Future Problem Solving in Gifted Education

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Abstract

This chapter traces the growth of the Future Problem Solving Program from its beginning at one high school in Athens, Georgia in 1974 to its 30th Anniversary as an International Program with over 250,000 students around the world participating from grades 1 to 12, and to the present. The various components and rationale of the Program are described with examples of problems and students’ innovative solutions. The chapter will end with a discussion of the benefits of this program for the students who participate as well as for the larger society, and an argument for widening its scope beyond gifted education will be made.

Key Words: Action Based Problem Solving, Community Problem Solving, competition, Creative Problem Solving (CPS), creativity, future, Future Problem Solving (FPS), fuzzy, problem finding, Torrance, types of problems, higher-level thinking, real problems, teamwork, research, and organization skills.
FUTURE PROBLEM SOLVING IN GIFTED EDUCATION

“To dream and to plan, to be curious about the future and to wonder how much it can be influenced by our efforts are important aspects of our being human...” (Torrance, 1983/1995, p. 131)

The Birth of FPSP

The 1960’s were a time of turbulence and great social consciousness in many countries. In the United States, groups of people mobilized to protest the Vietnam War, work for Civil Rights, ensure Equal Rights for women, and become more involved in social and governmental issues than ever before. It was also a time when societies began facing problems they had never contemplated—issues of integration, pollution, overpopulation, riots, serial assassinations, challenges of cultural pluralism, polarization of the segments of society, and so on.

In the relative calm that followed this turbulent period, a little old man living in Athens, Georgia became very concerned about what he observed as students’ lack of creativity and apathy about the future. He worried that students were not very knowledgeable about their past, and they did not seem very concerned about their future. He also worried that they were not learning to think creatively and to use what knowledge they had imaginatively. Many people have worried about the younger generation in such a way, but this little old man was no ordinary little old man, he was E. Paul Torrance, and he decided to do something about this problem.

Torrance (1978) had been impressed with Toffler’s Future Shock (1970), a popular and controversial book that predicted the stress that people would face from the immense changes that would take place in the next 30 years. Toffler explained future shock as similar to culture shock, but more serious because of the accelerating rate of change that would sweep through the industrialized world with “unprecedented impact”(p. 9) leaving some people stressed and
disoriented. He also coined the term “information overload” (Toffler, p. 360) to describe how people would feel if they were unable to adapt.

A wonderful opportunity arose when, according to a handwritten note by Paul Torrance’s wife, Pansy, “Don Hight [Clarke Central High School principal] phoned and asked Paul to devise some sort of task for students to do” (note recovered from the Torrances’ effects). Thus, it was that one night in 1974, Paul Torrance and his wife, Pansy, sat at their kitchen table discussing their concerns about students and trying to think of a way to get them more engaged in solving societal problems of the future. It was that night that they decided to create a competition to involve students in solving problems of the future (Torrance, 1974).

Torrance recalled his assignment with the U.S. Air Force after WWII as the Director of Survival Research in Colorado (Hébert, Cramond, Neumeister, Millar, & Silvian, 2002; Millar, 1995). Working with jet aces, Torrance soon realized that it would be impossible to prepare them to survive every possible situation in which they might find themselves. Therefore, he determined to train them to think creatively in order to solve survival problems in whatever environment they found themselves.

Based on that experience and all they had learned through their studies and teaching at the Creative Problem Solving Institute in Buffalo, Paul and Pansy Torrance (1978) decided to use the Osborn-Parnes Creative Problem Solving Process (CPS; Osborn, 1953; Parnes, 1967) as the method by which they would teach students to solve open-ended problems without clear answers. They knew that CPS would give the students the structure to work together and the freedom to be creative. They adapted the CPS process to include research on problems of the future and created a month-long curriculum unit at Clarke Central High School in Athens, Georgia.
The program proved to be successful and grew rapidly in both length and breadth over the next few years. By the school year of 1976 – 1977, the Future Problem Solving Program (FPSP) was established as a yearlong program with over 150 schools and 3,000 4th – 12th grade students participating. In addition to the group problem-solving component, a scenario-writing component and individual competition were introduced. By the next school year, 1977 – 1978, FPSP was a nationwide program in approximately 300 Schools with approximately 6,000 students participating in it. Moreover, there were approximately 10,000 students involved in FPSP within their schools as the process was integrated into the curriculum.

The Future Problem Solving Program continued to grow so that by 1978 – 1979, it was estimated that over 30,000 students participated in FPSP across the country. Then, in 1983 – 1984 the Advanced Division was introduced to take the problem solving one step further. The Advanced Division required that students identify a problem in their own community and carry out their proposed solution. This later became Community Problem Solving (CmPS), which is a systematic way for students to become involved citizens in their communities.

The thirtieth anniversary of the Future Problem Solving Program was bittersweet. The summer before, in July 2003, the father of the program, E. Paul Torrance, had passed away. His loss was still keenly felt, but the FPSP had much to celebrate at its International Competition in 2004. The program had grown from that kitchen table in the Torrance home to a worldwide program, from a curriculum unit at one high school to an international program with affiliate programs in Australia, Canada, Hong Kong, Korea, Malaysia, New Zealand, Russia, and Singapore in addition to the United States. There were over 250,000 students and over 40 affiliate programs participating around the world.

Now called the Future Problem Solving Program International, FPSPI has grown in the
kinds of opportunities that it offers to engage students in problem solving. Student can participate individually or as a member of a team, within a course or outside of the regular curriculum, competitively or not, and through the future problems provided by the international organization or problems they identify in their own communities. It has expanded from a competition for high school students to a program for students of all ages and in several different domains.

The Process and Examples

Overview

Students either work on FPS in their own classes or schools or compete at the local, state, and international levels in teams of four or as individuals. Because in real life problems are seldom presented as clearly as they usually are in school situations, students practice and train on fuzzy situations that are based on projected problems of the future or problem situations that they and/or their teacher choose. Topics are selected from three strands: Business and Economics; Science and Technology; and Social and Political Issues. The topics are focused on the future, but relevant to today. They are complex issues that individuals at different ages and from different viewpoints can understand as presented. Every year, several topics are listed in each category on the FPSPI website, and participants can vote on them through the website (http://www.fpSPI.org) For example, the topics for the next school year have already been voted on and listed on the site. Participants can now vote for the topics for the succeeding year. The 2006-2007 topics include: Fundraising and Charity Giving; Protection of National Treasures; Cultural Prejudice; Caring for Elders; and Privacy. The 2007-2008 topics are: Body Enhancement; Simulation Technology; Neurotechnology; Debt in Developing Countries; and Child Labor.
When a team registers for the FPSPI competition, they are given the list of topics for that year, a fuzzy that presents the first problem situation, and a list of resources. The first two problems are practice problems. The teams work on the first one, send it in to the affiliate, and receive constructive feedback. Then, they are sent the second fuzzy and another resource list. They repeat the process incorporating the feedback they received, and receive constructive feedback again. The third problem is the Qualifying Problem for the Bowl. Teams that do well on this problem are invited to compete in the Bowl. In the U.S., this is done at the state level. At the Bowl, the students do not receive the fuzzy until the competition begins although they have had the topic and an opportunity to do research on it. The teams work on the Bowl problem in a 3-hour timed session with only the help of a dictionary. Teams that win in their divisions at the Bowl level are invited to attend the International Competition. The process takes place over the course of a school year.

The Process

“Future Problem Solving Program International (FPSPI) teaches students how to think ... not what to think.” (FPSPI, Who We Are, Participant Thoughts)

The process that students are taught consists of six steps (FPSPI Fact Sheet, 2007). In order to explain the process, I will give a brief explanation of each step and an example taken through the steps. The explanations and examples at each step are streamlined to fit into this chapter. Individuals who are interested in implementing this procedure are encouraged to pursue additional training or information through the FPSPI. In addition, I have added a section in the appendix that illustrates an example Future Problem Solving activity taken from the beginning of the process through the end. (see appendix for sample problem solution from beginning to end.)

1. Identify challenges related to the topic or future scene.
This step involves investigating the problem, which is stated as a “fuzzy.” Students receive the fuzzy in one of three ways. Students who compete in individual or team problem solving, or in scenario writing, receive a few paragraphs explaining the situation from the FPSP International Office. This situation is called a fuzzy because there are many issues and possible problems embedded in it. Students working on Community Problem Solving identify a problem in their community, and those engaged in Curriculum-Based Problem Solving are assigned or choose a problem from some area of the curriculum.

Because in real life problems are seldom clear, distinct, and delimited, this step helps students understand the problem situation, find several embedded related problems, and choose one to develop and refine. They must analyze the situation to determine what problem, if solved, would solve most of the problems in the situation, yet could be addressed realistically, albeit creatively. These are some sophisticated higher level thinking skills that are not typically taught in school, yet are necessary in real life. The students also begin research in order to understand the parameters of the problem situation and possible solutions.

For example, if the first fuzzy is about the effects of world climatic changes on communities, the students would receive a description of the problem and a list of possible research resources of all types according to their division. See the appendix for an example of a possible fuzzy on this topic.

The students read and discuss the fuzzy, identify several problems involved in the situation, and begin doing research on the issues. At this point, they try to get as much information as possible so that they can understand what is involved, causes, and possible outcomes.

2. Select an underlying problem
Based upon their research and their lists of problems, the students must choose and define the problem that is at the heart of the problem situation, and which, if solved, could go far in solving the larger situation. Then, they must word the problem for creative attack.

Continuing with our example, the students list the problems and identify criteria by which to select the best problem by using a grid as illustrated in the appendix. The formulaic beginning of all problem statements is “In what ways might we…?” shortened to IWWMW, in order to focus the students on thinking of positive solutions to the situation. Continuing with the example given for the fuzzy, a team might decide to choose the problem, “In what ways might we design our communities to withstand the effects of climatic changes?” Another group might use the same fuzzy and derive this problem statement, ”IWWMW lessen civilizations effects on the climate?” Still others may choose, “IWWMW prevent storms or make them less damaging?” Students might choose to look at the problem in many ways. The first problem statement above would require some knowledge of architecture and trends in climate change while the second would focus more on ecology and the effects on weather. The third takes the approach of decreasing the likelihood and severity of storms. They choose the problem, sometimes combining problems if that makes sense. Then, they word the problem for attack using the beginning statement: "In what ways might we…?," shortened to IWWMW. Our group might end this step with the problem, “In what ways might we design our cities to better weather the effects of climatic changes?” Other groups might choose other problems for the same Fuzzy such as, “IWWMW lessen the effects of civilization on the climate?” “IWWMW better forecast potential disasters and protect our communities?” or “IWWMW lessen the severity of storms so that they cause less destruction?”
Because the process is recursive, at this point the teams may find that they need to go back to the research to get more information based upon the focus of their problem statement. At some point, they may even decide to limit, change, or enlarge the focus of the problem statement.

3. **Produce solution ideas to the underlying problem**

At this step, the purpose is to create many, varied, and unusual solution ideas that respond to the underlying problem. Students brainstorm and record their ideas, following the rules of no criticism and hitchhiking off other ideas. Even unlikely and fantasy ideas are encouraged in that they might prove to be feasible after all, and a crazy idea might trigger someone else in the group to come up with a great idea. Many of our most innovative ideas have come about from what were undoubtedly considered crazy at one time. Imagine the looks on the people around the table when the inventor(s) of the Roomba told manufacturers that they had invented a vacuum cleaner that would vacuum a room on its own! Our team’s brainstormed ideas are listed in the appendix.

4. **Generate and select criteria to evaluate solution ideas**

In this step, the team must consider what criteria to apply to their solutions in order to choose the best one. This is a critical step, and one that I find students often have difficulty doing for the first time. I recall that in Dr. Torrance’s class, some of us complained one night that the process had not resulted in what we thought was the best solution. He told us that we probably did not use appropriate criteria. Why did we not think it was the best solution? In my case, it was because I did not like the winning solution. He assured us that it was fine to use a criterion like “which one do I like the best?” This is especially true when the problem is a personal one—like choosing a date, or picking a party theme, etc.

I have found that some concrete activities help children who have difficulty with this. One activity that I found helpful in this regard was bringing in comic strips for the groups of
students to critique. As they told me which ones they thought were best, I wrote the qualities on the board: best art, funniest, best characters, most interesting, etc. Then, I explained that these were criteria that could be used to judge the comic strips (Crabbe, 1986). The same thing could be done with candy, toys, etc.

Because FPSPI deals with global issues, there are lists of some standard criteria that are often used. These can include such qualities of the solutions as: safe, effective, efficient, low cost, acceptable, easy, possible, legal, ethical, humane. Students can start with some of these criteria, but they will score more points if their criteria are clearly targeted to the problem rather than just stock criteria (Shewach, 1990). More importantly, they will find that they can choose a better solution for their specific problem if the criteria are well chosen and well articulated.

Other important considerations when writing the criteria are that they should include a measure of degree so that the solutions can be compared. *Which solution is most affordable?* is better than *Which solution is affordable?* In addition, each criterion should contain just one dimension: *Which solution will provide the best protection...?* is better than *Which solution will provide the best protection for the least money?* Finally, each criterion should be worded in a positive way so that a high value on any criterion makes that solution more desirable. *Which solution will take the least time?* is better than *Which solution will take the most time?* in this situation. Using these guidelines, the teams choose five criteria that they feel will help them choose the best solution to their specific problem.

For the problem of *IWWMW design our communities to withstand climatic changes?*, our hypothetical team chose:

1. Which solution is most affordable for the communities?
2. Which solution will provide the best protection for the people?
3. Which solution will be most acceptable to the people in the communities based on their cultural values?

4. Which solution will have the most aesthetic appeal?

5. Which solution can be carried out in the shortest time?

These criteria address different aspects of the problem taking into consideration some of the components of the original fuzzy as well as how to make the solution more acceptable for implementation.

5. Evaluate solution ideas to determine the better action plan

The team works together to choose approximately 10 of their brainstormed solutions to evaluate according to the criteria in a grid such as Table 1.

(Insert Table 1 about here)

In this example, I have used five solutions for space purposes. With young children or less experienced teams, a lower number of solutions might be generated and used. However, for the competition, teams are awarded more points for a larger number of pertinent ideas generated. Each proposed solution is then ranked according to each criterion.

6. Develop the action plan

This step requires the team to consider how they might implement their desired solution in order to solve the problem. They must write a plan to sell the idea to whatever constituency would be appropriate. In our example, it would be the targeted community.

Organization and Components

"More than ever, an education that emphasizes general problem solving skills will be important. In a changing world, education is the best preparation for being able to adapt." - Bill Gates, *The Road Ahead* (Future Problem Solving Program, Who we are, 2007).
The Executive Director of FPSPI administers the program from the International Office in Melbourne, Florida. The program charters affiliate programs in most of the states of the United States, as well as in Australia, New Zealand, and Korea. Affiliate Directors for each of these regions direct the programs within their area. In areas where there is no affiliate program, an existing Future Problem Solving Program may mentor new or aspiring affiliate programs. Countries currently being mentored include: Singapore, Malaysia, Hong Kong, and Canada.

As it now exists, FPSI has five components at the international level: Team Problem Solving, Individual Problem Solving, Action-based Problem Solving, Community Problem Solving, and Scenario Writing. Some affiliates may incorporate more or fewer components locally. For example, Georgia had a visual arts competition at one time that encouraged students to submit visual representations of their views of the future as drawings, sculptures, paintings, and videos. The visual component presented some difficult challenges for submission and judging, and it was discontinued. On the other hand, some affiliate programs may not offer opportunities in all of the areas.
Team and Individual Problem Solving

There are three divisions in the Team and Individual Problem Solving components are: Team Problem Solving, Individual Problem Solving, Action-based Problem Solving, Community Problem Solving, and Scenario Writing, however, all affiliate programs may not offer opportunities in all of these areas.

Team Problem Solving

There are three divisions in the Team Problem Solving component according to the students’ grade in school: Juniors, grades 4-6; Middle, grades 7-9; and Seniors, grades 10-12. Teams of four, or individuals in affiliate programs that have such a component, apply the process in two practice problems and a qualifying program during the school year. Evaluators score the teams’ work and return feedback to help teams improve. The teams that score highest on the qualifying problem are invited to Affiliate FPS Bowls held in the spring. The winners of the Affiliate FPS Bowls are eligible to compete at the FPSP International Conference in June.

Action-Based Problem Solving

This non-competitive component is ideal for young students, those who are learning the process, or those who want to use the process in a non-competitive way. Teams of four to six students work together on two problems per year in three divisions: Primary (grades K-3), Junior (grades 3-6) and Middle (grades 6-9).

Community Problem Solving

Groups of students who participate in Community Problem Solving (CmPS) can work in larger groups than the teams for the other components. For example, they may work in class, cross class, or cross grade groups. The teams can be of any size, but only 15 can present at the conference.
The important difference is that for this component the students identify problems in their own communities and actually implement the action plan. Because the action plans must be much more detailed, and the students must carry them out there is typically a longer work period for the problem, extending for a year or more ((Terry & Bohnenberger, 1995),

As in the other competitive components, the top place winners from affiliate programs are eligible to attend the FPSP International Conference in June where their projects will be judged for the top award. They do not solve a problem at the International Conference.

Some examples of community problems that such groups have solved include: saving historic buildings that were threatened by flooding and traffic, writing a solid waste management plan for a county, and developing Boredom Busting kits to help children hospitalized for long periods of time (Bohnenberger & Terry, 2002).

Scenario Writing

Participants in this component choose one of the topics for the year as the theme for a futuristic short story set 20 years in the future and of no more than 1,500 words. An affiliate may send the first place winner in each division to the International Bowl and may submit the top three scenarios to the International Scenario Writing Competition (FPSPI). The winning scenarios from each division are published every year, and the book is available for purchase from the FPSPI site. Some excerpts from student scenarios are included in the appendix.

Rationale and Benefits

The most basic skill that can be taught in today’s schools is problem solving. In fact, the teaching of future problem solving skills may be the key to the successful teaching of the basics such as reading, writing and arithmetic. Many children are not motivated to master these basics unless they can see the connection between them and their future lives ((Torrance, 1970, p. 65).
There are clear benefits for students from participating in the Future Problem Solving Program International. At face value, the program incorporates higher-level thinking about real problems, teamwork, research, and organization skills. The FPSPI website lists many others, and that list is in the appendix.

However, some of the best information in this regard may be found in the comments of participants. My own daughter, who is now in college, participated from fourth grade through high school in the team problem-solving component. She told me that FPS was the most valuable thing she learned in middle school.

These participant comments exemplify the value of the program beyond the academic skills:

"I think FPSPI is a great way to learn how to recognize challenges and find solutions to those challenges." Senior, Aurora, NB (FPSPI, Participant Thoughts, 2007).

"The best part (of the International Conference) was not the competition, it was the memories." Junior, Hebron CT (FPSPI, Participant Thoughts, 2007).

"FPSPI has been very important to my education and development as an independent thinker…and it has been a lot of fun." Senior, Zionsville, OH ((FPSPI, Participant Thoughts, 2007).

A colleague, Dr. Thomas Hébert, commented after attending his first FPSPI Bowl, “I was amazed by the energy and excitement of the students. This clearly provides many social and emotional benefits beyond the competition itself.” (personal communication with Tom Hébert, June, 2001).

The benefit that is most rare in any educational program is that the process teaches problem finding. As indicated in the discussion of the second step of the process, real life
problems seldom present themselves as clear, defined, and delimited. Yet, most problems presented to students in school are just that. In addition, most instructional problems have a definite solution that is dependent on the successful application of a strategy learned in the classroom.

Starko (2006, pp. 151-165) presented a very clear and compelling case for the importance of problem finding in education. In so doing, she included a hierarchy of problem types developed by Getzels (1987). Type I is a problem with a known form, a known method for solving it, and a solution unknown to the problem solver, but known to others. This would describe most school problems with the answers in the teachers’ guide. Type II problems also have the first condition—the problem is clearly presented to the solver—but the method for solving it is not clear. This would be typical of a problem on a pretest for which a student has not learned the method for solving it yet. Type III problems are those that must be found before they can be solved. They are open-ended with no known method or solution. These, the highest-level problems, are not usually addressed in classes, but they are the ones that we most need to solve in our society.

Starko (2005) also cited the pertinent quote from the 1938 Einstein and Infeld book, *The Evolution of Physics*:

“The formulation of a problem is often more important than its solution, which may be merely a matter of mathematical or experimental skill. To raise new questions, new possibilities, to regard old problems from a new angle, requires imagination and marks real advance in science.” (cited in Guerra & Abreu, 2007).
Discussion

Many states have tests that students must pass to graduate from high school...On balance, they are designed to measure the acquisition of discipline-based knowledge in the core subjects in the curriculum, but more often than not, little or nothing is done to measure many of the other qualities that we have suggested may spell the difference between success and failure for the students who will grow up to be the workers of 21st century America: creativity and innovation, facility with the use of ideas and abstractions, the self-discipline and organization needed to manage one’s work and drive it through to a successful conclusion, the ability to function well as a member of a team, and so on. (National Center on Education and the Economy, 2006, p. 14).

The world is getting smaller even as our problems are getting bigger. Issues of hand-to-hand combat in restricted areas have been replaced by concerns about the capacity of several countries to destroy the world. The ease and speed of modern travel have also increased the ease and speed of the spread of disease. A predicted shift of the earth’s climate regions would cause major changes in entire cultures—changes in their way of life, crops, houses, clothes, recreation, and values. What once were local, regional, or even continental problems are now global problems. For example, last year’s annual meeting of the World Economic Forum, held in Switzerland in January 2006, had as its theme: The Creative Imperative. During the five days of the forum, groups worked together to generate innovative solutions to global challenges (World Economic Forum, 2006).

The growth of the amount of information, and the tentative nature of that information, requires that we revise our ideas of schooling and education. In the past, an educated person was judged by what he knew. We are shifting to a time when educated people will be evaluated by
what they can learn and how quickly they can adapt. Think about it, when your grandparents were children, they studied history chronologically from the beginning of time to the present. Even though this study was limited to a Western perspective, they had many years of history to learn. My teachers attempted to teach us the same way, and we never even got as far as World War I. We cannot continue to accumulate knowledge and expect it all to be taught in the same time and in the same way.

All students, not just those who are labeled as gifted, should be receiving training in the Future Problem Solving Process. All students must learn how to find problems, generate solutions, evaluate them, sell their solutions to others, and implement them. They must learn how to work on teams as well as independently. They should all learn to be involved in their communities and how they can make a difference. Most importantly, they must learn how to learn, and they must learn about the tentative nature of knowledge. Think about your own schooling. How much of what you were taught in school is no longer considered true? How much of what you now know and use was not taught to you in school, could not be taught to you in school because it was not known?

In 1981, R. Buckminster Fuller (Huddle, 1984, p. 176) reflected on his childhood at the turn of the last century. He recalled that as people tried to predict the future in the new century, they could not begin to conceive of automobiles, electrons travel to the moon, or even air wars as reality. Only about 1% of the world was literate, and fewer still thought of humanity in world terms. We, too, are poised on the brink of change in the new millennium and cannot presume that we are more precognitive about what lies ahead than were our predecessors. However, one prediction that was true then will undoubtedly remain true: successful adaptation to world change and the continued civilization and enrichment of our world depend on creative endeavors.
We must prepare our students to be creative for their own good and for the good of the world.

FPSPI is one way to do this.

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References


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Table 1. Grid for evaluating top solutions by chosen criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>1. affordable</th>
<th>2. protection</th>
<th>3. acceptable</th>
<th>4. aesthetics</th>
<th>5. time</th>
<th>Total</th>
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<tr>
<td>Live in family groups</td>
<td>5</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>15</td>
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<tr>
<td>Elevated houses</td>
<td>4</td>
<td>3</td>
<td>5</td>
<td>4</td>
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<td>19</td>
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<td>Sturdy construction</td>
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<td>4</td>
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<td>3</td>
<td>2</td>
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<td>2</td>
<td>5</td>
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<td>12</td>
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Table 2. Grid for evaluating top solutions in example problem

Table 3. Curriculum Standards and The Future Problem Solving Program International (FPSP Standards)

<table>
<thead>
<tr>
<th>Criteria</th>
<th>effective</th>
<th>doable</th>
<th>3. long term</th>
<th>4. educates</th>
<th>5. can be sold to the population</th>
<th>Total</th>
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<td>5</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>3</td>
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<td>2</td>
<td>4</td>
<td>3</td>
<td>4</td>
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<td>Carpooling website</td>
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<td>2</td>
<td>1</td>
<td>11</td>
</tr>
</tbody>
</table>

• Understands and applies the basic principles of presenting an argument.
• Effectively uses mental processes that are based on identifying similarities and differences (compares, contrasts, classifies).
• Applies basic problem-solving techniques.
• Applies decision-making techniques.

Working with Others
• Uses conflict-resolution techniques when disagreements occur.
• Works well with diverse individuals and in diverse situations.
• Displays effective interpersonal communication skills.
• Contributes to the overall effort of a group.
• Demonstrates leadership skills when making decisions.

Technology
• Understands the nature and uses of different forms of technology to obtain topic research.
• Understands the relationship among science, technology, society, and the individual.
• Understands the nature and operation of systems.
• Understands the nature and uses of different forms of technology.

Behavioral Studies
• Understands conflict, cooperation and interdependence among individuals, groups, and institutions.
• Understands that group and cultural influences contribute to human development, identity, and behavior when working on a project in a multi-cultural community.
• Understands various meanings of social group, general implications of group membership, and different ways groups function to involve various groups in a project.
• Understands that interactions among learning, inheritance and physical development affect human behavior in order to respond appropriately to a variety of situations.

TOPIC AND CONTENT SPECIFIC STANDARDS

Science
Nature of Science
• Understands the nature of scientific knowledge as it relates to FPS topics.
• Understands the nature of scientific inquiry when conducting investigation using systematic observation and logical reasoning to research FPS topics.
• Understands the scientific enterprise as the catalyst for many FPS topics as societal challenges often inspire scientific research.

History
• Understands and knows how to analyze chronological relationships and patterns to forecast trends.
• Understands the historical perspective in relationship to its impact on the future.

Civics
What is Government and What Should it Do?
• Understands ideas about civic life, politics, and government through exposure to multiple topics.
• Understands the sources, purposes, and functions of law and the importance of the rule of law for the protection of individual rights and the common good as it relates to challenges in the development of future societies.

Geography
The World in Spatial Terms
• Knows the location of places, geographic features, and patterns of the environment through the exposure to global issues.
**Places and Regions**
- Understands the physical and human characteristics of place through the use of parameters in future scenes.
- Understands the concepts of regions through topics relating to specific areas.
- Understands that culture and experience influence people’s perceptions of places and regions through cultural diversity of the topics.

**Environment and Society**
- Understands how human actions modify the physical environment as it relates to future attributes of the environment.
- Understands the changes that occur in the meaning, use, distribution and importance of resources in relationship to the possibility of the depletion of resources in the future.

**Uses of Geography**
- Understands global development and environmental issues through exposure to topics that focus on global awareness.

**Economics**
- Understands that scarcity of productive resources requires choices that generate opportunities by applying these concepts to research, challenges, solution ideas and development of an action plan.
- Understands characteristics of different economic systems, economic institutions, and economic incentives as they relate to FPSP topics.
- Understands basic features of market structures and exchanges.
- Understands basic concepts of United States fiscal policy and monetary policy, as well as basic concepts about international economics associated with FPSP topics.

**The Arts**

**Visual Arts**
- Understands action plan and applies media, technology and processes related to the visual arts in CmPS.
- Knows a range of subject matter, symbols and potential ideas in the visual arts.
- Understands the visual arts in relation to history and culture.
- Designs and produces informal productions in the presentation of action plan.
Appendix A

Example Future Problem Solving Activity

In a school situation these steps would probably be spread out over several weeks. However, once students learn the process, they are able to go through it in just a couple of hours at the competition since they have already done the research. This is an example of how FPS might be used in a curriculum-based manner. If this were a registered team, the Future Problem Solving Program International Office would send the main topics for the school year, and the registered teams would receive lists of resources appropriate to the topics and the students’ ages.

The Steps

The Fuzzy Situation and Information Gathering

Future problem solving always begins with the recognition of a fuzzy situation that represents a complex of problems. In this example, the students in a middle school science class are studying climate, and one student brings up the issue of global warming. The students become animated in saying what they have heard about this topic.

The teacher, recognizing that the students are spouting a mix of facts, opinions, and questions, asks them to hold on to their ideas for the moment. Then, he puts them in teams of four to list their ideas on the subject, and categorize them into facts, opinions, and questions. If they are not sure if something is a fact or opinion, it is categorized with the questions. Then, the students further categorize their ideas into causes of global warming, effects, signs of it, and any other categories that they feel help.

The students come back together as a large group to share their ideas and determine what they know and what they need to know. They compare their lists to consolidate them and add or scratch off items as they discuss them. The final lists may look something like this:
## Global Warming

<table>
<thead>
<tr>
<th>Fact</th>
<th>Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>The temperatures have been rising</td>
<td>Is this a part of a regular pattern?</td>
</tr>
<tr>
<td>Storms are more destructive</td>
<td>Are storms more severe or is it just that the earth is more populated along coasts and other dangerous areas?</td>
</tr>
<tr>
<td>Ocean levels are higher</td>
<td></td>
</tr>
<tr>
<td>Polar icecaps are melting</td>
<td></td>
</tr>
<tr>
<td>More skin cancer</td>
<td>Is skin cancer related to global warming?</td>
</tr>
<tr>
<td>Hole in the ozone layer</td>
<td>Is it a natural cause or caused by people?</td>
</tr>
<tr>
<td>Heat is a kind of pollution</td>
<td>Are there positive points to global warming?</td>
</tr>
<tr>
<td></td>
<td>Do we have any control over it?</td>
</tr>
</tbody>
</table>
Based upon these lists, students are assigned in groups to find the information that is needed and to check the veracity of the items listed as facts. The teacher helps the students word their questions for investigation, in other words, help ensure that they are using the correct terms, and assists them as needed in determining what sources to use. Students should be encouraged to expand their search past the usual sources on the Internet or encyclopedia, and also interview experts, like a meteorologist from the local news station, a climatologist from a university, watch documentaries, and look at climate maps. Local farmers might be willing to provide information about their observations on climate over the last few years and the impact on agriculture. Students could brainstorm various sources and seek disconfirming evidence, as well as learn about how to evaluate sources for trustworthiness.

In a class of mixed ability, the students could work according to their own abilities and interests with teacher guidance. In a class of academically gifted students, the level of investigation and resources might be more sophisticated according to their abilities and backgrounds.

In short, the students discussed the issue to determine their prior knowledge and determine the needed knowledge. They then worked in groups to gather information to read, view, summarize, and discuss, and they performed error analysis to ensure that they felt comfortable that the things they listed as facts are indeed facts. During this process, additional questions may be added to the list of questions and additional facts should be added to the list of facts. Students may choose to include one or more additional columns such as “disputed idea” or “opinion” or “myth” as they discuss their findings. These lists should be posted where the class can refer to them frequently and add or delete items as the group agrees.
Step 1: Identify Challenges

At this point, the students list all of the challenges that they can see in the issue of global warming. The list might include: agricultural problems, death of sea creatures, flooding, food shortages, increased health issues related to heat, challenges to home design, energy shortages, earlier maturity of animals, increased greenhouse gases, loss of certain species such as polar bears and penguins, increases of other species such as roaches and birds, changes in breeding and migratory patterns, loss of coral reefs, changes in schedules and calendars to accommodate hotter days and months, changes in clothing and hair styles, changes in recreation, etc.

Because the listing of problems may create new questions, additional research and discovery may be necessary. Thus, students learn that problem solving is a recursive process rather than a linear one, and problems and solutions can create additional problems and solutions.

Step 2: Select an Underlying Problem

When the students have brainstormed a sufficient number of problems, they begin the process of targeting a specific problem to solve. The problem they choose should be one that they deem important, that, if solved, could solve other problems, that is interesting to them, and can be worked on.

This is an important step that requires the students to analyze, evaluate, negotiate, and prioritize use several other higher level thinking skills and behaviors. This step, which is not taught in schools, is the most crucial step for research. (Anyone who works with graduate students is familiar with the very bright students who successfully master coursework but are unable to find a workable problem and operationalize it as a researchable hypothesis.)

Our students decide that the production of greenhouse gases is a major problem that is at the root of many of the other problems and is one that they can work on. They formulate the
following problem statement: “In what ways might we get the U.S., the largest producer of greenhouse gases, to lower the production of these gases?” The teacher encourages the students because they have chosen a central and important problem, but he is afraid that they may not have narrowed it down enough.

By doing further research, the students discover that greenhouse gases are called that because they allow sunlight to enter the earth’s atmosphere easily, then trap the heat and hold it in, like a greenhouse does. They discover that greenhouse gases are both natural and manmade. They are necessary to hold in some of the heat, but the problem occurs when the natural balance is upset and too much heat is held in. Most of the manmade greenhouse gases come from burning fossil fuels. The U.S. produces the largest amount of greenhouse gases because we consume the most energy, but our levels are lowering while developing countries levels are increasing. The class decides to watch “An Inconvenient Truth.” Some of the students download podcasts on the topic. Others find articles that argue against the notion of global warming on the internet. They stage a debate and argue the issues on both sides. Finally, the class decides that although it is not proven that global warming is really occurring beyond what might be normal cyclical fluctuations, and it is not known how much human emissions affect this anyway, they would rather err on the side of safety.

The teacher brings in a sign with the slogan, “Think globally, act locally,” and asks the class to figure out what it means. The students think about the meaning in terms of their problem, and agree to limit the scope to something more manageable. So, their problem statement now becomes: “IWWMW…convince people in our community to lessen their consumption of energy, thereby lowering their impact on the environment.”

Step 3: Produce Solution Ideas
Now the students have to think divergently again to brainstorm as many ideas as possible as solutions to the problem. They enjoy coming up with many, varied, and unusual solution ideas in groups of three or four. Some of their ideas are silly or ridiculous, but they know that they should accept all ideas at this point.

Some of the ideas that they produce are: fine people for using energy, turn off the electricity when a house has reached a certain maximum usage, look down on energy consumers, make everyone learn about energy conservation, offer rewards for houses that use less energy, make gasoline cost a lot, use a media campaign to educate people, have everyone keep an energy diary, make a movie locally to show people about global warming, produce a monthly newspaper about energy use, create an energy police force that checks on energy use, put more buses on the streets, create special carpooling rewards, make a carpooling website where people can sign up to ride together, put bikes on the street for people to use, put timers in showers to get people to take quick ones, encourage people to wear their clothes and use their towels more than once before washing, find out about how people conserve energy in other countries, hang clothes out to dry, and so on.

Step 4: Generate and Select Criteria

Now the class must use criteria to select the best solution. The criteria should be important for picking the best solution to this problem, should be particularly suited to the problem, and should be worded in a positive way, such as most efficient, least expensive, most workable, etc. This is very important, otherwise students may choose criteria for which a high score may be either positive or negative. For example, if students choose criteria like cheapest, ugliest, hardest to do, most effective, etc., it will be impossible to rate the ideas because the
highest score in some cases would be good, and in other cases would be bad. So, it would be hard to compare the solutions by using the criteria.


The students brainstorm as many criteria as they can before choosing the 5 that will help select the best solution. These students select the following criteria: effective for reducing emissions, doable, has long term results, educates, and can be sold to the community.

Step 5: Apply Criteria to Solution Ideas

At this step, the students must evaluate the solution ideas using criteria to rank order the solution ideas. Using the FPS model, the students would pick their top solutions and their top criteria from the lists and create a grid such as the one below. In competition, the students must list 10 solutions and 5 criteria, but other quantities could be used depending on the maturity of the students, the complexity of the problem, and the number of ideas generated! I have chosen five each of solutions and criteria for this example. The solutions are listed in the left column and the criteria are listed in the top row. Then, each possible solution is ranked according to each criterion and the totals are added. In FPS, the highest ranked solution gets the highest number. If there are 10 solutions being considered, the solution considered best according to that criterion gets a 10, the next best a 9, and so on down to 1. More sophisticated ranking schemes can be used whereby solutions can be tied, or certain criteria weighted more heavily, but this is the basic method used.

(Insert Table 2 about here.)
Once the students have used each criterion to rank each solution, they add the numbers across, and the strategy with the highest number of points is the “winner.” At this point, the students may look at the winning solution, and decide that they don’t really think it is the best solution. If that happens, the teacher should ascertain through questioning why they don’t think it is the best solution. Usually they will be able to come up with some ideas like: it would be too hard to do, it isn’t fun, it would cost too much, it wouldn’t work, etc. Then, they are directed to choose criteria from this list to add to or replace the criteria they have. When students don’t like, or have confidence in, the solution they have chosen, it is usually because they didn’t include all of the essential criteria.

Another option is to combine two or more solutions to make a more complete solution. In this case, two solutions were ranked high and are close enough to be combined: the educational campaign and the energy diaries. Students could decide to include energy diaries as part of the educational campaign. In this case, they might also add their third ranked solution—look to other countries—if they see a logical fit with the others. One student suggests that they contact a class in a country that uses less energy and have both classes keep energy diaries to compare.

Step 6: Develop an Action Plan

In the competition, this is as far as the teams go. They develop a plan to explain or sell the highest ranked solution (or combination of solutions) to the critical audience. The critical audience is the person or group that needs to be sold on the idea in order for it to be implemented. They show their solution’s relevance and importance to the underlying problem and describe in detail how the problem will be solved. They also consider sources of assistance and resistance to the plan, and include ideas for how to incorporate them into the plan.
Our students, however, decide that they will implement their plan. This is now a Community Problem Solving Project (CmPS) because they are really working in their community to solve a problem. They want to develop an educational plan that will convince the people in the community to voluntarily limit their energy consumption. With the guidance of the teacher, they decide to incorporate some of their other solutions into the educational plan and work on it in stages. They decide to work in groups to implement the parts of the plan.

They envision that they will work with one or two classes in other countries to keep energy diaries for a month. After that time, they will compare the energy use, and make some tables to show how the countries compare. This will be a key part of their educational campaign. They will request a time to present this information along with any other information they develop at the Town Hall Meeting. At that time, they hope to convince key members of the community that they should conserve energy and offer some suggestions for where they might cut back based on data from their diary comparisons and other research. They begin by having a group of students take on each of the following initial tasks:

1. Find out who in the community will help them and who will be likely to resist energy conservation and begin working with their supporters.
2. Identify countries that use little energy in order to find a class that will keep an energy diary, too.
3. Create the format for the energy diary.
4. Work on the plan for the overall educational campaign beginning with making the appointment for the Town Meeting.
5. Create a system for keeping photographic and written records of all of their work for publicity and a history of the project.
Each of these activities might include problem situations that would require students to use the problem solving cycle again, or at least use parts of it. For example, the group may identify several countries with whom they might communicate, but they want to narrow the list down. They may determine criteria by which to judge which classes in other countries would be best for their collaboration.

As new challenges develop, and as the plan moves forward, the students may reform the work groups, add or merge groups, and rethink certain parts of the plan. They continue to do research for their educational campaign and work with members of the community who can help them in certain ways. They talk to community members who oppose energy conservation or doubt global warming in order to prepare for questions at the Town Hall Meeting. Most importantly, they monitor and record their own energy use and attempt to limit it.

Of course, not all FPS curriculum projects become this extensive or involved. This example showed how a curriculum issue could evolve into a community project that would have the students involved in a real problem, using higher level thinking skills, real communication skills, research for real answers, mathematical reasoning and data demonstration which all derived from student interest. Such activities are inherently motivating and allow for differentiated instruction for students based upon their interests and abilities.

Table 3 illustrates the many educational standards that can be met by using the FPS process in school. Depending on the type and level of the problem, more or fewer skills can be included.