

Illinois Math and Science Academy

From the Selected Works of Stephanie Pace Marshall, Ph.D.

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Remarks Given to Ball State University

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BALL STATE UNIVERSITY

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Given by Dr. Stephanie Marshall

ILLINOIS MATHEMATICS AND SCIENCE
ACADEMY

We are delighted that you are here.

Thank you, it's a pleasure for me to talk about the Illinois Mathematics and Science Academy.

Before I begin to talk about the Academy, the myths handicapping gifted education, the needs of gifted students, and more specifically the reasons why we examined science and mathematics education for academically talented youngsters, I want to set the stage and provide a context for my remarks. And so I want to read you a story that I hope will set a philosophical framework; it is entitled "The Animal School;" and it reads as follows:

"Once upon a time, the animals decided they must do something heroic to meet the problems of a new world, so they organized a school. They adopted an activity curriculum consisting of running, climbing, swimming, and flying, and to make it easier to administer, all the animals took all the subjects.

"The DUCK was excellent in swimming, better in fact than his instructor, and made passing grades in flying, but he was very poor in running. Since he was slow in running, he had to stay after school and also drop swimming to practice running. This was kept up until his web feet were badly worn and he was only average in swimming. But average was acceptable in school, and so nobody worried about that, except the DUCK.

"The RABBIT started at the top of the class in running, but had a nervous breakdown because of so much make-up work in swimming.

"The SQUIRREL was excellent in climbing until he developed frustration in the flying class, where his teacher made him start from the ground-up instead of from the tree-top-down. He also developed a charlie horse from over exertion and then received a C in climbing and a D in running.

"The EAGLE was a problem child, and was disciplined severely. In the climbing class he beat all the others to the top of the tree, but instead of climbing, insisted on using his own way to get there.

"At the end of the year, an abnormal EEL that could swim exceedingly well, and also run, climb, and fly a little had the highest average and was valedictorian.

"The PRAIRIE DOGS stayed out of school and fought the tax levy because the administration would not add digging and burrowing to the curriculum. They apprenticed their

child to a BADGER and later joined the GROUNDHOGS and GOPHERS to start a successful private school." and the narrative ends with:

"There is nothing so unequal as the equal treatment of unequals."

I felt it appropriate to begin this way because I hope this narrative puts the Illinois Academy into perspective.

When we talk about the Illinois Academy of Math and Science, we are talking about a three year residential school for extraordinarily talented young people. We are talking about students that are truly gifted, one-half of one percent of our gifted population.

As you may be aware, there are a number of myths that have surrounded the education of gifted children. It is important that you put these myths in perspective because they have unfortunately clouded the thinking of many people when they begin to consider initiatives such as the Illinois Academy.

One critical myth, and perhaps the most important to irradicate, is that gifted children will make it by themselves and that it is not necessary to provide differentiated programs and opportunities for them, because they will develop the

resources they need to succeed on their own.

Unfortunately, despite the apparent logic of this "cream always rises to the top" myth, it is simply untrue. Research on gifted education indicates that despite the intellectual gifts of students, they simply will not reach their potential without differentiated instruction and materials.

In 1972 the Federal Office of Gifted and Talented developed a national definition of Gifted. The definition made it apparent that the federal government believed that gifted education was not an enrichment option, but rather a requirement, if gifted students were to maximize their potential.

The profound nature of gifted children's potential contributions to society was recognized in Congress's declaration that:

1. the Nation's greatest resource for solving critical national problems in areas of national concern is its gifted and talented children.
2. unless the special abilities of gifted and talented children are developed during their elementary and secondary school years, their special potentials for assisting the Nation may be lost, and
3. gifted and talented children from economically disadvantaged families and areas often are not afforded the opportunity to fulfill their special and valuable potentials, due to inadequate or inappropriate educational services.

Dr. Benjamin Bloom from the University of Chicago clearly stated that there is strong evidence that no matter what individual gifts are ,

unless there is a long and intensive process of coordination and training, they will not obtain an extreme level of capability.

Another commonly held myth is that gifted students should not be accelerated because of the potential detriment it may be to their social or emotional growth. This, too, is false. Again the research indicates that youngsters identified as gifted are in general more mature and more socially and emotionally well adjusted than other students. Research supports acceleration for gifted students as an option for extending their potential, because it provides opportunities for students to interact with others at their intellectual level.

Gifted students have unique needs. They need to be challenged:

1. by mastery-level work in areas of strengths and interest
2. by exposure to new areas of learning.
3. by the opportunity to see relationships among all bodies of knowledge
4. by experiences that promote understanding of human value systems
5. through discussions with intellectual peers; playmates; imaginary
6. by activities at complex levels of thought
7. through opportunities for divergent production, opportunities for the creation of new knowledge; and
8. by opportunities for working on REAL problems.

With these needs in mind, what kind of an educational environment would best prepare gifted youngsters to meet the demands of their own creative intelligence and energies? In our judgment, it is one that provides opportunities for three experiences: acceleration, enrichment, and counseling; experiences that are built with the Academy's program.

Gifted children need exposure at earlier and earlier ages to new domains of knowledge - domains such as logic, law, foreign language; they also need to be exposed to extensions of the basic domains of knowledge, such as philosophy, reasoning, problem solving, research and decision-making.

They need academic counseling, psycho-social counseling and career counseling. And they need to be able to talk about what it feels like to be different, and how they

can use that difference to enhance themselves and others.

In addition, they also need to focus on affective skills. They need to learn to become tolerant of themselves and others. They need to discriminate between the real and the ideal because they have a tremendously strong sense of justice, and they must develop and use their high levels of sensitivity in beneficial ways because of their vulnerability in social situations.

We've focused on the generic needs of all academically talented people, but let's talk about some research as it relates to math and science. Why do talented youngsters seem to shun science and math and reject it as options for their academic work?

A recently conducted survey sent to 2000 high school educators nationwide indicates that both educational inadequacies and budgetary deficiencies are two factors in teachers' inability to spark enthusiasm among youngsters that are capable of scientific study. In addition, inadequate research and lab experiences, little opportunity for independent study were cited.

Clearly, this survey indicates that we are losing, our most capable students in mathematics and science.

It was within the context of this erosion and loss of intellectual talent that a number of Illinois' most highly regarded educators, researchers, and business people came together in 1982 to discuss the status of math and science education in Northern Illinois and to propose an Academy.

The initial conversations were not monumental. We didn't realize what we would be embarking on. Several school superintendents, business and corporate heads and research people met periodically as part of the area's Valley Industrial Association. We began to discuss the impact of education on the high tech business in the area.

After several discussions, a decision was made to establish a not-for-profit corporation named The Corridor Partnership for Excellence in Education to foster business and educational and research

partnerships. The Corridor Partnership took on two tasks:

1. The establishment of a math and science academy
2. The improvement of math and science education in our 4-county area

That was in 1982 - 4 years and several legislative session later, the Governor of Illinois embraced the concept of Illinois Mathematics and Science and the Academy was passed under SB 730 as one of the legislative reforms of Illinois.

Dr. Leon Lederman, Director of Fermi National Accelerator Laboratory initially proposed the idea of the Academy, but the establishment of the Academy was in the greatest sense of a grass roots efforts - born out of the business/educational/research partnership and the legislation that we were linking our notions

with available resources - our
gifted and talented youth.

The Illinois Academy for Math and Science is a bold and important initiative. It will not only provide a superior learning environment for gifted students, but will also serve as a catalyst to improve the educational delivery system for all students.

Although we are fortunate to have outstanding teachers in math and science in our secondary schools, we cannot possibly provide gifted students in the upper one-half of one percent of the high school population with the kind of exceptional programming, research and emersion in science and mathematics that a residential academy would provide.

At the present time the gifted program in Illinois serves approximately 85,000 students, 21,000 of whom are in grades 9-12.

Although Illinois is making good strides in gifted programming, the quantity and quality of programming differs from district to district because of the State's diversity. Well, that's the background.

Now let's talk specifically about the topic of why you are here.

What is the Illinois Academy?

The Illinois Math and Science Academy, is a three year school for youngsters gifted in science and mathematics.

The mission and goals of the Academy were clearly stated in the Board philosophy statement adopted on April 1, 1986.

MISSION

The Illinois Mathematics and Science Academy was created to inspire and challenge young boys and girls gifted in mathematics and scientific ability in a manner which will maximize the use of these talents for the benefit of society.

GOALS OF IMSA

.. To provide an educational, social and emotinal climate in which students with exceptional aptitude in mathematics and science can develop their intellectual gifts and become committed to the search for

humane solutions to our world's problems.

.. To serve as a laboratory for the development, testing and dissemination of innovative techniques in mathematics, science and the humanities which can become a resource for secondary school teachers in Illinois and the nation.

The Academy is one of three (North Carolina and Louisiana) publicly funded residential schools in the country; and will admit about one out of every 1000 sophomores in Illinois, approximately 800 to 1000 students will comprise the school when it is fully operational in three years. The class of 1989 for which we received 768 applicants is 205 students and it officially began on September 8, 1986. Our legislative charge was to select students through competitive examinations and to have them representative of the geographical, racial and sexual distribution of Illinois. Of the 205, 119 boys, 86 girls, 55% Chicago and suburbs, 45% downstate, Average SATM - 620, Average SATV 537, GPA 3.9, 70% white, 10% black, 15% oriental, 3% hispanic, 2% other.

Our selection process was developed in consultation with Dr. Clifford Wing from Duke University.

USED ACCOMPLISHMENT-BASED ASSESSMENT

1. Recognized accomplishment suggests drive
2. Individual accomplishments in one area are usually indication of accomplishment in others as well
3. Best predictor of future accomplishment is record of past accomplishment

RATED IN 5 AREAS

1. Mathematical reasoning
2. Scientific reasoning
3. Communication ability
4. Interpersonal relations
5. Performance ability

The academy was designed to bridge the 10th, 11th, and 12th grades of high school and the first year of college which distinguishes it from the other two residential schools.

After three years at the Academy, graduates would enter college at least at the sophomore year of college. The essence of the Academy programs is academic regular infused with risk taking, problem solving, creative thinking, an ability to analyze, synthesize and evaluate characteristics.

- comment on curiosity, creativity, and intelligence ability in math and science
- comment on special activities, projects and initiative
- characteristics/behaviors observation, inquisitive, experimenting, persistence, self starter, innovator, analytical, leadership

First 100 totally competitive ranking; second 100 fill in, 100-150 points higher than college scores in SAT.

SELECTION PROCESS

1. Application - applicants are nominated

a. Student applicant completed form and responds to questionnaire

1. How would IMSA enhance your goals and development as potential leader or scholar

2. What contribution can you make to IMSA and what will you do to promote its mission

3. Awards, certificates, recognition

4. Extra curricular, community involvement

5. Special interests

b. Evaluation

The school will not only provide a superb education in science and mathematics, but it will also provide education in the humanities, foreign language and the arts.

Liberal ly educated people in the traditional sense of the word are prepared to live in a complex, changing world in where they must constantly make choices. They have the disciplines of mind which permits freedom of action.

For this year, there are no electives other than Foreign Language. Students take 1 math course, 2 science courses, 1 English, 1 social science, and 1 foreign language and physical education. We offer German, Spanish, Latin and Russian. Our staff is eminently qualified to offer this program. 12 faculty, 8 part time; M.A. and Ph.D., 9 resident counselors. Risk takers, problem solvers, deal with ambiguity sense of adventure, pioneers. If schools are to places where children are thinking and learning, their teachers must be doing the same.

The Academy was also charged with stimulating further excellence in Illinois schools in math and science by acting as a catalyst for the improvement of the teaching of science and mathematics throughout Illinois.

The Academy will thus function as a lighthouse for academic excellence in Illinois by stimulating curriculum development initiatives, providing pre-service training for teachers, hosting several institutes (such as the International Physics Olympiad, providing opportunities for teacher exchanges, developing video-tapes, and providing speakers and resource people.

Seminars and guest lectures by eminent scientists, individual study and research, group projects and clubs, numerous opportunities for group and individual research with scientific mentors and affiliated research laboratories, will provide the stimulus of working and learning

with their intellectual peers in an
atmosphere of complete commitment
and dedication to educational
excellence.

The Illinois Academy was born during the 1985 legislative session. With the leadership of the Governor and the support of the General Assembly, a 17-person Board of Trustees was established in October of 1985, and \$500,000 was appropriated for initial start-up costs.

Since that time, a \$12,000,000 school building has been acquired, a supplemental grant of over \$5,000,000 has been appropriated for construction of residential housing and a 3.5 appropriation for operating the program for 1986-87 was passed by the General Assembly and an additional _____ has been allocated for dormitories. Unfortunately the operating budget was not adequate. We have submitted a budget of 11. million for next year.

The Illinois Mathematics and Science Academy is a unique learning environment that will be characterized by thoughtful and ethical problem-solving, and a celebration of what's possible in the cultivation and development of human potential.

According to our course catalogue the Illinois Mathematics and Science Academy has four primary goals:

1. To develop intellectual potential, academic achievement, creativity and responsibility in all students.
2. To approach mathematics and science as the products of human creativity and curiosity.
3. To foster interdisciplinary approaches to thinking and learning by integrating the

study of mathematics,
natural and social sciences
with the arts and
humanities.

4. To cultivate a residential
environment that is
stimulating, nurturing and
bias-free.

Although, the academic program of the Academy is designed to be accelerative, students will be encouraged to play and tinker with math and science, and students and staff will be afforded the luxury of time to reflect. The program is also interdisciplinary in nature; traditional departments were not formed. We were very conscious of the concept that what you call it becomes what it is so we decided to call things what we want them to become.

In our architectural drawings, rather than create___ a lake we created a biological research pond. Since we want science to be interdisciplinary and our math to focus on inquiry - we named our first science course integrated science and our first math course mathematical inquiry.

It is important to understand that the heart of this program is its intensely enriching and

stimulating instructional environment. Experimentation and collaborative risk-taking are the behavioral norms, not the behavioral by-products of this environment.

It is also important to underscore that the academy will not exclusively teach classes in science and math. Our emphasis is in math and science, but is balanced with humanities. To prepare students for careers in science, it is important that we educate them to express themselves clearly and well, to understand scientific work in the context of society and to live healthy responsible lives as members of the society, that is why ethical problem-solving was stated as a central focus.

As part of our lobbying, if you will, for this Academy, I wrote to several members of the House and Senate. One representative wrote me a letter in response which was disturbing. He said "Dr. Marshall, I think this is a fine idea, but it is an idea whose time has not yet come."

I re-read his letter and wondered what force decided when it was time for an idea. I believe ideas come through people; it is people who determine whether an idea is propitious or not, whether the time is sound or not, whether the benefits are right or not. An idea doesn't come by itself, and the time does not come without people pushing it.

I have talked about the educational reasons for an Academy, but there are economic reasons as well.

Illinois suffers right now from a national misconception of our

scientific and technological prowess. In a recent National Science Foundation survey of 50 states, which surveyed math and science educational initiatives, Illinois was barely mentioned. Despite the presence of two national laboratories, many superb industrial research centers, and the great recognition given to our universities, Illinois is not given recognition, and is barely mentioned when one talks about initiatives in science and mathematics.

The Academy will have a strong rippling effect far beyond our own student body. It will stimulate young students all over the state. It will outreach to teachers and to schools throughout the state. It will have tremendous impact across the state on curriculum development, teacher institutes, workshops, exchange programs, telecommunications, staff development programs, and mentorship programs, and will provide another

source of leading scientists by
offering strong incentives to its
graduates to stay in Illinois.

I know that one of the concerns about the academy relates to the fact that we' will be skimming off the cream of the crop. However, when we talk about less than one-half of one percent of a population, we are talking about one or two students in most high schools.

I have heard a concern relative to "cloistered elitism" Because I heard the reference to elitism so frequently I decided I'd better look it up.

Elitism is defined by Webster as a separate according to social class and SES. This simply does not apply to the Academy.

The Academy is a place for the aggregation of talent; admission is not dependent on social class or affluence - only ability - much like the Chicago Symphony and the Chicago Bears.

As a matter of fact we have students here who are from affluent families and those who are on food stamps.

Unlike Illinois Lighthouse schools who offer exemplary programs only for those who can afford to live there, the Illinois Mathematics and Science Academy offers an exemplary program for those of rare talent regardless of SES, race or gender.

Obviously, we are separating a group of our population, but we are separating them so they may serve all of us. The Academy is operated in such a way that students of rare talent are recruited from throughout Illinois, from all racial, social,

and economic strata; there is no bias toward any articulated class of student.

In our judgment, it is the gifted student for whom educational should mean the most. None can potentially derive greater benefits from a close emersion in the intellectual and technical heritage of our civilization, and none can potentially contribute more than young people of rare talent. Not to provide all that can be done to encourage their contribution seem to me to be a profound misreading of the concept of public welfare.

As a product of the cooperative efforts of all educational constituents, the Academy will be a breeding place for productive educational innovation, and will set standards that other states and schools will be forced to emulate.

In an article printed in Educational Leadership, Isaac

Wirzburp, who is a professor mathematics at the University of Chicago, said the following, "We must acknowledge that an educated population and a well trained work force are essential to the recovery of our country's dynamic spirit and economic strength. We must go beyond mere recognition of the problem and mount a serious effort, a genuine national mobilization for education. To give up, to procrastinate or to plan only for short term would be to mortgage our freedom and our future."

Despite the progress we have made, the battle is not over. 3.5 million is not sufficient to handle the overall program we envisioned. We will be seeking corporate funding and any other funds for that matter. Recently the IMSA Fund for the Advancement of Education was created to receive contributions.

We also need to build a
legislative coalition. . If you know
friends in high places and support

the Academy - a letter and/or phone call will be helpful. We need additional legislative support; but we also need corporate support so we can show the legislature that we have many friends and the commitment of the business community.

What is the Illinois Mathematics and Science Academy. It is really a collage of images and impressions that is far more than the sum of its parts. The days are exciting and unpredictable.

One day started with a call from the Governor's Office and the NSF in Washington and ended with a student coming into my office after report cards and saying Dr. Marshall, I just got an A in chemistry, would you give me a hug? Kids tell us that they :

1. Have never been challenged so much before
2. Felt safe
3. Felt free to ask questions
4. Felt free to student and work
5. Are respected here
6. Feel less competition here

Teachers tell us :

1. Stimulating learning/teaching environment
2. Real sense of community
3. Flexible risk taking atmosphere
4. Questions raised never thought of before

Parents tell us:

This is the right place for their child to be

Those of us who are here, feel privileged and yet a tremendous obligation to do what's right and if we continue to listen to the students, I think we'll remain on target.

I'd like to close with another Vignette that I hope graphically describes the need for programs and teachers that understand the needs of unique children.

"A Vignette of 5" by Ethelouise Carpenter

He was five, and in kindergarten. The first time he was told his boots were on the wrong feet he looked down and said, "no, these are my feet," and the next time, "Well it doesn't matter. I know where I'm going."

As the weeks went on we learned that he had a copper spaniel dog, he slept in a four-holster bed and he lived (in this university community) next door to merry housing.

He had a hole in his boots that sucked up water and he objected to walking to school on lumpy sidewalks. He had a new baby sister who leaked and who had a bath when there wasn't any dirt on her.

In school he complained about a child who was acting too deteriorating and one day he announced he had had a mestressing accident.

At the workbench he ground wood and made Swiss cheese. He didn't

like pineapple juice because it
"kinda bit him." He said he loved
to eat celery because he could hear
the noise inside his head. He said
he couldn't play with guinea pigs
because they were "bad for his
energies." He made a very mykannic
thing of wood and wire, and touched
dry cell wires to the globe to make
the world turn.

He squeezed shoots of water from
a plastic soap container,
discovering he could do it to the
rhythm of Yankee Doodle. He made a
mouse trap and a suit of knight
armor. He bottled milkweed seeds so
he could see them loose without
losing them. He raced two worms
across a board and blew noises out
of mailing tubes. He liked the
smell of turkentine when he cleaned
off animal paint. He took off his
shoes because he liked the rug
feeling through his socks. He wore
a man-shirt and necktie which he
invariably wound up in the workbench
vise.