StATS: A model of collaboration to develop science talent among rural students

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StATS: A Model of Collaboration to Develop Science Talent Among Rural Students

Marcia Gentry
Sharon Ferriss

This article describes an environmental science program for talented, rural, middle school students including the background, rationale, and the collaboration that made the program possible. Descriptive research results related to the effects of this program on student involvement, follow-up, and product development over eight program years are reported.

Marcia Gentry is Assistant Professor in the Educational Foundations Department at Mankato State University where she teaches courses in research, evaluation, and gifted education. She also co-directs a new Master's degree in gifted education and talent development that interfaces gifted education with general education. Sharon Ferriss is a StATS facilitator and has developed the program during its tenure. She is the curriculum coordinator for Quincy community schools where previously she taught middle school science and was Michigan's Science teacher of the year.

StATS is the result of collaboration among three rural districts in southern Michigan which have used their resources and provided in-kind support to make this program available to their students. Each spring, students are invited to apply for admission to the StATS I program for the following school year. There is a parent/student meeting for those interested in the program, during which the application procedures and program are described and questions answered. Students must complete an application in which they describe their interest in the program, write an essay on an environmental issue of their choice, and obtain two letters of reference documenting their interest, commitment, and achievement in science. Applications are screened and students whose applications are exemplary are interviewed prior to final placement. A team of adults, including both of the StATS instructors and local district representatives, interviews the students and selects 26 candidates for the program. Approximately half of the students who complete the application process are placed in the program each year, and a waiting list is developed for the following year.

After their selection for StATS I, students take home the Environmental Interest-a-Lyzer (Gentry, 1990), adapted from Renzulli’s Interest-a-Lyzer (1977), to complete before the program begins. This survey was developed specifically for the StATS program and was designed to help students identify and refine their interests and potential interests in environmental sciences. It contains two questions that assess students’ awareness concern about several environmental issues, followed by six open-ended questions regarding their concerns, knowledge, questions, and investigative interests about these issues. The survey concludes with two questions about the students’ current conservation efforts and what efforts they may want to begin. This information is disaggregated in the areas of the student’s environmental awareness, concerns, knowledge, questions, interests, and conservation efforts. The areas of interest vary with each new StATS I class resulting in a curriculum that changes each year to meet the needs of the students and promote interest-based environmental literacy.

Since 1990, seventh and eighth graders have pursued their shared interests and concerns about environmental issues through StATS I which is scheduled for 17 half-day sessions during the school day throughout the year. Students from the three districts are bussed (using existing bus service) to and from the StATS program at the area vocational center. Students are released from their classes and teachers work with the StATS facilitators to compact curriculum and to eliminate extra work for the students on these days.

StATS is a team effort, facilitated by a local science teacher and the vocational center’s Natural Resources Agricultural Technology instructor. The two, released from their regular duties, work together to develop curriculum, connect with local agencies, and provide opportunities for students to develop authentic skills in the environmental sciences.

Rationale

StATS is based upon the principles of providing students with challenge, choice, interest, enjoyment, and personal meaning in their educational experiences as a means to motivate and to develop lifelong learning habits. It also addresses the need of students to work...

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with others who have similar abilities and interests (Rogers, 1991; Robinson, 1991). Researchers have suggested that grouping students according to ability or interest, in class or across classes, is beneficial in meeting the academic needs of gifted students (Gentry, 1996; Kulik 1992; Parke, 1989; Rogers 1991), a premise upon which the identification procedure for the program is based. As noted by Spicker, Southern and Davis (1987), this is especially important for students from small rural areas where opportunities and resources might otherwise be limited. Finally, STATS is based upon the rationale from gifted education advocating the use of authentic methods, development of research skills, through the development of real-world products and services (Renzulli, 1977; Renzulli & Reis, 1985; Renzulli, 1994).

In the STATS program, as recommended by Renzulli (1988), many of the methodological activities and products are completed with the help of professionals from local and regional agencies so that the students learn first hand from practicing professionals. The ways in which challenge, choice, interest, enjoyment, and personal meaning are developed in STATS provide the rationale for the program.

Challenge is an integral part of gifted education and can help ensure excellence. The methods and processes by which challenge can be offered include: presenting high level content, using advanced thinking skills, using advanced and authentic methodologies, developing products or services for a real audience, and compacting curriculum (Bloom, 1985; Reis et al., 1993; Renzulli, 1994; Schlichter, 1986; Treffinger, 1986; US Department of Education, 1993). Vygotsky (1962) supported the notion of challenge in his theory about the Zone of Proximal Development in which he asserted that the only good instruction is that which proceeds slightly ahead of the learning development of the child. The federal report, National Excellence: A Case for Developing America's Talent (US Department of Education, 1993), recognized that the regular curriculum is often not challenging for students and called for more challenging curriculum standards and for providing students with more challenging learning opportunities. Recent national studies on curriculum compacting (Reis et al., 1993) and Classroom Practices (Archambault, et al., 1993) also provided compelling evidence about the need for increased levels of challenge.

Choice is a powerful motivator and has been consistently recommended to enhance student learning (Bloom, 1985; Dewey, 1913, 1916; Goodlad, 1984; Holt, 1983; Renzulli & Reis 1983; Shore et al., 1991; Wang & Lindvall, 1984). Shore, Cornell, Robinson, and Ward (1991), suggested broad curricular choices for students related to inquiry, discovery and problem solving. Renzulli (1977; 1994) advocated that students be given opportunities to choose problems to pursue. He suggested that when students are grouped together by common interests and focused on the development of an authentic product or service, students choose the tasks that meet their strengths and talents. STATS gives students choice within educational activities, providing students ownership and control of their learning, thus relevance and achievement may be enhanced.

Interest is another powerful motivator for students and, when nurtured, can lead to personal and educational accomplishments. This is not a new educational concept. William James (1890) proposed that awakening and nurturing children’s interests are central to learning, and later, Dewey (1913) suggested that educators need to draw out the abilities and interests of the child. Gruber (1986) argued that the main force in the self-construction of the extraordinary is a person’s own activities and interests. Educators in gifted education have called for interest to be central in determining a child’s educational program (Gallagher, 1985; Maker, 1982; Parke, 1989; Passow, 1982; Renzulli, 1978; Ward, 1980). Further, Deci and Ryan (1985) suggested that because people enjoy tasks that interest them, studying interests can lead to an understanding of motivation and learning. In a review of recent research related to the concept of interest, Schiefele (1991) discussed the role of interest in learning and motivation, pointing out that people naturally approach activities that interest them, making interest a directive force. He suggested that adapting instruction to student interests may have long term positive motivational effects. Tobias (1994) also investigated the role of interest on learning and reported that interest has an energizing effect on learning and leads to a deep comprehension of subjects.

Enjoyment is also instrumental for student involvement in the learning process (Csikszentmihalyi, 1990; Dewey, 1916; Renzulli, 1994; Schiefele, 1991). Phenix (1964) emphasized the importance of appeal to the imagination for learning to occur, however in his landmark study, Goodlad (1984) reported that most classrooms had flat tones with neutral emotion, ambiance, and a paucity of praise and guidance, suggesting the need to create a more enjoyable atmosphere conducive to learning. Renzulli (1994) proposed that learning is most effective when children enjoy what they are doing, and that creative productive individuals perform at optimal levels when they are doing what they most enjoy. Csikszentmihalyi (1990) found that topic interest was significantly correlated with involvement, enjoyment, concentration and activation.

Creating meaningfulness provides opportunities for students to explore and to pursue topics and products through self-directed learning and to develop personally meaningful products. As STATS is selected by students who share a common interest, it is similar to an enrichment cluster (Renzulli, 1994) because students want to be there and work together for a commonly agreed upon purpose. In a recent study on the effects of enrichment clusters on student product development, Reis, Gentry and Park (1995) found that over 90% of the students involved in the clusters produced products. Moreover, when a child loves an area of study, then learning becomes personally meaningful, helping him or her construct knowledge. Therefore, offering opportunities for students to conduct individual and small group investigations helps to provide personally meaningful educational experiences (Renzulli, 1994).

Results

Collaboration, connection, and a focus on student interests has made the program strong and contributed to its success. The program is popular with students year after year (more interest than spaces, no attrition, and voluntary high level productivity by students). Further, although it affects the schedules of three middle schools and pulls students out of school during regular class time, it maintains the support of personnel from those schools. Communication through the students, by facilitators, and via projects that connect to the home schools—such as the STATS newsletter, surveys, and recycling efforts—have helped to integrate STATS with the home schools. Consequently there have been few problems with the program's acceptance. Further, by using existing personnel, resources, busing, and facili-
ties, a program that might have seemed impossible at the onset became very plausible. Recently, the area community college has shown its support of the program by offering the use of its facilities and resources. A project description is described and information regarding program outcomes are reviewed.

**STATS I Program Outcomes**

**Water Quality (1994-95) and Wetland Restoration (1996-97)**

Water has been a priority for STATS students over the years. In 1994 there was a strong interest in water quality. Since an integral component of developing an authentic curriculum in STATS is enabling students to work directly with professionals to learn methodologies, good ecological practices, and responsible actions, part of the student-directed management plan for investigating this problem was to invite professionals from agencies dealing with water quality to discuss current information, research, and issues. The students decided to assemble an educational slide show program called Adopt-a-Watershed. They were awarded a grant from the local Community Foundation for cameras and film to photo journal the project. Students working in the field with professionals documented problem sites and areas where best management practices were employed. Students conducted chemical, biological, and physical tests at critical areas of the watershed using methods of practicing field professionals such as conducting a macroinvertebrate survey, using spectrophotometry, and profiling the watershed. They presented their findings at the annual District Council meeting to an audience of interested public and government officials. Their presentation was covered by the local press, and the slide show continues to be made available to teachers in the county as an educational tool.

These students extended their study of water quality aboard a Lake Michigan research vessel to investigate how the water shed they monitored had affected the Great Lake. The data that the students collected is kept in the ship's log and is part of a longitudinal study.

The work of the 1994-95 STATS students was the basis for a wetland restoration project suggested by the 1996-97 students. After studying the watershed data collected by the 1994-95 STATS I class and working with water quality field managers, these students approached the Soil Conservation District and Progressive Engineering with an idea to plant indigenous wetland flora that would absorb excess nitrates and phosphates and improve the filtering capacity of the wetland by preventing these chemicals from flowing downstream. Additionally the plants would slow down the water flow allowing the sediments to collect in the wetland rather than enter the lake system. The wetland site they proposed to restore was a critical area identified by the Soil Conservation District three years earlier and was one of three experimental sites in Michigan designated as a sediment basin designed to filter chemicals and contain sediments, thereby improving water quality downstream. Once the field professionals approved their plan to do the planting, students invited a group of high school Natural Resources students who were working on other projects in the same watershed to assist them in the planting project. The student wetland restoration project was awarded first place this year in the State of Michigan's Envirothon competition.

**STATS I student productivity and STATS II follow up services**

The state of Michigan requires portfolios of its secondary students, so, in addition to their involvement in the interest-directed curriculum, most STATS I students chose to complete a portfolio project in their personal strength area. Their visual, oral, written and kinesthetic products were self-selected and presented to appropriate audiences including community, school, and parent. Students became productive through their involvement in various aspects of research, teaching, and innovation. Additionally, greater than one third of the STATS I students requested and received follow-up services after the conclusion of this program. For each of the program years, the number of students involved in STATS I and those who produced portfolio products or requested follow-up services are indicated in Table 1.

**STATS II Program Outcomes**

Any STATS I student can extend the experience through the STATS II program which was established in 1991 in response to student requests. The STATS II program supports students interested in more in-depth study. Services include an agri-environmental wilderness expedition (AEWE), independent study/mentorship, and home-school support services. Activities vary in length, and students can revolve in and out of the STATS II program at any time during high school.

**Agri-Environmental Wilderness Expedition**

In 1991, as a result of the initial STATS I program and subsequent desire by students for summer follow-up to the academic year experiences, a W. K. Kellogg Foundation Grant was submitted and funded to purchase a mobile lab and backpacking equipment to allow students to travel and camp in the wilderness while they investigated environmental issues. Equipment for this program purchased through the grant is reused each year and is available for loan to other educators in the county.

The Agri-Environmental Wilderness Expedition (AEWE) program was developed to offer STATS I students an opportunity for in-depth field work. Stu-

<table>
<thead>
<tr>
<th>Year/Focus</th>
<th>Students in Program</th>
<th>Students who produced products*</th>
<th>Students who received follow-up services*</th>
</tr>
</thead>
<tbody>
<tr>
<td>90-91 Acid Rain</td>
<td>25</td>
<td>23 (92)</td>
<td>9 (32)</td>
</tr>
<tr>
<td>91-92 Landfill</td>
<td>20</td>
<td>17 (85)</td>
<td>7 (35)</td>
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<tr>
<td>92-93 Ground Ozone</td>
<td>24</td>
<td>20 (83)</td>
<td>9 (38)</td>
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<tr>
<td>93-94 Recycling</td>
<td>24</td>
<td>22 (92)</td>
<td>9 (38)</td>
</tr>
<tr>
<td>94-95 Water Quality</td>
<td>27</td>
<td>25 (93)</td>
<td>10 (37)</td>
</tr>
<tr>
<td>95-96 Endangered Species</td>
<td>26</td>
<td>27 (96)</td>
<td>10 (36)</td>
</tr>
<tr>
<td>96-97 Wetland Restoration</td>
<td>27</td>
<td>23 (85)</td>
<td>9 (36)</td>
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<tr>
<td>97-98</td>
<td>27</td>
<td>25 (93)</td>
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*Numbers in parentheses are percentages.
**Data are not yet available.

Table 1.
students attend training sessions prior to the week-long backpacking trip. Training includes low impact camping and safety, photography, journalizing techniques, and field research methods. During the trip, students conduct an interest-based research project and journal the experience. Upon completion of a portfolio project, they earned 1/2 high school credit. Since its inception, AEWE has involved 210 students in week long low-impact camping and field experiences to Isle Royale National Park, MI; Porcupine Mountains National Park, MI; Smoky Mountains National Park, TN; Algonquin Provincial Park, CAN; Boundary Waters Wilderness Area, MN; Yellowstone National Park, WY; and White Mountains National Forest, NH. Students produced a variety of products in this program including a photo exhibit and community forum, a hiking manual, several newspaper columns and photo essays, and an impact survey regarding the effects of humans on the flora of National Parks.

Several students involved in AEWE have expressed interest in pursuing environmental-related careers. Independent Study Mentorships

Independent study enables students to collaborate with mentors after submitting an acceptable research proposal. For example, in 1995-96 an eleventh grade student submitted a proposal to work with the soil conservation district to develop a video tape that described the wetland restoration project in the county. This video was designed as a educational training tape and was submitted to the state of Michigan's Department of Environmental Quality as a part of a grant awarded to the county for improving water quality in the county. The student worked with field agents from the soil conservation district, then wrote, filmed and edited the tape. She sought professional narration and editing assistance through a local media specialist who helped her develop a professional product. As a result of this student's work with the soil conservation project and field agents who acted as mentors, this tape is now used state-wide as an educational tool.

Another example of a student initiated independent study/mentorship experience is that of a ninth grade student who submitted a research proposal to work with a limnologist from Eastern Michigan University to study the effects of grazers on algae decomposition of cat-tails. The experimental design was presented at the Michigan Academy of Sciences Annual Meeting in April of 1997. Another student developed an idea for an original board game that explored the effects of calories and cholesterol on health. During the next four years, this student developed the concept, field tested a prototype of the game, made revisions and worked with a professional in the graphic arts field to lay out and design the final version. A US copyright was applied for and granted, and the student is working with a marketing professional to distribute the game.

As part of the STATS II independent study/mentorship option, students interested in teaching have written and implemented lesson plans for environmental studies with elementary students. An outdoor pond day experience initiated by independent study students has become part of the regular elementary science curriculum in one school district. Other students have pursued their interest in journalism, and under the supervision of the editor of the local newspaper are working on staff. Their articles are published, and one student has a regular column.

Home-School Support Services

A third way in which the STATS I program is extended is through support of home school activities for STATS students. Program materials are loaned to students, instructors give additional time for technical assistance, and small mini-grants are available to fund acceptable student proposals. This opportunity allows STATS students across the county to become more involved in advanced topics for science fairs, special projects, research, and competitions such as Science Olympiad. Additionally, STATS products and resources are made available to local teachers as a means of supporting the home schools and building bridges between the programs.

Discussion: Limitations, Implications, and Trends

Although the descriptive results of this project were impressive, there exist several limitations to the current study including the ex post facto nature of the data; the lack of valid/reliable instrumentation; and the generalizability of this rural program to other settings. To provide documentation of the effectiveness in future research or replication studies of similar special programs, the authors suggest planning the research at the onset of the program. The STATS programs, as with many innovations in education, was not designed as a research study, and only after several years of what seemed to be successful existence did those involved consider reporting results. By planning and collecting data as programs are developed, implemented, and carried out, and by employing a combination of quantitative and qualitative methods, more substantive findings than those reported here may be achieved. For example, yearly exit interviews, as well as follow-up interviews at scheduled intervals, with students would have provided valuable insight into both the short-term and long-term effects of their involvement in the program.

Although the descriptive, ex post facto approach used in this study provided insight into the programs, their activities, and effects on students, adding a quantitative approach would have provided greater insight. By using pre and post measures on variables such as achievement, product quality, self-efficacy, and self-concept, more definitive outcomes could have been measured. Combining quantitative and qualitative methods would serve researchers, coordinators of gifted programs, and program developers by providing a more complete picture of the observable and measurable effects of such programs when they are implemented.

Although the information in this study may not be entirely new to the field of gifted education, it does serve to illustrate how some strategies can be integrated and developed into a program that transcends traditional school boundaries in a rural setting. For areas with limited resources and small populations, such cooperative programming should be considered as a means by which resources can be pooled and students' special interests and talents can be served. In the absence of cooperation and creativity on the part of the school districts and educators involved, such programs would not exist. This program can also serve as a model for using student interests and strengths together with real-world problems and collaboration within educational venues from special programs to the "regular classroom."

After eight years, STATS continues to grow and change in response to student interests and directions. In a rural area with limited resources, this program has managed to offer enriching educational experiences to students that would not be found in their own schools. The numbers of students who produce products in STATS I (85% and greater, each year), and the number of students who continue their studies after the conclusion (35% and greater, each
An interactive design model

dent with common interests are

Bringing Environmental Education Into

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ates it from the other two. This article explains the model and the way it

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year) are a indicative of the program’s

in a county with 6000 students

numbers of students in any one middle

school with a passion for the environ-

ment probably would not sustain an

intensive program such as StATS. How-

ever, with collaboration, these students, bonded by their common interests and

strengths have been able to come togeth-

er regularly during the school year to

pursue these interests.

StATS currently serves as a

model program for educators

interested in developing similar colla-

borative ventures that concentrate on areas of

student interest and talent develop-

ment. The facilitators of the StATS pro-

gram have made presentations about

the program at regional, state, national and

international conferences. Chosen as one of

35 programs from a national search

for exemplary environmental programs, StATS is highlighted in the EPA’s

guide, Getting Started: a Guide to

Bringing Environmental Education Into

Your Classroom (Bones, 1994).

Additionally, StATS demonstrates what is possible when the learning is authentic,

challenging, meaningful, and grounded in student interests. Perhaps an addition-

al value of such a program is to remind

us that students can accomplish great things that go well beyond our curricu-

lum and standardized tests, if we only

provide them the time and latitude to

explore their interests, dreams, and pas-

sions. As suggested by Renzulli (1994)

this is most likely to occur when stu-

dents with common interests are

grouped with facilitators who will help

them pursue these interests in a rigorous, challenging, authentic manner.

REFERENCES


Distance education for the gifted and talented: An interactive design model

David H. McKinnon

C. J. Patrick Nolan

In 1994, the New South Wales Board of Studies, Australia, introduced three high level Distinction Courses for gifted and talented students: comparative literature, cosmology, and philosophy. All are offered by distance education but the cosmology course employs an interactive design model and an extensive communication system that differentiates it from the other two. This article explains the model and the way it is used in practice to organize, sequence and deliver the course. Discussion addresses ways in which the model might be used to design a wider range of courses for gifted and talented students.

David H. McKinnon is a senior lecturer in the Faculty of Education at Charles Sturt University, Bathurst, Australia. He is the Course Coordinator of the Cosmology Distance Course. His main academic and research interests are curriculum development, education with computers, science education and the education of the gifted and talented.

C. J. Patrick Nolan is the director of the Educational Research and Development Center and Associate Professor of Education at Massey University, New Zealand. His main academic interests are curriculum development, education with computers, experiential learning, and school development and administration.

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