Problem-Solving Competitions: Just the Solution!

by Tracy L. Riley and Frances A. Karnes

Charles Lindbergh, also known as "Lucky Lindy," won the Orteig Prize in 1919 for the first non-stop flight across the Atlantic. Canning evolved after Napoleon promised cash prizes to anyone who could work out how to preserve food for his military troops. In 1933, the parking meter was developed after a frustrated newspaper journalist promised a cash prize to anyone who could figure out how to track the length of time a car was in a parking space. The Gossamer Condor, a cyclist-powered plane with a 96-foot wingspan, was developed in 1977 for a winning prize of 50,000 English pounds. These and other stories of scientific and technological innovations, whose developers were lured by inducement prizes, are discussed in a 2003 issue of Fortune magazine in which its writers state, "The idea is to tempt geniuses to come up with breakthrough solutions to thorny problems" (O'Reilly, p. 54). This goal is similar to that of many problem-solving competitions that have been developed for young people by teachers, businesses, scientists, engineers, technologists, and other interested community members.

Competitions have long been a cornerstone of gifted and talented education (Riley & Karnes, 1998/99). They provide opportunities for students to compete or perform, while exhibiting, refining, and developing their special abilities and talents. Riley and Karnes state that, for gifted and talented students, competitions "put their talents to the test" (p. 22). Competitions allow students a chance to showcase their special abilities and receive recognition and acknowledgement (Davis & Rimm, 1998; Riley & Karnes).

This article describes competitions across a range of curricular areas that develop students' problem-solving skills by setting authentic, real-world tasks. As individuals or members of a team, students in these competitions are challenged with finding solutions to problems faced not only in today's scientific and technological world, but also in the worlds of business, education, law, religion, humanities, and society in general. The benefits for students, their teachers, and community, as well as potential drawbacks are discussed. Steps for getting students involved in the selection and participation of competitions are also provided. The Osborn-Parnes Creative Problem Solving model is used as the framework for this article, finding one solution to meeting the needs of gifted and talented students.

Objective Finding: Qualitative Differentiation

One of the goals of gifted and talented education is to provide students with a differentiated educational experience. Qualitatively differentiated programs are those that tailor the content, processes, and products of the curriculum to meet individual differences. What students learn, how they learn, and how they demonstrate their learning is reliant upon responsive learning environments facilitated by flexible, adaptable, passionate, and excited teachers (Riley, 2005).

The content is modified for gifted and talented students, moving beyond the basics to the complex by added breadth and delving below the surface of facts and terms to uncover the underlying meaning or depth (Riley, 2005). Additionally, more intricate details and connections between ideas are emphasized, and this can be achieved by providing opportunities for multidisciplinary and conceptual study (Kaplan, 2001; Roberts & Roberts, 2005; Tomlinson et al., 2002). The content should also be relevant and meaningful, simulating the knowledge needed by those professionals who study and work within the disciplines (Maker & Nielson, 1995; Renzulli, Gentry, & Reis, 2003; Tomlinson et al.). For example, Tomlinson et al. distinguish between scholars who complete "expert-like" work and practitioners who work at "expert-levels," pointing out that gifted and talented students generally require the latter because of its "greater intellectual demand" (p. 31).

It is important that process skills not be taught in isolation of a meaningful, relevant context (Kaplan, 2001; Karnes & Bean, 2004; Riley, 2005; Seney, 2001). In other words, the process skills of thinking, communication, research, and personal understanding must always be embedded in differentiated content and result in differentiated products (Karnes & Bean, 2004). For gifted and talented students, educators should consider the provision of independent and self-directed learning, yet balance that with recognition of the value of group dynamics, answering the call for opportunities to spend time with like-minded people or intellectual soul mates. Allowances should be made for homogeneous ability grouping of students, particularly for academic outcomes that break the glass ceiling that heterogeneous groups sometimes create (Rogers, 2002). Maker and Nielson (1995) highlight the importance of teaching students how to interact effectively with a group, stating "group process and group interaction activities should be an integral part of curricula for gifted students" (p. 126).

Critical and creative thinking are probably the two most frequently cited process skills in the education of gifted and talented students. In both critical and creative thinking, a shift is made from acquiring information to using it. Thus, research, library and scientific skills, both basic and advanced, must be taught. Process skills should mirror methodologies in a real or professional sense, giving gifted students the "tools of the trade." For success in meeting their personalized, differentiated learning goals, students need the skills of organization, time management, planning, decision-making, and goal setting.

Gifted and talented students also need the chance to communicate their ideas to an appropriate audience. Karnes and Bean (2004) outline these skills as speech, group discussion, interviews, debates, writing, active listening, and interpretation of nonverbal messages. Sharing information and ideas is the outcome of communication and the audience must be considered, aiming for one that will understand and appreciate the gifted student's abilities.

Maker and Nielson describe products (1995) as the tangible or intangible results of learning; they serve as the evidence of learning. The pinnacle of differentiation, student products, is the outcome of integrating advanced level content with appropriate process skills. Stephens and Karnes (2001) believe that "product development is an essential component in the gifted education program that assists in meeting the complex and advanced needs of gifted students as they become tomorrow's creative problem solvers and thinkers" (p. 207). Products demonstrate the gifted student's "transformation of ideas" as they challenge what exists with what might be possible.

Fact Finding: Matching Competitions to Differentiation

There is a close match between the goals of differentiation and the purposes of problem-solving competitions. Karnes and Riley (2005) have outlined the general benefits of entering competitions. Likewise, the benefits of hands-on authentic problem-solving competitions are countless—for participants, their teachers, and the competition sponsors. In many of these competitions, students are exposed to team approaches to practical problem solving that mirrors the "real world" of business, science, technology, and so on (Holt & Willard-Holt, 2000). Students are introduced to new ideas, many of which normally fall outside of the regular school curriculum. For

example, in the *Let's Get Real*™ competitions, students are taught about business concepts, such as cost/benefit analyses, and polish their oral and visual presentation skills, research proficiencies, and communication abilities. As students explore solutions to authentic problems, they are also given the opportunity to develop career awareness and to make favorable impressions upon potential future employers (Holt & Willard-Holt, 2000).

Students who participate in these competitions often work in teams, enhancing their cooperative skills, as well as having an opportunity to work with others of like minds (Conrad et al., 2001). For gifted and talented students, competing as a member of a team also provides students with an appropriate yardstick to measure their abilities, a sense of appreciation for the strengths and skills of others, and the potential for friendships with intellectual soul mates. Furthermore, some competitions place high value upon students' demonstrated camaraderie and sportsmanship (BEST Robotics, 2005). As Nifong (1996) states, "The very act of being engaged with other competitors, the very synergy of that . . . summons up the best of everybody" (p. 13). It is no wonder that competitions are reported to be motivating, exciting opportunities for young people (Campbell et al., 2001; Conrad et al.; Cropper, 1998; Riley & Karnes, 1999).

For teachers, problem-solving competitions provide the perfect catalyst for interdisciplinary study, authentic assessment, higher level thinking, creativity, challenge, and real-world applications—the principles of a differentiated curriculum (Riley, 2005). Involvement in competitions also forges relationships between schools and businesses and organizations that sponsor, support, coach, or fund activities (Riley & Karnes, 1999). "The links forged between schools, corporations, and nonprofit organizations may open up future areas of communication and cooperation, lead to greater mutual respect and understanding, and ultimately create employees who are better prepared for the new millennium" (Holt & Willard-Holt, 2000, p. 247).

The benefits for sponsors of competitions include opportunities for making a positive contribution to the betterment of society through education, valuable public relations, and interactions with motivated, enthusiastic young people (Holt & Willard-Holt, 2000). In problem-solving competitions, sponsors may end up with feasible, innovative solutions to real problems they are facing. Competitions also provide opportunities for recruitment in the field and, when carefully designed, may enhance the numbers of minority and other underrepresented groups in the profession (BEST Robotics, 2005).

Competitions of any nature, however, do create some concerns. For example, Rimm (1986) believes that competition can lead to underachievement if too much emphasis is placed on winning. Karnes and Riley (2005) recommend that teachers prepare students by discussing winning and losing and placing emphasis on the process of competition rather than the outcome. In selecting problem-solving competitions, it is also important to choose those designed with a focus on student improvement and enjoyment, rather than simply their solutions. Finally, some problem-solving competitions may raise worldly issues and concerns that could be disturbing for some gifted and talented children. Students who are overly sensitive may worry over some topics presented as problems, and should be well coached and monitored.

Problem Finding: Challenges and Issues of Competitions

What are the challenges and issues faced by teachers wanting to use problem-solving competitions with their students? And more importantly, how might these be overcome? With a busy timetable and overwhelming curriculum, teachers may find they simply do not have time to facilitate their students' involvement in competitions. However, some competitions have aligned their goals directly to curricular standards and many are endorsed by teachers' and administrators' organizations. For example, the Toshiba/NSTA Exploravision awards are designed so that teachers can incorporate the National Science Education Standards into their classroom through the competition. Many of the competition Web sites actually eliminate teacher planning time, with excellent Web-based resources, information, and support regarding content, processes, and products related to the competition.

Another hidden challenge can be the costs (financial and others) involved in some competitions. Finding support among families and friends can be one approach. Businesses and community groups could also be invited to be sponsors for a competition. For example, a group of students developing a park for their local community involved more than 30 organizations and individuals, including Boy Scouts, local politicians, landscapers, architects, surveyors, contractors, and others, who volunteered labor, services, and supplies for the project (Christopher Columbus Awards, 2005). Karnes

and Stephens (2003) offer many suggestions for fund raising events, which could underwrite the costs of participating in competitions.

Idea Finding: Competition Possibilities

There are many possible solutions to finding competitions that will challenge gifted and talented students through authentic problems (see Table 1). In this section some of those competitions are outlined. Their origin, purpose, deadlines, eligibility, judging criteria, prizes and contact information are provided, along with examples of previous and current problems. More information about competitions can be found in Karnes and Riley's book *Competitions for Talented Kids* (2005).

Let's Get Real™

Let's Get Real™ is a competitive problem-solving program that began in 1995 in response to concerns raised in the corporate sector regarding entry-level employees' lack of preparation for solving authentic, everyday business problems (Holt & Willard-Holt, 2000). Students in grades 6–12 are given an opportunity to learn to work together on real business problems while also coming up with solutions. Teams of two to six students work with an adult coordinator to present a solution to problems related to the environment, manufacturing, distribution, engineering, software creation, human resources, health and safety, facilities design, public relations, or other issues faced by the corporate sponsors.

Teams select from a range of problems on the competition Web site (http://www.lgreal.org/index.shtml) in October and present a written solution by mid-January. Finalist teams are notified in mid-February with an invitation to present their oral solutions in mid-March. Solutions are judged on practicality, effectiveness of the solution, cost efficiency, creativity, development of idea, and documentation, with the winning teams announced in May. The challenges and prizes offered by the sponsors vary. For example, PPL Corporation, a worldwide energy corporation, presented these challenges in 2004–2005:

- Present a business case that describes the degree to which Vehicle-to-Grid cars could increase the reliability of energy in the electric grid. Your case should state why PPL should or should not invest research monies related to the development of Vehicle-to-Grid technologies.
- Develop a plan that will address the Hemlock Woolly Adelgid infestation that threatens the health of Eastern hemlock trees. (http://www.lgreal.org/index.shtml)

The guidelines and applications can be retrieved online, as well as information about each challenge, links to Web sites to help students discover solutions, and previous winning solutions and teams. All entries must be by teams; no individual entries will be considered. Teams do not have to be affiliated with a school setting to participate, but must have an adult coordinator. For more details, visit the Web site or write to Let's Get Real™, 624 Waltonville Rd., Hummelstown, PA 17036.

BEST Robotics

Another problem-solving competition is BEST Robotics. Established in 1993, this program aims to promote teamwork, problem solving, project management, and pride amongst middle school and high school students through boosting engineering, science, and technology. In its first year, this competition had 14 schools and 221 student participants—today more than 8,000 students participate annually (BEST Robotics, 2005). This problem-solving competition appeals to today's generation of "fix-it kids" (Malone, Clendaniel, & Boland, 2002, p. 34) who work as teams to design, build, and test a radio-controlled robot to outperform all the others. Over a 6-week period, students have to create a radio-controlled robot along with a table display that includes a project notebook, oral presentation, and an interview with the judges, who are engineers and other technical professionals. Student teams are judged based upon their creativity, use of technology, publicity, presentation, participation, enthusiasm, sportsmanship, and robot performance.

The guidelines can be obtained by contacting the local sponsor by e-mail or by visiting the competition Web site. BEST regional competitions are held in November, and the sponsor recommends checking for the nearest location and dates by visiting the Web site's competition calendar. Winners are announced at the regional tournaments. First, second, and third place awards are given along with several other special awards, including the BEST Award, Competition Award, Founders Award for Creative Design, Most Robust, Most Elegant, Most Photogenic, T-shirt Award, and Web Page Award. BEST Robotics Inc. is a

Table 1
Problem-Solving Competitions

Competition	Area(s)	Contact Details	Web Site
Let's Get Real™	Business	624 Waltonville Rd. Hummelstown, PA 17036	http://www.lgreal.org/index.shtml
BEST Robotics	Engineering and technology	This is a Web-based organization.	http://www.bestinc.org
Christopher Columbus Awards	Service learning, science and technology	105 Terry Drive Ste 120 Newtown, PA 18940-3425	http://www.christophercolumbusawards.com
Kids Philosophy Slam	Philosophy	P.O. Box 406 Lanesboro, MN 55949	http://www.philosophyslam.org
Odyssey of the Mind	Creative thinking and problem solving	1325 Rt. 130 South, Ste. F Gloucester City, NJ 08030	http://www.odysseyofthemind.com
Future Problem Solving Program	Creative and community problem solving	2028 Regency Road Lexington, KY 40503-2309	http://www.fpsp.org
Toshiba/NSTA ExploraVision Awards Program	Science	1840 Wilson Blvd. Arlington, VA 22201-3000	http://www.exploravision.org

Web-based organization located at http://www.bestinc.org. (The Web site has e-mail details for personal contact.)

Christopher Columbus Awards

The Christopher Columbus Awards program was established in 1996 and was designed for students in grades 6–8. The purpose of the competition is to encourage students' curiosity and creativity in order to help them improve their community through scientific and technological innovation. The areas included are problem solving, science, technology, and service learning. Students compete in groups of three to four students with a teacher as the adult coach. The teams have to identify a problem in their community and design a solution. The guidelines are available through the competition's Web site (http://www.christophercolumbusawards.com).

The deadline for entry is mid-February and winners are notified by mid-April. Students are judged on their creativity, innovation, scientific accuracy, feasibility, and communication. The judges are selected based on their prestige from the fields of science and technology. Every team that enters receives a certificate and the judges' comments. Thirty semifinalist teams receive a T-shirt. Eight finalist teams receive an all-expense-paid trip to Walt Disney World and a $200 development grant. Two gold medal teams receive a $2,000 U.S. Savings Bond and a plaque for each team member and the sponsoring school. The winning team receives a $25,000 grant to pursue their project.

Kids Philosophy Slam

The areas of philosophy, critical thinking, and creativity are incorporated into the Kids Philosophy Slam competition, which is designed for students in grades K–12. The purpose is to give students a voice and encourage them to think using their creative potential through philosophical forms. Students are given a philosophical question, and then submit an original piece of work such as a poem, essay, song, or artwork based on their response to the question. Guidelines may be found on the competition's Web site (http://www.philosophyslam.org). Rules vary for different age and grade levels.

All entries must be postmarked by early February, and finalists are announced in late March. Judges consist of a panel of philosophers, educators, and parents. They judge on creativity, originality, and overall strength of the message the student is conveying. There is more than $5,000 in prizes, including certificates, T-shirts, and savings bonds. Teachers and students should visit the sponsor's Web

site for resources and ideas, including a Philosopher of the Week section with information and links.

Odyssey of the Mind

In 1978, Odyssey of the Mind (OM) was established to foster creative thinking and provide creative problem-solving opportunities for all students in kindergarten through college. Five problems are produced annually and cover a variety of areas from building mechanical devices such as spring-driven cars to presenting a creative interpretation of a literary classic. Each team performs its solution within a specified timeframe and within certain cost limits. OM charters affiliates that run local and state competitions and culminate with an International OM World Finals held in late May or early June.

Guidelines are available in the summer of each year. Winners are notified at the awards ceremony following each competition. Judges are adult volunteers trained before the competitions and represent educators, business people, and other interested adults. Teams are judged in three areas. The first is the "long-term" problem, that is, the solution that the team has created and showcases in the competition. The second is the style. How one "markets" or elaborates the solution is considered. This may be achieved by the use of such elements as music, dance, costumes, script, and so on. Finally, spontaneity is judged as a third category. Each team receives a problem to solve the day of the competition. The team must solve it on the spot without any preparation and within a time limit. Awards vary, but generally include medals, trophies, and certificates. For detailed information visit the OM Website at http://www.odysseyofthemind.com.

Future Problem Solving Program

One of the longest-standing competitions is the Future Problem Solving Program, which began in 1974 for students in grades 4–12. The purpose of this program is to motivate and assist students to develop and use creative thinking skills, written and verbal communication skills, teamwork skills, research skills, and critical and analytical thinking skills; learn about complex issues which will shape the future; develop an active interest in the future; and learn and utilize problem-solving strategies. There are several different competitions:

1. *The Regular Program—Group Problem Solving*. The Regular Program consists of teams of four given a futuristic "fuzzy" situation with which they must brainstorm problems, identify an underlying problem, brainstorm solutions to that problem, set criteria for judging the solutions, rank the top solutions, and pick the best solution.
2. *The Individual Program—Individual Problem Solving*. The Individual Program is a scaled down version of the Regular Program, consisting of just one participant.
3. *The Scenario Writing Program*. The Scenario Writing Program has participants write short stories on designated topics taking place in the future.
4. *The Community Problem Solving Program*. The Community Problem Solving Program has a team of any size identify a real life problem, follow the Regular Program steps to a best solution, and finally implement their solution.

There is no deadline for entering the program. However, those students who have not gone through the practice problems before attempting the qualifying problem generally do not perform as well as those who have had the experience and practice. Each state has its own deadlines for when the problems are due. For the regular and individual programs, the students are given two practice problems, which they send in. These are critiqued, returned, and followed by the problem that qualifies them for their state bowl, or for those residing in states without affiliates, for the International Conference in June. At the International Conference, the students are given a final problem to decide the winners in each division and category for the entire program. Top Community Problem Solving teams are invited to the International Conference to present their projects to the evaluators for final judging.

The awards for winning the various competitions vary from state to state, but usually include trophies and/or plaques. Winners at the International Conference are also awarded trophies and/or plaques. For guidelines and information contact the Future Problem Solving Program, 2028 Regency Road, Lexington, KY 40503-2309 or visit the Web site at http://www.fpsp.org.

Toshiba/NSTA ExploraVision Awards

Toshiba/NSTA ExploraVision Awards program was established in 1992 and is now the world's largest science contest in which students expand on or design technologies that could exist 20 years in the future. Students participate in teams of three or four with a teacher/adviser and an optional community adviser in one of four

grade levels: K–3, 4–6, 7–9, and 10–12. By February 1, the teams must submit a teacher signed entry form, a 10-page or fewer typed description of their technology, and story boards depicting scenes from a sample 5-minute video they would produce to convey their ideas. In mid-March the 48 regional semi-finalist teams are announced and their videos are due in mid-April. In the beginning of May, the 12 finalist teams are announced, and in early June the four first-place winners (one from each grade category) and the eight second-place teams (two from each grade category) are announced at a press conference that is the kick-off to an awards weekend.

Winning teams are judged by leading science educators and based on creativity, scientific accuracy, communication, and feasibility of vision. Student members of the four first-place teams each receive a U.S. EE savings bond worth $10,000 at maturity. Second-place winners receive U.S. EE series bonds worth $5,000 at maturity. First- and second-place Canadian winners receive Canada savings bonds purchased for the equivalent issue price in Canadian dollars. National finalist team members and their parents/guardians travel to Washington, DC, in June for ExploraVision Awards Weekend where they are recognized for their outstanding achievement. Each student on the 24 regional winning teams and honorable mention teams is recognized for his or her creative vision with a special gift. Every student team member who enters the competition with a complete entry receives a certificate of participation and a small gift. There are also prizes and recognition for coaches and mentors. Guidelines are available from Toshiba/NSTA ExploraVision Awards, 1840 Wilson Blvd., Arlington, VA 22201-3000. The Web site (http://www.exploravision.org/) answers many questions students may have and is filled with useful information.

Solution Finding: Selecting and Supporting Competitions

With so many possibilities, it is important that teachers and students work together to make the right choices for involvement. Karnes and Riley (2005) suggest the following steps in the selection of competitions:

1. Assess the student's talent area(s). Remember to consider his or her strengths and abilities in content, process, and product domains.
2. Discuss the student's interests.
3. Talk about the areas the student would like to learn more about or improve.
4. Write a compilation of the student's abilities, interests, and areas for further development. Rank order these and select the top five areas.
5. Select several competitions that have similar goals and purposes to those the student would like to showcase and develop.
6. Read the guidelines of each competition carefully, making sure the student can meet expectations, has time for involvement, has the resources for participation, and so on.

Once students have selected their competitions, they will require ongoing support from their teachers, sponsors, and parents. Tallent-Runnels and Candler-Lotven (1996) discuss the importance of ensuring students have good time management skills, suggesting that a competition schedule be developed and constantly evaluated to see if it is working. Karnes and Riley (2005) provide a competitions calendar for students as part of a competitions journal that also includes helpful self-management tips, form letters, and sample press releases. Teachers also can prepare students by facilitating trial presentation runs, co-evaluating their products, providing time for practice, helping secure resources, and preparing them to cope with the pressure of competition day.

Acceptance Finding: Competitions Are the Solution!

The final stage of competition is after the judges' decisions have been made and prizes awarded. Karnes and Riley (2005) encourage students to evaluate their own performance and competition experiences. Students can rate their competition experience on a Likert-type scale (from poor to excellent) and use the results for planning and participation in future competitions. They recommend students evaluate their planning, organization, time management, participation, interaction with others, product, attitude, and appearance. Teachers should also evaluate their students' experiences, considering the organization of the competition, fairness of judging and criteria, match with classroom learning objectives, costs and resources, time involved, and so on. At this stage, the purpose in evaluation is to start planning for future competition involvement.

Getting gifted and talented students involved in competitions is one way of developing and enhancing

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their problem-solving skills. With careful planning and facilitation, the rewards extend beyond the prizes given to first-place winners. Teachers, their students, and competition sponsors can benefit. The greatest outcomes, however, might be for the world of tomorrow, as students grapple with authentic problems faced today. Their solutions can make a difference! GCT

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