

NORTH SALEM CENTRAL SCHOOL DISTRICT

PROBLEM SOLVING RESOURCES

A Master List Of Behaviors To Support Problem-Solving

9/12/13

Our Mission: Engage students to continuously learn, question, define and solve problems through critical and creative thinking.

Each task in this resource is annotated to indicate its connection to:

- **Critical, convergent thinking**
- **Creative, divergent thinking**
- **Communication**
- **Collaboration**
- **Self-Reflection**

FINDING / CLARIFYING THE PROBLEM AND GETTING ORGANIZED

Step 1 Of The Cycle Of Problem Solving

1. I generated many ideas and asked questions to help me find a specific problem to solve
(creative, divergent thinking)

2. I took an original, unique, imaginative approach to find a specific problem to solve

Five Whys: Getting To The Root Of The Problem

http://www.mindtools.com/pages/article/newTMC_5W.htm

Cause and Effect Analysis

http://www.mindtools.com/pages/article/newTMC_03.htm

(creative, divergent thinking)

3. I analyzed data from more than one point of view to find and define a problem. f
(critical, convergent thinking, creative, divergent thinking.)

4. If I selected a problem another person or persons needs solved, I asked clarifying and probing questions to learn more about the problem and the requirements for its solution. I wrote my questions and the responses I got.
(critical, convergent thinking, communication)

5. I used my own words to restate and explain what the problem is about.
(critical, convergent thinking)

<p>6. I drew sketches or diagrams to make a visual description of the problem. (creative, divergent thinking)</p>
<p>7. I made sure that I understood the requirements, rules, or criteria that the solution must meet. I communicated and confirmed with the person or persons who presented the problem to learn more about such things as the problem and their criteria, rules, or conditions for the solution. I wrote a list of what I learned from this investigation. (critical, convergent thinking; communication)</p>
<p>8. I researched the person or persons to whom I will present a solution to the problem or asked them directly, when possible. I understand why the problem is/can be important to them, what they expect in a solution, and how they expect me to communicate with them. I made notes about what I learned about this person or persons. (critical, convergent thinking; communication)</p>
<p>9. I asked clarifying questions to understand the facts and I asked probing questions to understand the ideas. (critical, convergent thinking; communication)</p>
<p>10. I know whether I am expected to propose a solution or actually make or implement that solution. (critical, convergent thinking)</p>
<p>11. I know when my work is due – the check-points along the way and the final product and/or presentation. (critical, convergent thinking)</p>
<p>12. I have an initial plan of action and time-table to do the work to find a solution and prepare a presentation to the person or persons who want the solution. (critical, convergent thinking)</p>
<p>13. I know how to get help when and if I need it. I have listed the possible sources of help. (critical, convergent thinking)</p>
<p>14. If I am working on a problem-solving team, we have decided how we will share the work and collaborate. (collaboration)</p>
<p>15. I know the format I am expected to use to present the final solution to an audience, i.e. the person(s) who want(s) the solution or from whom I need support or approval. (critical, convergent thinking)</p>
<p>16. I decided on the technology I will need to do the work and communicate my solution. (critical, convergent thinking)</p>
<p>17. I made arrangements to use the space and equipment I will need to do my work. (critical, convergent thinking)</p>

18. I decided on a way to keep track of the work I will do as a problem solver so that I can display and explain my thinking and work processes. An entrepreneur's or problem-solver's notebook is an example of a strategy to keep track of work to help me as a problem-solver. Someone may want to give me recognition for my work as a problem solver and I will need to explain the processes I use to solve problems. (college letters of reference, college essays, scholarship applications and interviews, job applications and interviews, resume, etc.)

(critical, convergent thinking)

19. As possible, I did my problem solving work in a digital environment so that the work I did during problem solving and my final products and/or presentations were all stored digitally. In this way I can build a digital portfolio of my work and be able to create mini-presentations about "me as a problem solver" to audiences such as college admissions interviewers, scholarship committees, potential employers, etc.

(critical, convergent thinking)

CONDUCTING RESEARCH TO HELP ME DEVELOP SEVERAL POSSIBLE SOLUTIONS

Step 2 Of The Cycle Of Problem Solving

20. I decided on what points of view I will consider as I do my research and select a solution. These points of view are those of the people who have an interest in or may be affected by the problem and its solution. I made notes about the point(s) of view that are important.

(creative, divergent thinking; communication)

21. I made a list of what I need to know more about regarding the main concepts, fields of knowledge, and other content that is important to my research.

(creative, divergent thinking)

22. I listed the questions I need to answer in my research to find a solution.

(critical, convergent thinking)

23. I listed where I will go to find the information I need to answer my questions. I use advanced search strategies in my research.

(critical, convergent thinking)

24. I evaluated each source of information and selected the sources that were valid and useful.

(critical, convergent thinking)

25. I carefully and thoroughly inspected the details of the factual information from the sources I found.

(critical, convergent thinking)

26. I designed and conducted experiments to get information I need.

(creative, divergent thinking)

27. I discovered what information was missing and found ways to get it.

(critical, convergent thinking; creative, divergent thinking)

28. When I needed to think mathematically, I draw diagrams, sketch, organize the data in different ways, make charts or graphs, create maps, or use other visual strategies to help my thinking.

(creative, divergent thinking)

29. I organized, analyzed, integrated and saved valid and useful information from multiple sources that answered my questions. I cited my sources. These critical thinking processes helped me make decisions, revise ideas, and ask further questions to guide my research.

(critical, convergent thinking)

30. I judged my own thinking regarding how it is influenced by my own biases, stereotypes, prejudices, emotions, or other factors that might influence my objectivity and rationality.

(critical, convergent thinking)

31. I used the lists of thinking skill verbs and selected verbs for the work I will do to find, analyze, and evaluate information, ideas, plans, etc..

(critical, convergent thinking)

32. I had a healthy skepticism of the information I found and looked for verification from other sources.

(critical, convergent thinking)

33. I went beyond collecting facts to use inductive reasoning to find logical links between the information and interpretations and using deductive reasoning to understand generalizations that helped me understand the "big picture" of what I am learning.

(creative, divergent thinking, communication)

34. I considered information from various points of view including those that disagreed with my ideas in the process of analyzing, evaluating, and improving my ideas for a solution to the problem.

(creative, divergent thinking; communication)

35. I collected tools and resources I will need to experiment on creating a solution.

(critical, convergent thinking)

36. If there are costs, I know how to get those funds.

(critical, convergent thinking)

GENERATING IDEAS FOR AND SELECTING A SOLUTION

Steps 3 and 4 of the Cycle Of Problem Solving

37. I created several possible solutions.

(creative, divergent thinking)

38. I got and used feedback on my ideas to help me revise ideas for solutions and/or focus my search for a solution.

(collaboration; communication)

39. I sorted, arranged, categorized, assessed, analyzed, and prioritized my ideas to work towards finding the best solution so far.

Constructive Controversy http://www.mindtools.com/pages/article/newTMC_71.htm

Straw Man Concept

http://www.mindtools.com/pages/article/newTMC_84.htm

Six Thinking Hats: Looking At A Decision From All Points Of View

http://www.mindtools.com/pages/article/newTED_07.htm

(critical, convergent thinking)

40. I selected a solution and checked it to be sure that it met the requirements, rules, or criteria.

(critical, convergent thinking)

41. I built or implemented the solution if that was the requirement.

(critical, convergent thinking)

42. I built prototypes or made drafts of my solution, got feedback on them, and improved my work.

(creative, divergent thinking)

43. If my work included implementing the solution, I keep records of how well the solution worked.

(critical, convergent thinking)

44. When applicable, I kept and analyzed data on the function of the solution(s) I tried out.

(critical, convergent thinking)

PRESENTING MY SOLUTION TO AN AUDIENCE

Step 5 Of The Cycle Of Problem Solving

45. I used my understanding of the cultural, worldview, frames of reference, and beliefs of my audience to improve my communication.

(communication)

46. I used a rubric or check-list to improve my writing or another form of communication with my audience.

(communication)

47. I prepared a clear presentation to communicate with the specific person or persons who want the solution. My idea about how to best solve the problem was very convincing. I used my own words and did not copy or plagiarize.

Opinion Writing (if my writing is intended to persuade my audience)

- I clearly stated the problem and my opinion about for a solution.
- I provided several reasons with detailed, factual support for my proposed solution.
- I used diagrams or other graphics to help clarify my proposal.
- I addressed the most probable question or concern that might be made about my proposed solution and answered and refuted it.
- I made a strong closing statement about my proposed solution to the problem.
- I used appropriate and varied transitions and syntax to create cohesion and clarify relationships among ideas.
- I used vocabulary and examples that were appropriate for my audience.
- I checked my work for spelling, grammar, punctuation, and other conventions of writing.

Informational Writing (If my writing is intended to inform my audience)

- I clearly described the problem and the solution under consideration.
- I organized ideas/concepts and information so that each new element builds on previous elements to create a unified whole.

- I used sufficient, relevant, and significant facts, extended definitions, concrete details, quotations, or other information and examples relevant to the audience.
- I used diagrams or other graphics to help clarify the information.
- I used appropriate and varied transitions and syntax to create cohesion and clarify relationships among ideas.
- I used vocabulary and examples that were appropriate for my audience.
- I checked my work for spelling, grammar, punctuation, and other conventions of writing.

(communication)

48. I used digital tools to enhance the clarity and impact of my presentation.

Creating Effective Visual Presentations

<http://www.mindtools.com/pages/article/creating-presentation-visuals.htm>

(communication)

49. I used effective public speaking strategies when I made my presentation including paying attention to:

- Personal appearance
- Being prepared and practiced
- Eye contact with audience
- Volume, grammar, elocution
- Use of time and pacing
- Body language
- Enthusiasm
- Integration of technology and/or props

(communication)

50. When I presented the solution to the problem, I provided enough detailed information which can include written explanations; labeled, neat drawings; photographs; videos; diagrams; flowchart or other charts; graphs; tables; maps; and other forms of information. I want my audience to understand and be persuaded by my ideas.

(communication)

51. When I present an action plan to implement the solution, I provided enough detailed information which can include written explanations; labeled, neat drawings; photographs; videos; diagrams; flowchart, or other charts; graphs; tables; maps; and other forms of information. I want my audience to understand and be persuaded by my ideas.

(communication)

52. I studied examples of excellent reports / presentations and used that knowledge to improve my own work.

(communication)

53. I selected vocabulary, examples, metaphors, stories, etc. appropriate to my audience.

(communication)

54. The length of my presentation was respectful of my audience.

(communication)

55. I checked to be sure that my audience understood what I was communicating. I adjusted my presentation as needed to improve communication.

(communication)

56. If asked, I can provide a summary of how I attacked and solved the problem. I can provide examples of my work along the way to show my skills as a problem-solver.

(communication)

57. I responded to questions from my audience in a clear and thoughtful manner.

(communication)

OPENNESS AND COURAGE TO EXPLORE

Relevant to all steps of the Cycle Of Problem Solving

58. If I got stuck I found a way to get un-stuck, if I tried something that did not work I tried something else, I tolerated being uncertain, if I was frustrated I had a strategy to keep trying, and if I failed to find the way I tried something else. I was persistent and tenacious.

(creative, divergent thinking)

59. I used what seemed to be errors, mistakes, or failures to learn and find new ideas to solve the problem

(creative, divergent thinking)

60. If I reached a "dead end" in finding a solution, I returned to the process of understanding the problem, doing research, and finding more possibilities for solutions.

(critical, convergent thinking and creative, divergent thinking)

61. I gave myself time to be creative and I got the job done on time.

10 Common Mistakes Of Time Management

<http://www.mindtools.com/pages/article/time-management-mistakes.htm>

(creative, divergent thinking)

62. I took appropriate risks as I created and tested ideas to solve the problem.

(creative, divergent thinking)

63. I studied the problem-solving work of others and to find strategies and models of excellence that will help me be a better problem-solving.

(creative, divergent thinking)

WORKING CREATIVELY WITH OTHERS

Relevant to all steps of the Cycle Of Problem Solving

64. I helped my group use current technological tools available for on-line collaboration.

(collaboration)

65. I helped my group have constructive controversies so that our disagreements and different opinions can improve the problem solving processes.

(collaboration, communication)

66. I modeled for and encouraged my group members to use creative thinking strategies and to be open to the ideas from the rest of the group. I emotionally supported all the members of my group to use creative thinking skills.
(collaboration)

67. We built on each other's ideas and generated new, unique, and better ideas because of this collaboration.
(collaboration)

68. Whenever I work with another person in any way during my problem-solving work, I am polite, respectful, and considerate of their ideas and time.
(collaboration)

69. I helped my group be organized, efficient, and on-schedule.
(collaboration)

70. I "did my homework" and am well-prepared for group work.
(collaboration)

71. I helped by group reflect on our work together and improve our collaboration.
(collaboration, communication)

CREATIVE PRODUCTION AND INNOVATION

Relevant to all steps of the Cycle Of Problem Solving

72. I was ethical in producing my creative works –I did not copy or plagiarize.
(critical, convergent thinking)

73. I am a "Question-Stormer" (Inquiry Institute). I ask many questions throughout my problem-solving work such as:

What is?

What might be?

When?

Where?

Why?, Why not?

Why are we?

Who?

How does it work/ why does it not work?

How is it the same as/different from?

What caused?

What is the effect of?

What is the pattern?

What is important/unimportant?

What if the following were true/not true, the rules/not the rules, the criteria /not the criteria?

What if we were limited by/free from?

What if we did/did not?

What do they like/not like, want/not want?

What is getting in our way and what do we do about it?

Use of the brainstorming strategies but only using questions

Question Storming

<http://inquiryinstitute.com/resources/q-storming>

<http://vimeo.com/48200106>

Starbursting Understanding New Ideas By Asking Questions

http://www.mindtools.com/pages/article/newCT_91.htm

(creative, divergent thinking)

74. I reviewed, selected, and used the strategies for creative thinking that were just right for my problem solving work such as:

- Brainstorming

Silent Brainstorming -- brainstorm alone on Post-its before you share with the group

<http://winnipegagilist.blogspot.com/2012/01/silent-brainstorming.html>

Brainstorming with affinity mapping http://www.mindtools.com/pages/article/newTMC_86.htm

Reverse Brainstorming http://www.mindtools.com/pages/article/newCT_96.htm

Brainstorming With Post-its What Does It “LOOK LIKE?”

<https://www.google.com/search?q=brainstorming+with+postits&hl=en&tbm=isch&tbo=u&source=univ&sa=X&ei=lho6UfXAOerG0QHx-oHgAQ&ved=0CD8QsAQ&biw=1254&bih=730>

Brainstorming What is it?

<http://www.buffalostate.edu/orgs/cbir/readingroom/html/Steege-99.html>

- Clever detective using all of my senses – finding the many details of information that may go un-noticed, “hidden,” unusual, surprising, counter to what I thought I would find, etc.
- In their shoes and showing empathy – taking the intellectual and/or emotional point of view of another person or group to understand an idea, problem, solution, etc. more fully.
- What if ____? -- see the what-if questions in the task regarding Questionstorming in this section.
- Finding patterns – discover the patterns in actions, events, processes, successes, failures, causes and effects, how something works, how something is made, etc.
- Making connections – finding similarity in two or more ideas like an idea in biology and an idea in chemistry, an idea in science and an idea in social studies, etc. – finding connections among what you read, see, or hear; your own life experiences; and the experiences of others in the world.

- Thinking through metaphors – how is a river, hurricane, drive to the mall, argument with your friend, garden, etc. like the problem you are trying to solve?

(creative, divergent thinking)

75. I used one or more of the following SCAMPER (Mind Tools) strategies to help me find new ways to think: Substitute, Combine, Adapt, Modify, Put To Another Use, Eliminate, Reverse

http://www.mindtools.com/pages/article/newCT_02.htm

(creative, divergent thinking)

76. Improved my creative thinking strategies by paying attention to the following attributes of creative thinking:

- Fluency (I generate many new ideas)
- Flexibility (I am open to examining new ideas in unexpected ways)
- Originality (I generate ideas that are different from the ideas I or others usually have)
- Elaboration (I add details to my ideas to make them more complete)
- Tinker (I refine, strengthen, or develop my ideas by continuing to analyze possibilities, consider new information, and revisit my ideas thinking of them as “works in progress.”)

E. Paul Torrance

(creative, divergent thinking)

77. I was resourceful and made use of what was available to get the job done.

(creative, divergent thinking)

78. I moved back and forth between creative, divergent thinking and critical, convergent thinking as required by the problem-solving work and got the work done on time.

(creative, divergent thinking)

SELF-REFLECTION AND GOAL SETTING

Steps 6, 7 and 8 of the Cycle of Problem Solving

79. I accurately assessed the quality of the work I did and showed the parts of my work that substantiate my assessment. I asked for feedback and constructive suggestions from others to help me evaluate my work.

(self-reflection)

80. I described and explained my thinking processes, why I used those processes, and how they helped me make progress in solving the problem.

(self-reflection)

81. I described how I am improving as a problem solver and showed evidence from two or more problems I solved to substantiate my opinion.

(self-reflection)

82. I described how I am improving as an independent problem-solver and how well I work with others to solve-problems.

(self-reflection)

83. I set “doable” goals to improve as a problem solver.
(self-reflection)

84. I make an action plan of how to accomplish my “doable” goals to improve.
(self-reflection)

85. I followed through and carried out my goal to improve.
(self-reflection)

Some information in this list comes from or is adapted from the following EdLeader21 rubrics: Creativity, Critical Thinking, Collaboration and Communication