they would wear a ballerina's shoes to go fishing; this concept can be bridged to the concept of determining the purpose of reading. To make the bridging more concrete, the teacher can bring in examples of different shoes or can bring in pictures of shoes.

Activity: Another activity that is vital to reading fluency and choosing the correct rule is the Goldilocks Rule. In bridging from this Rule to the concept of choosing the correct book, the teacher reviews the story of Goldilocks and the Three Bears by discussing that the mother bear's porridge wasn't right, and the papa bear's porridge wasn't right, but the baby bear's porridge was just right. The teacher again uses chart paper. The diagram below depicts what the chart paper can have written on it.

GOLDILOCKS RULE

Too easy	Just Right	Too Hard
I know all the rules *It does not make me think*	*I understand* *I understand* *It makes me think*	*I do not know a lot of words* *I do not understand*

Activity: Another important construct in developing reading fluency is the ability to synthesize; in developing reading fluency a key concept is that one is thinking as he or she is reading, and that thinking grows and changes. The ability to synthesize is the ability to recognize and coordinate previous thinking skills into new thinking patterns. The bridging concept is that of a young child. As an infant, a child can move its limbs and do some grasping. Later on, the child develops into a person who can crawl. While the child can move its limbs and grasp, it has developed these into a new schema of crawling. Then the child develops the schema of using a table or another person to pull itself up, and finally ends up walking. This scheme can be activated by putting pictures of an infant, a baby crawling, and a young child crawling and walking on chart paper. This is now bridged to the idea of synthesizing one's thinking. At this age it would be most effective for the teacher to model their synthesizing. Let's look at the story of the little engine that could. On the same chart, the teacher writes down that she initially thought the story was about a blue train, and next to this draws a picture of a blue train. She then writes that she is now thinking that the story is about the red engine that broke down, and has a picture of a red engine drawn next to these words. At this point, the teacher can discuss with the class that her thinking, like the child, has grown and changed. Next the teacher shows another stage of development in her thinking about the story by putting on the chart paper that the story is about not giving up. This can lead to some class discussion about how this connects to the baby crawling and pulling itself up. Now the teacher shows more growth in her thinking by writing on the paper, "My thinking has grown. I now think that even if you are little, you can help in a big way". With discussion and the use of pictures and diagrams, the kindergarten students can bridge from the concept of the development of the child to the concept of synthesizing thinking.

Activity: At a more advanced level, ideas like those in this illustration can be used to discuss types of ordinary reasons for making choices. This can be used to bridge to an organized set of behavior reasons or perspectives. Descriptive

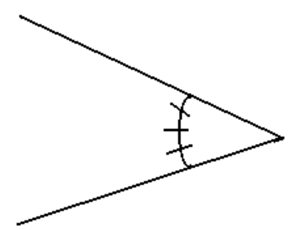
Psychology provides a very but useful set of organizing reasons from four interrelated perspectives, namely {hedonic, prudential ethical, esthetic}.

An Illustration from Elementary Mathematics:
The 'Greater Than' Symbol and the 'Less Than' Symbol

Principle: "Great than" and "less than" symbols open in opposite directions.

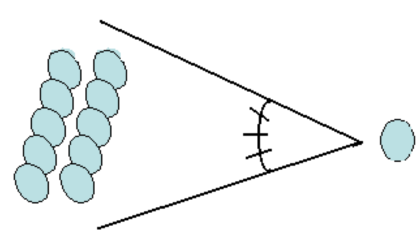
In general, bridging can involve any way of connecting anything that a student finds to something they might find more remote. Students of all ages have difficulty with the direction of the 'greater than' (>) symbol and the 'less than' (<). The ongoing question is "what direction should the opening be pointed?"

Rather than depending on a principle or a concept, the bridge in this illustration merely provides a vivid pictorial memory device.



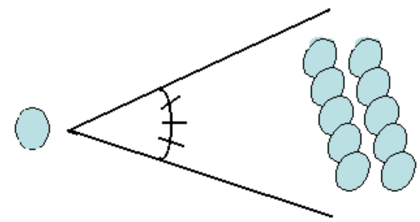
Example: This example is from a kindergarten class studying mathematics. Consider an alligator with his mouth open, like the one shown.

Consider the situation in which there are 10 cookies in one part of the room, and 1 cookie in the other part of the room. Ask the students in which direction the alligator will go; students will state that the alligator will eat the 10 cookies first.



The teacher can now bridge to the concept that 10 is greater than one (10 >1), and follow with other examples.

If the position in the room of the cookies were reversed, the teacher would still coach the students to have the alligator eat the larger amount of cookies. This is illustrated in the following picture. Here the students use the concept that the alligator will go for the greater amount. The teacher can now coach the students to construct the relation that 1 is less than 10 (1<10).



Illustrations from Elementary Mathematics or Middle School Mathematics: Bridging from Common Trades to Trading Equivalent Fractions

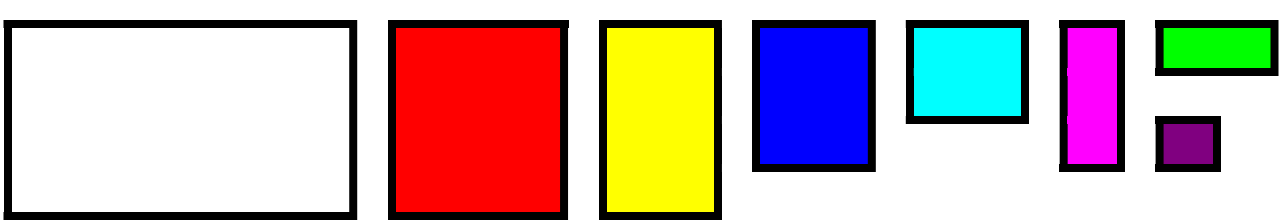
Principle: We make trades having equivalent value, but which have some other reason to make.

The underlying common principle for this illustration is the trading principle. Its application to money trades is an instance that can be used to bridge to somewhat more remote instances that involve trading equivalent fractions. The **reasons** aspect of this principle is especially important, since a trade is incompletely understood unless some reason for it can be imagined. Specifically, although a student may see a reason for reducing a fraction or changing an improper fraction to mixed form, reasons for trading the other way may seem more remote. This is especially the case if a student has little understanding of the arithmetic of fractions and if doing the arithmetic is the main reason they encounter for trading.

Example: After wrapping coins, Bob has 11 nickels and a few quarters and dimes. He exchanges the 3 quarters and 7 of the dimes with some of his friends for 39 nickels. This allows him to make a $2 roll of nickels, which is more useful for a bank deposit. Other examples can be given. Suppose Jan gives Roy 2 quarters and 5 dimes for a dollar. What are some are some reasons both parties might have for making this exchange?

Activity: Trades are used to make comparisons, although such trades are usually merely conceptual. Kay and Bob are working with some younger children who have a limited mastery of numerical concepts. Mike has 7 dimes and Sue has 3 quarters. Both think that they have the most money. Bob explains that 7 dimes are worth 70¢ and that 3 quarters are worth 75¢. This is a conceptual change into pennies. Kay has them (temporarily) trade their coins for nickels. Discuss this situation.

An Imaginary Money System: In this system, all money consists of colored rectangular pieces of different sizes and colors. They are named by their colors. The largest size is a white. Value is determined by size. A white has the same size and value as 2 reds. It also has the same size and value as 3 yellows. It takes 4 blues to make a white, 6 aquas to make a white, 8 pinks to make a white, 12 greens to make a white, 24 violets to make a white.



We now give a sample of some activities that can be used to make the relation ships between these pieces familiar. A template for making them is available on the Fraction Section of our website. Using these pieces will make the activities more accessible.

Activity: We can trade 4 pinks for 3 aquas. We could fit pieces together to see that they are of equivalent value. We could also see that both could be traded either for a red or for 6 greens. Discuss other examples of demonstrating equivalent value. Imagine some reasons for trading.

Activity: Kay has 2 yellows and Bob has 3 blues. Both can easily visualize that Bob has more money. Jan agrees but wants to demonstrate this by trading. She says that there are cases where seeing who has the most by visualizing may be difficult, especially when more pieces are involved. She says that she cannot tell by visualizing that 7 pinks are worth more than 5 aquas. She claims trading will always work. Roy says that he could tell this without trading since 4 pinks is equivalent to 3 aquas and 3 pinks are more than 2 aquas. Describe this situation, including the trades Jan might make. Discuss other such comparisons.

Activity: The comparison above involved comparing several pieces of one color with several pieces of another color. Compare 2 yellows and a red with 3 blues and 3 pinks. Consider trades with each that involve trading for a white.

Fraction Concepts: All pieces can be thought of as a fraction of a white. For instance, since 2 reds are equivalent to a white a red is ½ of a white. Comparing sizes is like comparing fractions. For instance, saying that 7 pinks are worth more than 5 aquas can be bridged to saying $^7/_8 > {}^5/_6$. Trading provides one way to see this. Trading 7 pinks for violets gives 21 of them, and so $^7/_8 = ^{21}/_{24}$. Trading 5 aquas gives 20 violets, and so $^5/_6 = ^{20}/_{24}$. This gives an initial reason for raising fractions that does not involve the more remote concepts of adding or subtracting fractions. Moreover comparison can be bridged to subtraction by asking how much more is the larger one.

Activity: Comparing 2 yellows and a red with 3 blues and 3 pinks can be bridged both to adding fractions and to changing improper fractions to mixed numerals. Explain how to think about this. Give additional examples.

Activity: Trading can be purely conceptual. A person with a plot that is ¾ of an acre and a plot that is ½ an acre does not have to make an actual trade to know that he has 1¼ acres. Adding fractions, is a form of making a conceptual trade of ¾+½ for 1¼. Discuss reasons for making this conceptual trade or for making it in the opposite direction.

The above bridging from color pieces to fractions concepts is an abbreviate version of what is done in the book *Visualizing Fractions with Color Pieces* by F. Richard Singer III. This book is available without charge on conceptualstudy.org.

Summary

The BQS is a Constructivist strategy that empowers students to connect prior knowledge, especially non-content knowledge, to content areas. In an environment structured by BQS, students are making connections throughout the lesson.

References

Bartlet, F.C. (1997). *Remembering: A study in experimental and social psychology.*New York: Cambridge University.

Dewey, J. (1991). *How we think.* Amherst: Prometheus Books.

Diamond, M. & Hopson, J. (1998). *Magic trees of the mind.* New York: Penguin Group.

Fischer, K. & Rose, S. (1998). Growth cycles of brain and mind. *Educational Leadership* (November), 56-60.

Leinhardt, G. (1992). What research on learning tells us about teaching. *Educational Leadership* 49 (7), 20-25.

Osman, M., & Hannafin, M. (1994). *Effects of advance questioning and prior knowledge on science learning.* Journal of Educational Research, 88 (no.1*)* (September/October), 5-13.

Overy, R. (1995). Why the allies won: New York: W.W. Norton and Company.

Pelech, J., & Singer, R. (2007). The bridging question strategy. *Journal for the Practical Application of Constructivist Theory in Education.* 2(1).

Saxe, G. (1985). *Effects of schooling on arithmetical understandings: Studies with Oksapmin children Papua New Guinea.* Journal of Educational Psychology, 77(50), 503-513.

Vygotsky, L. S. (Ed.). (1962). *Thought and language*. Cambridge, Massachusetts.

