"*BIG PICTURE*" Approach to Problem Solving*

"*The test was NOTHING like the homework!*" – Typical student who fails a test

What is your approach to solving problems? Do you jump right into to the first problem assigned in the homework OR do you attempt to see the BIG PICTURE before starting to solve any problem? Seeing the BIG PICTURE can be the difference between passing and failing.

Part 1: Seeing the *BIG PICTURE*

CONCEPT – *the first question to ask is*, "what is the *Concept*?"

A *concept* is a main idea. When you have a problem, you need to be familiar with the concept that is associated with the problem.

If you don't know the concept for your problem, then STOP here. Return to your BPR notes, textbook or lecture notes to better understand the concept BEFORE continuing.

S.A.M. – *the next question is*, "what is the S.A.M.?"

- ☑ **Set-up**
- ☑ **Algorithm**
- ☑ **Method**

} = **S.A.M.**

Every concept has a specific *S.A.M.* (*i.e. steps to follow*) for solving problems.

If you don't know the S.A.M. for your problem, then STOP here. Return to the examples in your textbook or lecture notes to better understand the S.A.M. BEFORE continuing.

VARIATION – *now that you identified the Concept and S.A.M., ask yourself,* "what is the *Variation* AND how does the variation AFFECT the S.A.M.?"

When you have a group of problems - *review all of the problems in the group*. They share the same *concept*, but are the problems different or the same? If they're different, how do they differ? This "difference" is the *variation*.

Does the variation affect the S.A.M.? How do you need to modify the S.A.M. for different problems?

If you don't know how to modify the S.A.M. for different problems, then look for example problems in other textbooks or online resources. If you still need help, see your professors, tutors or other classmates.

Understanding how the variation affects the S.A.M. is critical. This is the key to getting an "A" on your next test.

Now that you understand the ***Concept***, ***S.A.M.*** and ***Variation***, you can see the ***BIG PICTURE*** and are ready to begin solving problems.

** This is a fundamental practice in the MESA Program culture*

Part 2: Solving the Problem*

COME UP WITH A PLAN – *Using the S.A.M. from Part 1 of the Big Picture Approach to Problem Solving, make a plan for solving your specific problem.*

Before *making a plan*, check that you have a clear understanding of the problem. What is the problem asking? Do you understand all the words in the statement of the problem? Can you restate the problem in your own words? Is there missing information that, if known, would allow you to solve the problem? *Still don't understand the problem? Then return to the steps in Part 1 of the Big Picture Approach to Problem Solving.*

What are your techniques to solve problems? Successful problem solvers use a variety of techniques when they attempt to solve a problem. Here are some recommended strategies:

- ☐ Make a list of the known and unknown information. *Can you express the unknowns in terms of the knowns?*
- ☐ Make a list of information that is needed
- ☐ Draw a diagram
- ☐ Make a table
- ☐ Work backwards
- ☐ Try to solve a similar but simpler problem
- ☐ Research the problem to determine whether there are known techniques for solving problems of its kind
- ☐ Try to determine whether some pattern exists
- ☐ Write an equation
- ☐ Guess at a solution and then check it

Need help coming up with a plan? Then STOP here BEFORE continuing. Explain the problem to someone who may help (other classmates, tutors or professors). Ask them how they would solve it.

USE YOUR PLAN TO SOLVE THE PROBLEM

If you can see the Big Picture and have come up with a *good plan*, then this should be the easiest step in the Big Picture Approach to Problem Solving.

- ☑ Work carefully
- ☑ **Don't skip steps**
- ☑ Write clearly

If have trouble solving the problem, then go back and make sure you didn't make any mistakes. No mistakes? Then maybe you need to come up with a new plan. Don't worry, this is part of the learning process. It may help to take a break and come back later with a clear mind. ***Remember "20-minute rule"*** *– do not stay "stuck" on a problem more than 20 minutes. Skip it and get help later!*

THINK ABOUT YOUR ANSWER – *Does your answer make sense? Does it fit with the Big Picture?*

This is the most rewarding and important step. Getting the right answer proves that you have mastered the learning, and it is the learning that matters most.

- ☑ Check that your answer is correct. Does it fit with your expectations? *If your answer is not correct, then step back through each step. Where is the error?*
- ☑ How would the answer change if the problem changed? (See VARIATION in Part 1)
- ☑ Marvel at your accomplishment. Enjoy the rewards of your hard work.

CONGRATULATIONS! *You are now trained in the Big Picture Approach to Problem Solving.*

* Part 2 is adapted from the strategy by mathematician George Polya (1887-1985), author of *How to Solve It* (1945)