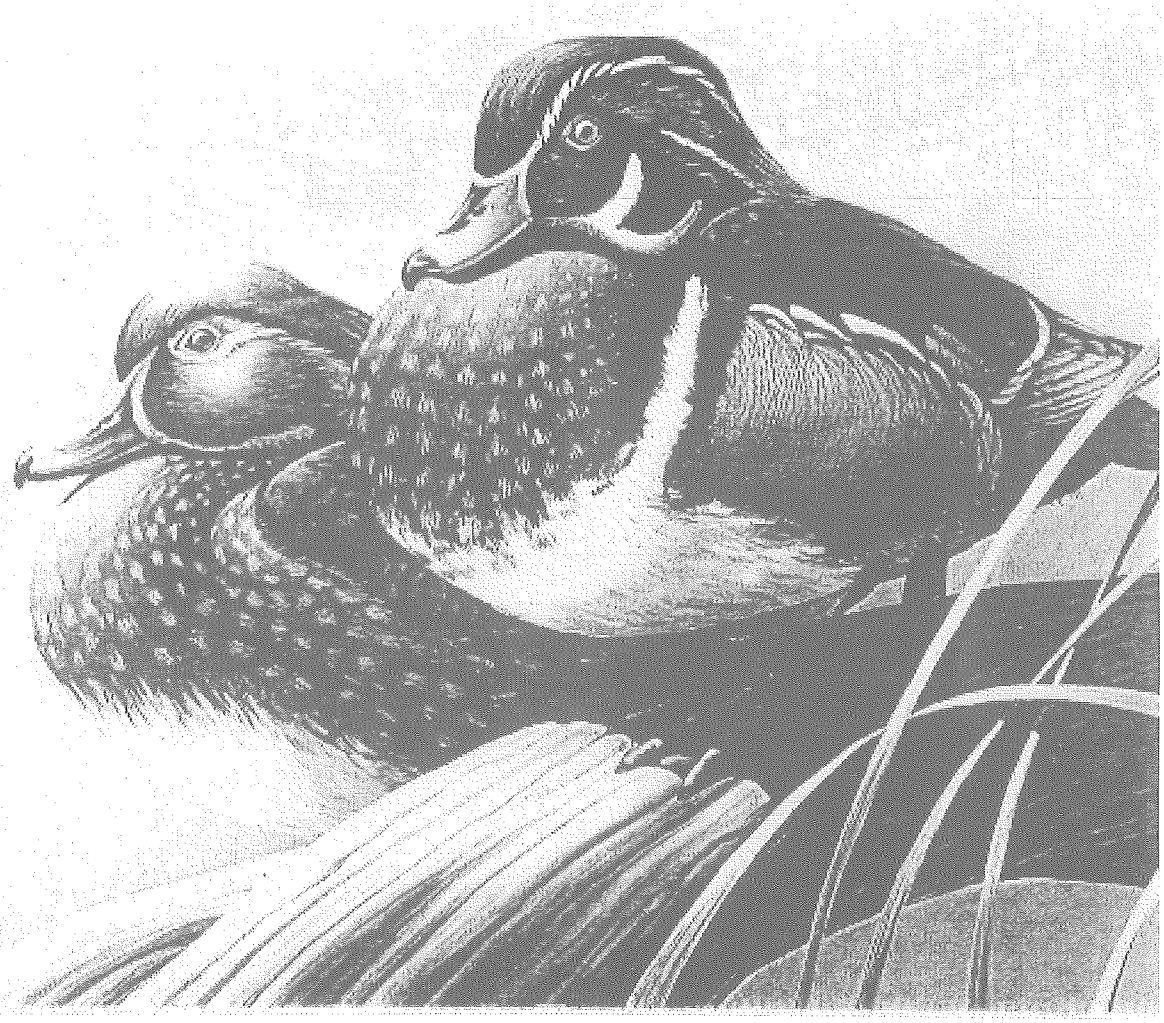
SPECTRUM

THE JOURNAL OF THE ILLINOIS SCIENCE TEACHERS ASSOCIATION



Congratulations to Ryan Kirby 1999 National Junior Duck Stamp Design Contest Winner

SPRING/SUMMER 2000

ILLINOIS SCIENCE TEACHERS ASSOCIATION I.S.T.A. www.ista-il.org

SPECTRUM

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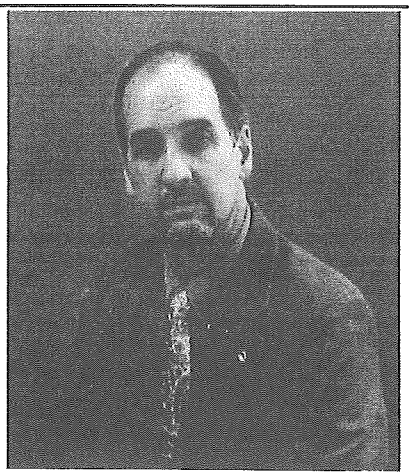
Cover: "Autumn Calm" by Ryan Kirby, winner of the 1999 National Jr. Duck Stamp Design Contest. Ryan is a student at Hamilton High School in Hamilton, Illinois. His art teacher (and father), Steve Mullins traveled to Washington, DC, courtesy of the U.S. Fish and Wildlife Service. Congratulations, Ryan!

ISTA NEWS

PRESIDENT'S LETTER

Building a Presence for Science in Illinois



One of the major goals (and frustrations) for any professional organization is trying to reach those the organization is designed to serve. In the case of the Illinois Science Teachers Association, that means connecting with the thousands of Illinois educators who provide science instruction to students across the P-16 continuum. It would seem that in an age of "information overload" implementing viable two-way communication with Illinois' science education community would be no big deal. Believe me...it's a BIG DEAL. ISTA's leadership has worked very diligently over the past several years to solicit a science educator to act as ISTA's point of contact in each Illinois school. We have found that identifying and contacting even a single teacher in each of Illinois' 4110 schools to a be a formidable task.

The ability to reach teachers at the local level is of great value to both our organization and to the science educators we seek to serve. We want to be able to inform all science teachers about our activities (conferences, meetings, publications) and the many changes (standards, assessments, teacher recertification) that impact teachers and their students. Establishing the means for quickly disseminating information is crucial to ISTA's stated mission of "providing proactive leadership, promoting effective classroom practices, supporting professional development, facilitating communication, collaboration and networking opportunities." Basically, it is impossible for ISTA "to advocate for science teachers" if we cannot connect with those teachers.

This is why I am so very pleased to inform our membership that Illinois has been selected as one of twenty-three states in the National Science Teachers Association's *Building a Presence for Science* Program. *Building a Presence for Science* is designed "to create a network of science advocates within a state and supply them with resources and professional development that will reach every school." It would seem that with NSTA's assistance we will be able to close in on one of our major organizational goals!

According to a letter from Executive Director Gerry Wheeler, NSTA will soon receive funds through a grant from ExxonMobil that will bring this innovative and award-winning program to Illinois. The program's activities are intended to:

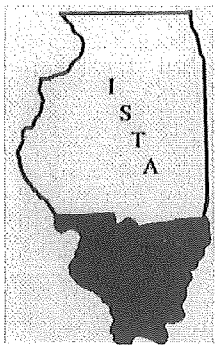
- Establish Key Leaders and Points of Contact for science in Illinois schools,
- Build a dynamic network to promote standards-based science teaching and learning,
- Promote inquiry-based instruction and hands-on learning,
- Enhance science teacher professional development,
- Facilitate information sharing among teaching colleagues,
- Promote collaboration among education agencies and professional organizations and
- Build science partnerships with the business and informal science communities.

Obviously, *Building a Presence for Science* is a very ambitious and wide-range initiative. However, objectives such as the ones listed above match very closely with those outlined in ISTA's own strategic plan.

The leadership of the Illinois Science Teachers Association is very excited to be a part of the *Building a Presence for Science* program. Details as to how this program will be implemented in Illinois and the role that ISTA will play in its implementation are still unclear. ISTA will be working to plan this exciting venture during summer. By the time you have read this, we should have a better sense of what *Building a Presence for Science* will mean to our organization, our science educators and our students. Stay tuned and keep your fingers crossed!

Dan Nelson

Reminder! Make arrangements TODAY for attending the 2000 ISTA Convention October 26-28, 2000, Pheasant Run



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Illinois Department of Natural Resources
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WSIU-TV

Over 300 teachers attended Science in the South this year. Included in the $60.00 registration were over 30 workshops for every level of teaching, a fantastic buffet lunch, dozens of giveways, and a 1-year membership to ISTA. Mark Your Calendars Now! March 9, 2001 for next year's Science in the South.

Special Thanks go to our Regional Superintendents of Schools for their Support:

Linda Blackman
Edwards/Pope/Gallatin/Wayne/Wabash/White/Saline/Hardin

Donald Brewer
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Harry Briggs
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Andrea Brown
Alexander/Johnson/Massac/Pulaski/Union

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Barry Kohl
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Delbert Maroon
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Clay/Lawrence/Crawford/Jasper/Richland

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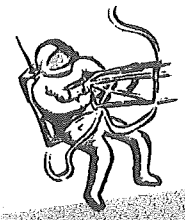
Congratulations to ISTA Treasurer Barbara Sandall

Newly Elected National Science Teachers Association Region XII Representative

Community Consolidated School District 15 Presents



Space Symposium 2000

August 10, 2000
A one-day conference for educators of grades K-8.

John G. Conyers, Ed.D.
Superintendent of Schools

Integrate space sciences into your school.
Fees: Before July 1: $50
After July 1: $60

Morning Sessions:

Fizzy Rockets: (3-5) Students launch film canister rockets to investigate the effects of varying the amount of fuel, pressure, and laws of motion.

Space Science: (3-8) Learn background about space sciences, plus obtain *Lunar Certification* (allows you to get lunar rocks from NASA sent to your school on loan) through the Glenn Research Space Center.

Discover 15 Shuttle Experience: (3-8) An overview of the District 15 Space Program and how "Engaged Learning" is implemented through the use of space simulations. Includes a tour of the David Hill Mission Control and Discover 15 Space Shuttle.

NEARlink/Moonlink: (3-8) Learn how you can have your class participate in actual NASA satellite missions where students use real-time data to run through simulations.

Totally Interdisciplinary Rocket Unit: (7-8) Integrate the subject of rockets into your junior high grade level. Everything a budding rocket scientist needs to know.

Afternoon Sessions:

Toys in Space: (3-5) Toys were items astronauts took into space and tested. This session will show how kids can use the scientific method to hypothesize how toys react in space, and then see real video of astronauts demonstrating the toys in space.

Discover 15 Shuttle Experience: (3-8) An overview of the District 15 Space Program and how "Engaged Learning" is implemented through the use of space simulations. Includes a tour of the David Hill Mission Control and Discover 15 Space Shuttle.

Star Lab: (3-8) Experience the thrill of viewing constellations in your classroom by using the Star Lab module. This will include background on seasonal skies and origins of the constellation names.

Rockets in the Classroom: (7-8) Tired of explaining physics and chemistry concepts to your students? These activities help your students learn important science principles by building rockets and launching them.

NEARlink/Moonlink: (3-8) Learn how you can have your class participate in actual NASA satellite missions where the students use real-time data to run through simulations.

(Sessions and speakers are subject to change.)

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Please list specific choices for the morning and afternoon sessions.

Morning Session

1st Choice: _____
2nd Choice: _____
3rd Choice: _____

Afternoon Session

1st Choice: _____
2nd Choice: _____
3rd Choice: _____

Sessions are limited to 25 participants. They will be filled on a first-come basis.

Make check payable to: **District 15 Space Shuttle Program**

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FYI: HAVE YOU READ THE LAW?

Excerpted From Public Act 91-0102, Teacher Certification and Recertification

This law affects you immediately. Become familiar with it. A Draft of he Rules and Regulations has been circulated. Unlike many previous mandates this is a **law** and will be in place for a long time. For more information contact the ISBE website http://www.isbe.state.il.us/
To access the entire law, visit the Illinois Legislature website: http://www.legis.state.il.us/publicacts

AN ACT CONCERNING EDUCATION, AMENDING NAMED ACTS.

Be it enacted by the People of the State of Illinois,
Represented in the General Assembly:

[REVISED SECTION]

(105 ILCS 5/21-1A) (From Ch. 122, par. 21-1a) Sec. 21-1a. Tests required for certification.

Beginning February 15, 2000, the State Board of Education, in consultation with the State Teacher Certification Board, shall implement and administer a new system of certification for teachers in the State of Illinois. The State Board of Education, in consultation with the State Teacher Certification Board, shall design and implement a system of examinations and various other criteria which shall be required prior to the issuance of Initial Teaching Certificates and Standard Teaching Certificates. These examinations and indicators shall be based on national and State professional teaching standards, as determined by the State Board of Education, in consultation with the State Teacher Certification Board. The State Board of Education may adopt any and all regulations necessary to implement and administer this Section.

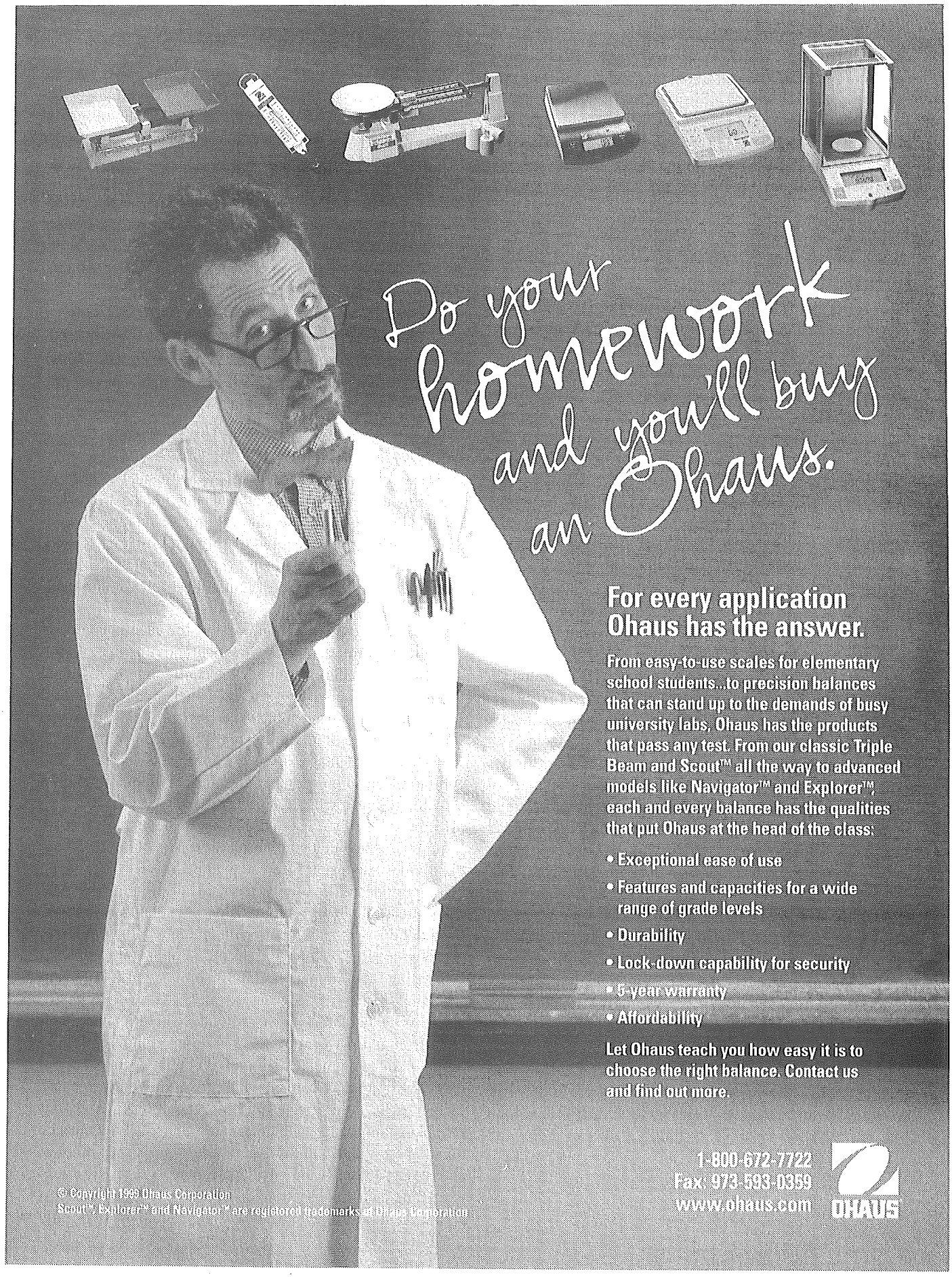
(105 ILCS 5/21-1b) (from Ch. 122, par. 21-1b) Sec. 21-1b.

Commencing July 1, 1999, each application for endorsement of an existing teaching certificate shall be accompanied by a$30 nonrefundable fee. There is hereby created a Teacher Certificate Fee Revolving Fund as a special fund within the State Treasury. The proceeds of each $30 fee shall be paid into the Teacher Certificate Fee Revolving Fund; and the moneys in that Fund shall be appropriated and used to provide the technology and other resources necessary for the timely and efficient processing of certification requests.(Source: P.A. 88-224.)

(105 ILCS 5/21-2) (from Ch. 122, par. 21-2) Sec. 21-2. Grades of certificates.

(b) Initial Teaching Certificate. Beginning February 15, 2000, persons who (1) have completed an approved teacher preparation program, (2) are recommended by an approved teacher preparation program, (3) have successfully completed the Initial Teaching Certification examinations required by the State Board of Education, and (4) have met all other criteria established by the State Board of Education in consultation with the State Teacher Certification Board, shall be issued an Initial Teaching Certificate valid for 4 years of teaching, as defined in Section 21-14 of this Code. Initial Teaching Certificates shall be issued for categories corresponding to Early Childhood, Elementary, Secondary, and Special K-12, with special certification designations for Special Education, Bilingual Education, fundamental learning areas (including Language Arts, Reading, Mathematics, Science, Social Science, Physical Development and Health, Fine Arts, and Foreign Language), and other areas designated by the State Board of Education, in consultation with the State Teacher Certification Board.

(c) Standard Certificate. Beginning February 15, 2000, persons who (1) have completed 4 years of teaching, as defined in Section 21-14 of this Code, with an Initial Certificate and have met all other criteria established by the State Board of Education in consultation with the State Teacher Certification Board, (2) have completed 4 years of teaching on a valid equivalent certificate in another State or territory of the United States, or have completed 4 years of teaching in a nonpublic Illinois elementary or secondary school with an Initial Certificate, and have met all other criteria established by the State Board of Education, in consultation with the State Teacher Certification Board, or (3) were issued teaching certificates prior to February 15, 2000 and are renewing those certificates after February 15, 2000, shall be issued a Standard Certificate valid for 5 years, which may be renewed thereafter every 5 years by the State Teacher Certification Board based on proof of continuing education or professional development. Beginning July 1, 2003, persons who have completed 4 years of teaching, as described in clauses (1) and (2) of this subsection (c), have successfully completed the Standard Teaching Certificate Examinations, and have met all other criteria established by the State Board of Education, in consultation with the State Teacher Certification Board, shall be issued Standard Certificates. Standard Certificates shall be issued for categories corresponding to Early Childhood, Elementary, Secondary, and Special K-12, with special certification designations for Special Education, Bilingual Education, fundamental learning areas (including Language Arts, Reading, Mathematics, Science, Social Science, Physical Development and Health, Fine Arts, and Foreign Language), and other areas designated by the State Board of Education, in consultation with the State Teacher Certification Board.



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(d) Master Certificate. Beginning February 15, 2000, persons who have successfully achieved National Board certification through the National Board for Professional Teaching Standards shall be issued a Master Certificate, valid for 10 years and renewable thereafter every 10 years through compliance with requirements set forth by the State Board of Education, in consultation with the State Teacher Certification Board. (Source: P.A. 90-548, eff. 1-1-98; 90-653, eff. 7-29-98;90-811, eff. 1-26-99.)

(105 ILCS 5/21-14) (from Ch. 122, par. 21-14)

Sec. 21-14. Registration and renewal of certificates.

(a) A limited four-year certificate or a certificate issued after July 1, 1955, shall be renewable at its expiration or within 60 days thereafter by the county superintendent of schools having supervision and control over the school where the teacher is teaching upon certified evidence of meeting the requirements for renewal as required by this Act and prescribed by the State Board of Education in consultation with the State Teacher Certification Board. An elementary supervisory certificate shall not be renewed at the end of the first four-year period covered by the certificate unless the holder thereof has filed certified evidence with the State Teacher Certification Board that he has a master's degree or that he has earned 8 semester hours of credit in the field of educational administration and supervision in a recognized institution of higher learning. The holder shall continue to earn 8 semester hours of credit each four-year period until such time as he has earned a master's degree.

All certificates not renewed or registered as herein provided shall lapse after a period of 5 years from the expiration of the last year of registration. Such certificates may be reinstated for a one year period upon payment of all accumulated registration fees. Such reinstated certificates shall only be renewed: (1) by earning 5 semester hours of credit in a recognized institution of higher learning in the field of professional education or in courses related to the holder's contractual teaching duties; or (2) by presenting evidence of holding a valid regular certificate of some other type. Any certificate may be voluntarily surrendered by the certificate holder. A voluntarily surrendered certificate shall be treated as a revoked certificate.

(b) When those teaching **certificates issued before February 15, 2000 are renewed for the first time** after February 15, 2000, all such teaching certificates shall be exchanged for Standard Teaching Certificates as provided in subsection (c) of Section 21-2. All Initial and Standard Teaching Certificates, including those issued to persons who previously held teaching certificates issued before February 15, 2000, shall be renewable under the conditions set forth in this subsection (b).

[ALL NEW SECTION]

Initial Teaching Certificates are nonrenewable and are valid for 4 years of teaching. Standard Teaching Certificates are renewable every 5 years as provided in subsection (c) of Section 21-2 and subsection (c) of this Section. For purposes of this Section, "teaching" is defined as employment and performance of services in an Illinois public or State-operated elementary school, secondary school, or cooperative or joint agreement with a governing body or board of control, in a certificated teaching position, or a charter school operating in compliance with the Charter Schools Law.

(c) In compliance with subsection (c) of Section 21-2 of this Code, which provides that a Standard Teaching Certificate may be renewed by the State Teacher Certification Board based upon proof of continuing professional development, the State Board of Education and the State Teacher Certification Board shall jointly:

(1) establish a procedure for renewing Standard Teaching Certificates, which shall include but not be limited to annual timelines for the renewal process and the components set forth in subsections (d) through (k) of this Section;

(2) establish the standards for certificate renewal;

(3) approve the providers of continuing professional development activities;

(4) determine the maximum credit for each category of continuing professional development activities, based upon recommendations submitted by a continuing professional development activity task force, which shall consist of 6 staff members from the State Board of Education, appointed by the State Superintendent of Education, and 6 teacher representatives, 3 of whom are selected by the Illinois Education Association and 3 of whom are selected by the Illinois Federation of Teachers;

(5) designate the type and amount of documentation required to show that continuing professional development activities have been completed; and

(6) provide, on a timely basis to all Illinois teachers, certificate holders, regional superintendents of schools, school districts, and others with an interest in continuing professional development, information about the standards and requirements established pursuant to this subsection (c).

(d) Any Standard Teaching Certificate held by an individual employed and performing services in an Illinois public or State-operated elementary school, secondary school, or cooperative or joint agreement with a governing body or board of control in a certificated teaching position or a charter school in compliance with the Charter Schools Law must be maintained Valid and Active through certificate renewal activities specified in the certificate renewal procedure established pursuant to subsection (c) of this Section, provided that a holder of a Valid and Active certificate who is only

employed on either a part-time basis or day-to-day basis as a substitute teacher shall pay only the required registration fee to renew his or her certificate and maintain it as Valid and Active. All other Standard Teaching Certificates held may be maintained as Valid and Exempt through the registration process provided for in the certificate renewal procedure established pursuant to subsection (c) of this Section. A Valid and Exempt certificate must be immediately activated, through procedures developed jointly by the State Board of Education and the State Teacher Certification Board, upon the certificate holder becoming employed and performing services in an Illinois public or State-operated elementary school, secondary school, or cooperative or joint agreement with a governing body or board of control in a certificated teaching position or a charter school operating in compliance with the Charter Schools Law. A holder of a Valid and Exempt certificate may activate his or her certificate through procedures provided for in the certificate renewal procedure established pursuant to subsection (c) of this Section.

(e)(1) A Standard Teaching Certificate that has been maintained as Valid and Active for the 5 years of the certificate's validity shall be renewed as Valid and Active upon the certificate holder: (i) completing at least 8 semester hours of coursework as described in subdivision (A) of paragraph (3) of this subsection (e); (ii) earning at least 24 continuing education units as described in subdivision (B) of paragraph (3) of this subsection (e); (iii) completing the National Board for Professional Teaching Standards process as described in subdivision (C) of paragraph (3) of this subsection (e); or (iv) earning 120 continuing professional development units ("CPDU") as described in subdivision (D) of paragraph (3) of this subsection (e). The maximum continuing professional development units for each continuing professional development activity identified in subdivisions (E) through (I) of paragraph (3) of this subsection (e) shall be jointly determined by the State Board of Education and the State Teacher Certification Board. If, however, the certificate holder has maintained the certificate as Valid and Exempt for a portion of the 5-year period of validity, the number of continuing professional development units needed to renew the certificate as Valid and Active shall be proportionately reduced by the amount of time the certificate was Valid and Exempt. Furthermore, if a certificate holder is employed and performs teaching services on a part-time basis for all or a portion of the certificate's 5-year period of validity, the number of continuing professional development units needed to renew the certificate as Valid and Active shall be reduced by 50% for the amount of time the certificate holder has been employed and performed teaching services on a part-time basis. Part-time shall be defined as less than 50% of the school day or school term.

(2) Each Valid and Active Standard Teaching Certificate holder shall develop a certificate renewal plan for satisfying the continuing professional development requirement provided for in subsection (c) of Section 21-2 of this Code. Certificate holders with multiple certificates shall develop a certificate renewal plan that addresses only that certificate or those certificates that are required of his or her certificated teaching position, if the certificate holder is employed and performing services in an Illinois public or State-operated elementary school, secondary school, or cooperative or joint agreement with a governing body or board of control, or that certificate or those certificates most closely related to his or her teaching position, if the certificate holder is employed in a charter school. Except as otherwise provided in this subsection (e), a certificate renewal plan shall include a minimum of 3 individual improvement goals developed by the certificate holder and shall reflect purposes (A), (B), and (C) and may reflect purpose (D) of the following continuing professional development purposes:

(A) Advance both the certificate holder's knowledge and skills as a teacher consistent with the Illinois Professional Teaching Standards and the Illinois Content Area Standards in the certificate holder's areas of certification, endorsement, or teaching assignment in order to keep the certificate holder current in those areas.

(B) Develop the certificate holder's knowledge and skills in areas determined to be critical for all Illinois teachers, as defined by the State Board of Education, known as "State priorities".

(C) Address the knowledge, skills, and goals of the certificate holder's local school improvement plan, if the teacher is employed in an Illinois public or State-operated elementary school, secondary school, or cooperative or joint agreement with a governing body or board of control.

(D) Expand knowledge and skills in an additional teaching field or toward the acquisition of another teaching certificate, endorsement, or relevant education degree.

A certificate renewal plan must include a description of how these goals are to be achieved and an explanation of selected continuing professional development activities to be completed, each of which must meet one or more of the continuing professional development purposes specified in this paragraph (2). The plan shall identify potential activities and include projected timelines for those activities that will assure completion of the plan before the expiration of the 5-year validity of the Standard Teaching Certificate. Except as otherwise provided in this subsection (e), at least 50% of continuing professional development units must relate to purposes (A) and (B) set forth in this paragraph (2): the advancement of a certificate holder's knowledge and skills as a teacher consistent with the Illinois Professional Teaching Standards and the Illinois Content Area Standards in the certificate holder's areas of certification, endorsement, or teaching assignment in order to keep the certificate holder current in those areas and the development of a certificate holder's knowledge and skills in the State priorities that exist at the time the certificate renewal plan is developed.

(3) Continuing professional development **activities included in a certificate renewal plan may include, but are not limited to, the following activities:**

(A) at least 8 semester hours of coursework in an approved education-related program, of which at least 2 semester hours relate to the continuing professional development purpose set forth in purpose (A) of paragraph (2) of this subsection (e), provided that such a plan need not include any other continuing professional development activities nor reflect or contain activities related to the other continuing professional development purposes set forth in paragraph (2) of this subsection (e);

(B) continuing education units that satisfy the continuing professional development purposes set forth in paragraph (2) of this subsection (e), with each continuing education unit equal to 5 clock hours, provided that a plan that includes at least 24 continuing education units (or 120 clock/contact hours) need not include any other continuing professional development activities;

(C) completion of the National Board of Professional Teaching Standards ("NBPTS") process, provided that a plan that includes completion of the NBPTS process need not include any other continuing professional development activities nor reflect or contain activities related to the continuing professional development purposes set forth in paragraph (2) of subsection (e) of this Section;

(D) completion of 120 continuing professional development units that satisfy the continuing professional development purposes set forth in paragraph (2) of this subsection (e) and may include without limitation the activities identified in subdivisions (E) through (I) of this paragraph (3);

(E) collaboration and partnership activities related to improving the teacher's knowledge and skills as a teacher, including the following:

(i) participating on collaborative planningand professional improvement teams and committees;

(ii) peer review and coaching;

(iii) mentoring in a formal mentoring program, including service as a consulting teacher participating in a remediation process formulated under Section 24A-5 of this Code;

(iv) participating in site-based management or decision making teams, relevant committees, boards, or task forces directly related to school improvement plans;

(v) coordinating community resources in schools, if the project is a specific goal of the school improvement plan;

(vi) facilitating parent education programs for a school, school district, or regional office of education directly related to student achievement or school improvement plans;

(vii) participating in business, school, or community partnerships directly related to student achievement or school improvement plans;

(viii) supervising a student teacher or teacher education candidate in clinical supervision, provided that the supervision may only be countedonce during the course of 5 years;

(F) college or university coursework related to ,improving the teacher's knowledge and skills as a teacher as follows:

(i) completing undergraduate or graduate credit earned from a regionally accredited institution in coursework relevant to the certificate area being renewed, provided the coursework meets Illinois Professional Teaching Standards or Illinois Content Area Standards and supports the essential characteristics of quality professional development; or

(ii) teaching college or university courses in areas relevant to the certificate area being renewed, provided that the teaching may only be counted once during the course of 5 years;

(G) conferences, workshops, institutes, seminars, and symposiums related to improving the teacher's knowledge and skills as a teacher, including the following:

(i) completing non-university credit directly related to student achievement, school improvement plans, or State priorities;

(ii) participating in or presenting at workshops, seminars, conferences, institutes, and symposiums;

(iii) training as external reviewers for Quality Assurance;

(iv) training as reviewers of university teacher preparation programs;

(H) other educational experiences related to improving the teacher's knowledge and skills as a teacher, including the following:

(i) participating in action research and inquiry projects;

(ii) observing programs or teaching in schools, related businesses, or industry that is systematic, purposeful, and relevant to certificate renewal;

(iii) traveling related to ones teaching assignment, directly related to student achievement or school improvement plans and approved at least 30 days prior to the travel experience, provided that the traveling shall not include time spent commuting to destinations where the learning experience will occur;

(iv) participating in study groups related to student achievement or school improvement plans; (v) serving on a statewide education-related committee, including but not limited to the State Teacher Certification Board, State Board of Education strategic agenda teams, or the State Advisory Council on Education of Children with Disabilities;

(vi) participate in work/learn programs, internships;or

(I) professional leadership experiences related to improving the teacher's knowledge and skills as a teacher, including the following:

(i) participating in curriculum development or assessment activities at the school, school district, regional office of education, State, or national level;

(ii) participating in team or department leadership in a school or school district;

(iii) participating on external or internal school or school district review teams;

(iv) publishing educational articles, columns, or books relevant to the certificate area being renewed; or

(v) participating in non-strike related professional association or labor organization service or activities related to professional development.

(4) A certificate renewal plan must initially be approved by the certificate holder's local professional development committee, as provided for in subsection (f) of this Section. If the local professional development committee does not approve the certificate renewal plan, the certificate holder may appeal that determination to the regional professional development review committee, as provided for in paragraph (2) of subsection (g) of this Section. If the regional professional development review committee disagrees with the local professional development committee's determination, the certificate renewal plan shall be deemed approved and the certificate holder may begin satisfying the continuing professional development activities set forth in the plan. If the regional professional development review committee agrees with the local professional development committee's determination, the certificate renewal plan shall be deemed disapproved and shall be returned to the certificate holder to develop a revised certificate renewal plan. In all cases, the regional professional development review committee shall immediately notify both the local professional development committee and the certificate holder of its determination.

(5) A certificate holder who wishes to modify the continuing professional development activities or goals in his or her certificate renewal plan must submit the proposed modifications to his or her local professional development committee for approval prior to engaging in the proposed activities. If the local professional development committee does not approve the proposed modification, the certificate holder may appeal that determination to the regional professional development review committee, as set forth in paragraph (4) of this subsection (e). (6) When a certificate holder changes assignments or school districts during the course of completing a certificate renewal plan, the professional development and continuing education credit earned pursuant to the plan shall transfer to the new assignment or school district and count toward the total requirements. This certificate renewal plan must be reviewed by the appropriate local professional development committee and may be modified to reflect the certificate holder's new work assignment or the school improvement plan of the new school district or school building.

(f) Notwithstanding any other provisions of this Code, each school district, charter school, and cooperative or joint agreement with a governing body or board of control that employs certificated staff, shall establish and implement, in conjunction with its exclusive representative, if any, one or more local professional development committees, as set forth in this subsection (f), which shall perform the following functions:

(1) review and approve certificate renewal plans and any modifications made to these plans, including transferred plans;

(2) maintain a file of approved certificate renewal plans;

(3) monitor certificate holders' progress in completing approved certificate renewal plans;

(4) assist in the development of professional development plans based upon needs identified in certificate renewal plans;

(5) determine whether certificate holders have met the requirements of their certificate renewal plans and notify certificate holders of its determination;

(6) provide a certificate holder with the opportunity to address the committee when it has determined that the certificate holder has not met the requirements of his or her certificate renewal plan;

(7) issue and forward recommendations for renewal or nonrenewal of certificate holders' Standard Teaching Certificates to the appropriate regional superintendent of schools, based upon whether certificate holders have met the requirements of their approved certificate renewal plans, with 30-day written notice of its recommendation provided to the certificate holder prior to forwarding the recommendation to the regional superintendent of schools, provided that if the local professional development committee's recommendation is for certificate nonrenewal, the written notice provided to the certificate holder shall include a return receipt; and

(8) reconsider its recommendation of certificate nonrenewal, upon request of the certificate holder within 30 days of receipt of written notification that the local professional development committee will make such a recommendation, and forward to the regional superintendent of schools its recommendation within 30 days of receipt of the certificate holder's request.

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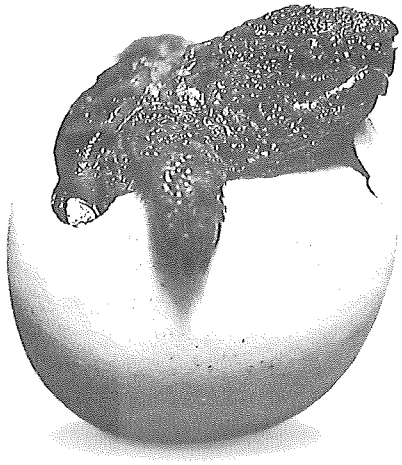

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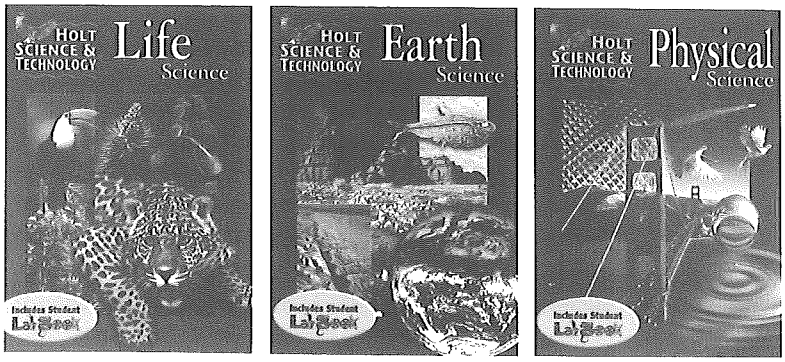

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Each local professional development committee shall consist of at least 3 classroom teachers; one superintendent or chief administrator of the school district, charter school, or cooperative or joint agreement or his or her designee; and one at-large member who shall be either (i) a parent, (ii) a member of the business community, (iii) a community member, or (iv) an administrator, with preference given to an individual chosen from among those persons listed in items (i), (ii), and (iii) in order to secure representation of an interest not already represented on the committee. If mutually agreed upon by the school district, charter school, or governing body or board of control of a cooperative or joint agreement and its exclusive representative, if any, additional members may be added to a local professional development committee, provided that a majority of members are classroom teachers. The school district, charter school, or governing body or board of control of a cooperative or joint agreement and its exclusive representative, if any, shall determine the term of service of the members of a local professional development committee. All individuals selected to serve on local professional development committees must be known to demonstrate the best practices in teaching or their respective field of practice.

The exclusive representative, if any, shall select the classroom teacher members of the local professional development committee. If no exclusive representative exists, then the classroom teacher members of a local professional development committee shall be selected by the classroom teachers that come within the local professional development committee's authority. The school district, charter school, or governing body or board of control of a cooperative or joint agreement shall select the 2 non-classroom teacher members (the superintendent or chief administrator of the school district, charter school, or cooperative or joint agreement or his or her designee and the at-large member) of a local professional development committee. Vacancies in positions on a local professional development committee shall be filled in the same manner as the original selections. The members of a local professional development committee shall select a chairperson. Local professional development committee meetings shall be scheduled so as not to interfere with committee members' regularly scheduled teaching duties, except when otherwise permitted by the policies of or agreed to or approved by the school district, charter school, or governing body or board of control of a cooperative or joint agreement, or its designee.

The board of education or governing board shall convene the first meeting of the local professional development committee. All actions taken by the local professional development committee shall require that a majority of committee members be present, and no committee action may be taken unless 50% or more of those present are teacher members.

The State Board of Education and the State Teache Certification Board shall jointly provide local professional development committee members with a training manual, and the members shall certify that they have received and read the manual.

Notwithstanding any other provisions of this subsection (f), for a teacher emplyed and preforming services in a nonpublic or State-operated elementary of secondary school, all references to a local professional development committee shall mean the regional superintendent of schools of the regional office of education for the geographic area where the teaching is done.

(g)(1) Each regional superintendent of schools shall review and concur or nonconcur with each recommendation for renewal or nonrenewal of a Standard Teaching Certificate he or she receives from a local professional development committee or, if a certificate holder appeals the recommendation to the regional professional development review committee, the recommendation for renewal or nonrenewal he or she receives from a regional professional development review committee and, within 14 days of receipt of the recommendation, shall provide the State Teacher Certification Board with verification of the following, if applicable:

(A) a certificate renewal plan was filed and approved by the appropriate local professional development committee;

(B) the professional development and continuing education activities set forth in the approved certificate renewal plan have been satisfactorily completed;

(C) the local professional development committee has recommended the renewal of the certificate holder's Standard Teaching Certificate and forwarded the recommendation, along with all supporting documentation as jointly required by the State Board of Education and the State Teacher Certification Board, to the regional superintendent of schools;

(D) the certificate holder has appealed his or her local professional development committee's recommendation of nonrenewal to the regional professional development review committee and the result of that appeal;

(E) the regional superintendent of schools has concurred or nonconcurred with the local professional development committee's or regional professional development review committee's recommendation to renew or nonrenew the certificate holder's Standard Teaching Certificate and made a recommendation to that effect; and

(F) the established registration fee for the Standard Teaching Certificate has been paid. At the same time the regional superintendent of schools provides the State Teacher Certification Board with the notice required by this subsection (g), he or she shall also notify the certificate holder in writing that this notice has been provided to the State Teacher Certification Board, provided that if the notice provided by the regional superintendent of schools to the State Teacher Certification Board includes a recommendation of certificate nonrenewal, the written notice provided to the certificate holder shall be by certified mail, return receipt requested.

(2) Each certificate holder shall have the right to appeal his or her local professional development committee's recommendation of nonrenewal to the regional professional development review committee, within 14 days of receipt of notice that the recommendation has been sent to the regional superintendent of schools. Each regional superintendent of schools shall establish a regional professional development review committee or committees for the purpose of advising the regional superintendent of schools, upon request, and handling certificate holder appeals. This committee shall consist of at least 4 classroom teachers, one non-administrative certificated educational employee, 2 administrators, and one at-large member who shall be either (i) a parent, (ii) a member of the business community, (iii) a community member, or (iv) an administrator, with preference given to an individual chosen from among those persons listed in items (i), (ii), and (iii) in order to secure representation of an interest not already represented on the committee. The teacher and non-administrative certificated educational employee members of the review committee shall be selected by their exclusive representative, if any, and the administrators and at-large member shall be selected by the regional superintendent of schools. A regional superintendent of schools may add additional members to the committee, provided that the same proportion of teachers to administrators and at-large members on the committee is maintained. Any additional teacher and non-administrative certificated educational employee members shall be selected by their exclusive representative, if any. Vacancies in positions on a regional professional development review committee shall be filled in the same manner as the original selections. Committee members shall serve staggered 3-year terms. All individuals selected to serve on regional professional development review committees must be known to demonstrate the best practices in teaching or their respective field of practice.

The exclusive representative responsible for choosing the individuals that serve on a regional professional development review committee shall notify each school district, charter school, or governing body or board of control of a cooperative or joint agreement employing the individuals chosen to serve and provide their names to the appropriate regional superintendent of schools. Regional professional development review committee meetings shall be scheduled so as not to interfere with the committee members' regularly scheduled teaching duties, except when otherwise permitted by the policies of or agreed to or approved by

the school district, charter school, or governing body or board of control of a cooperative or joint agreement, or its designee, provided that the school district, charter school, or governing body or board of control shall not unreasonably withhold permission for a committee member to attend regional professional development review committee meetings.

In a city having a population exceeding 500,000 that does not have a regional office of education, one or more separate regional professional development review committees shall be established as mutually agreed upon by the board of education of the school district organized under Article 34 of this Code and the exclusive representative. The composition of each committee shall be the same as for a regional professional development review committee, except that members of the committee shall be jointly appointed by the board of education and the exclusive representative. All other provisions of this Section concerning regional professional development review committees shall apply to these committees. The regional professional development review committee may require information in addition to that received from a certificate holder's local professional development committee or request that the certificate holder appear before it, shall either concur or nonconcur with a local professional development committee's recommendation of nonrenewal, and shall forward to the regional superintendent of schools its recommendation of renewal or nonrenewal. All actions taken by the regional professional development review committee shall require a quorum and be by a simple majority of those present and voting. A record of all votes shall be maintained. The committee shall have 45 days from receipt of a certificate holder's appeal to make its recommendation to the regional superintendent of schools. The State Board of Education and the State Teacher Certification Board shall jointly provide regional professional development review committee members with a training manual, and the members shall be required to attend one training seminar sponsored jointly by the State Board of Education and the State Teacher Certification Board.

(h)(1) The State Teacher Certification Board shall review the regional superintendent of schools' recommendations to renew or nonrenew Standard Teaching Certificates and notify certificate holders in writing whether their certificates have been renewed or nonrenewed within 90 days of receipt of the recommendations, unless a certificate holder has appealed a regional superintendent of schools' recommendation of nonrenewal, as provided in paragraph (2) of this subsection (h). The State Teacher Certification Board shall verify that the certificate holder has met the renewal criteria set forth in paragraph (1) of subsection (g) of this Section.

(2) Each certificate holder shall have the right to appeal a regional superintendent of school's recommendation to nonrenew his or her Standard Teaching Certificate to the State Teacher Certification Board, within 14 days of receipt of notice that the decision has been sent to the State Teacher Certification Board, which shall hold an appeal hearing within 60 days of receipt of the appeal. When such an appeal is taken, the certificate holder's Standard Teaching Certificate shall continue to be valid until the appeal is finally determined. The State Teacher Certification Board shall review the regional superintendent of school's recommendation, the regional professional development review committee's recommendation, if any, and the local professional development committee's recommendation and all relevant documentation to verify whether the certificate holder has met the renewal criteria set forth in paragraph (1) of subsection (g) of this Section. The State Teacher Certification Board may request that the certificate holder appear before it. All actions taken by the State Teacher Certification Board shall require a quorum and be by a simple

majority of those present and voting. A record of all votes shall be maintained. The State Teacher Certification Board shall notify the certificate holder in writing, within 7 days of completing the review, whether his or her Standard Teaching Certificate has been renewed or nonrenewed, provided that if the State Teacher Certification Board determines to nonrenew a certificate, the written notice provided to the certificate holder shall be by certified mail, return receipt requested. All certificate renewal or nonrenewal decisions of the State Teacher Certification Board are final and subject to administrative review, as set forth in Section 21-24 of this Code.

(i) Holders of Master Teaching Certificates shall meet the same requirements and follow the same procedures as holders of Standard Teaching Certificates, except that their renewal cycle shall be as set forth in subsection (d) of Section 21-2 of this Code.

(j) Holders of Valid and Exempt Standard and Master Teaching Certificates who are not employed and performing services in an Illinois public or State-operated elementary school, secondary school, or cooperative or joint agreement with a governing body or board of control, in a certificated teaching position, may voluntarily activate their certificates by developing and submitting a certificate renewal plan to the regional superintendent of schools of the regional office of education for the geographic area where their teaching is done, who, or whose designee, shall approve the plan and serve as the certificate holder's local professional development committee. These certificate holders shall follow the same renewal criteria and procedures as all other Standard and Master Teaching Certificate holders, except that their continuing professional development plans shall not be required to reflect or address the knowledge, skills, and goals of a local school improvement plan.

(k) Each school district, charter school, or cooperative or joint agreement shall be paid an annual amount of not less than $1,000, as determined by a formula based on the number of Standard Teaching and Master Teaching Certificate holders, subject to renewal and established by rule, not to exceed $1,000,000 annually for all school districts, charter schools, and cooperatives or joint agreements, for administrative costs associated with conducting the meetings of the local professional development committee. Each regional office of education shall receive $2,000 annually to pay school districts, charter schools, or cooperatives or joint agreements for costs, as defined by rule, incurred in staff attendance at regional professional development review committee meetings and the training seminar required under paragraph (2) of subsection (g) of this Section. (l) The State Board of Education and the State Teacher Certification Board shall jointly contract with an independent party to conduct a comprehensive evaluation of the certificate renewal system pursuant to this Section. The first report of this evaluation shall be presented to the General Assembly on January 1, 2005 and on January 1 of every third year thereafter. (Source: P.A. 90-548, eff. 1-1-98; 90-653, eff. 7-29-98; 90-811, eff. 1-26-99.)

EDITORIAL

LETTER FROM THE EDITOR SPRING/SUMMER 2000

For the last two years (actually, for a while longer than that), colleagues in science education across the state have been meeting to develop and draft state standards for science teacher preparation. By the time this is published, some of you will be fully aware of the existence of these standards, and some of you will have some knowledge of what they contain. For the rest, you should be cognizant of the fact that the standards went out for final review in late January, followed by public hearings in March, and the final versions probably coming out sometime later this year. Many of you may react, "Yet another set of standards?!" and turn away. This would be unfortunate since these new standards will directly impact what you deal with in future professional development as well as what newly-graduated science teachers will face before and after they enter our ranks.

The development process followed was among the better ones emerging from ISBE in quite some time. As professionals, you should have some idea about what the process entailed and what its results were. Many individuals representing a broad base of expertise were involved as working groups in the whole endeavor. The working groups were comprised of classroom teachers, university faculty, educators from educational entities and from the Illinois State Board of Education. One group met to work on standards for elementary science teacher preparation while a separate group worked on those for secondary levels (middle school/junior high and high school). A third group worked on assessment standards. Ideally, each set of standards will parallel one another to some extent. Similar work has progressed for the other content areas over the same time period.

The task was daunting. Many significant documents were considered during the development of these standards. Professional teacher standards from other states were examined, as were certification standards promulgated by NSTA and NCATE (the National Council for Accreditation of Teacher Education). Certification and Accreditation in Science Education (CASE) materials were considered, as were NTASC standards and Illinois Learning Standards. Professional development and education sections of the National Science Education Standards and the American Association for the Advancement of Science's Project 2061 were called upon from time to time as well.

From this set of resources, members of the working groups culled and debated and drafted, then redrafted, and re-debated and again redrafted standards for science teacher preparation. Groups and individuals external to the working groups were provided opportunities to review the drafts and offer input and suggestions for clarifications or to point out redundancies or omissions. The work was at times arduous, and the hours dedicated to completion of the task by everyone involved are uncountable. In the end, the set of standards which emerged were closely aligned with the Illinois Learning Standards, the Illinois Applications of Learning, Illinois Professional Teaching Standards, National Science Education Standards, and the NSTA and CASE standards for certification and accreditation. For each standard, there were written descriptors detailing the indicators of KNOWLEDGE which competent science teachers should know, followed by indicators of PERFORMANCE which competent science teachers should exhibit.

The secondary science teaching standards are lengthier than are the elementary standards simply because there was a greater need to address specific science content areas. As a consequence, the final version of the secondary science standards produced by the working groups contained eighteen general standards applicable to all sciences, followed by specific standards for each subdiscipline (biology, chemistry, earth and space sciences, environmental science, and physics). There was a strong consensus on the secondary working group that the ideal is for all teachers to have one strong preparation across the field of science, even if there is a specialization in one field. The rationale was that teachers needed to have some expertise in all of the sciences, not just a single one. This is particularly applicable as movement toward more integrated science occurs. The end result has been the evolution of a document detailing science teacher preparation standards of which we could be proud.

Now for the rest of the story. Hopefully, you now have a better understanding of what went in to the development of these new standards. Knowing these things will help you put into perspective what occurred next.

After all the working groups had completed their work, after all the groups had reviewed the final drafts of the standards and the documents were given over to ISBE for last refinements, after all the time and effort devoted to the development of these standards, the ISBE issued a final version in February which contained -- buried at the end of the general science teacher standards as "Standard 19" -- an entirely new standard on reading. That's right. Reading. Someone at ISBE decided that reading was important to everyone, and so they copied a standard ver batim from the Reading Content standards and implanted it within the science standards. The exact same reading standard suddenly appeared in the mathematics, social studies, and health education standards as well. Some of us who had worked on the standards discovered this inclusion and objected, but to no avail (at least, not as of yet).

I think most science educators would agree that reading is a fundamental and important tool for learning in any subject area. Further, science educators should all be knowledgeable that there are really two kinds of reading found in science: expository (or technical) and narrative (popular) reading, and students need to have skills reading both to be successful in science reading. Many of our students are woefully ill-prepared to deal with expository science texts, yet much of their information is provided from those very types of materials. As a consequence, it behooves science teachers to help students learn how to read such text and understand it. If the reading standard had limited itself to this aspect of reading, all would have been well and good. However, the reading standard went well beyond that and included criteria that the science teacher should "understand adolescent literacy and the home and school experiences that support it;" "understands the role of motivation and interest in subject area reading;" "knows that oral reading fluency requires accuracy, speed, and expression and understands its role in reading development;" and more.

One could obviously argue that reading skills are necessary in all subject areas, and that each content area's standards should therefore include something about reading. Similarly, one could argue that virtually any subject area could be dealt with in any other subject area, and thus require each subject area's standards to include standards from the others. Such an approach would be unwieldy at best. As a consequence, the standards were originally developed around subject areas with little integration (or bleeding of one into another).

Perhaps most troubling about the appearance of the reading standard in the science standards is the way in which it occurred. Never was such a standard suggested to any of the working groups. No such standard was ever debated or rewritten or modified to be suitable to science. The whole affair was a classic "back door" maneuver which perpetrated a fraud on the entire process. Some of us can just imagine how science teachers will react when they suddenly discover they must have expertise in teaching reading, too. The effect may likely be one casting a needlessly negative light on the veracity of the entire set of standards.

Despite this, I believe each member of each working group would encourage you to read the standards, to become familiar with them, and to try to work with them. We believe the ones focusing on science are exceptionally sound and on target. Overall, the package as a whole is a good one. Hopefully, it will help us continue to improve science education in Illinois.

Kevin

MINI IDEAS

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1999 Presidential Award for
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SPACE HISTORY AND ROCKETRY A FUN-FILLED COMBINATION

Teaching students about the history of the space program and the development of the rocket is very exciting. Students complete research in teams and teach their fellow classmates about specific areas of the United States' place in the history of space exploration. I divide the class into teams of six students. Each student on the team will research a different area of space history. The six areas I use cover most of the important aspects of the United States' involvement. The development of the rocket and the space race are combined for one area. The Mercury, Gemini, and Apollo Programs are three more areas. Skylab and Apollo/Soyuz are combined for the fifth area of study. The Space Shuttle is the final category.

All students in the class who are researching the same topic take notes together. There are many excellent web sites for Internet research. Encyclopedias, non-fiction books, and periodicals also are excellent sources of information. Each group presents their information to the class. After all the presentations, the original teams work together to make sure everyone on their team understands the sequence of events from Robert Goddard's rocket research in the 1920's to Wernher von Braun's Saturn V rocket that took the United States to the moon. They continue on to the Apollo/Soyuz program when the United States and Russia cooperated and started friendlier relations. Skylab shows the students how groups lived in space for extended periods of time. Finally, the pupils learn about our reusable space shuttle.

The teams create a brochure for a fictitious exhibit at the Smithsonian Museum including a summary of each area of the space history. This unit is definitely a favorite with my students. After learning about rockets used in the space program, the students build their own rockets and launch them in the spring.

WEB SITES FOR SPACE HISTORY

http://www.yahoo.com/Science/Space/Spacecraft/

http://www.yahoo.com/Science/Space/Missions/Lunar_Missions_and_Information/Apollo_Project/

http://www.yahoo.com/Science/Space/Astronauts/

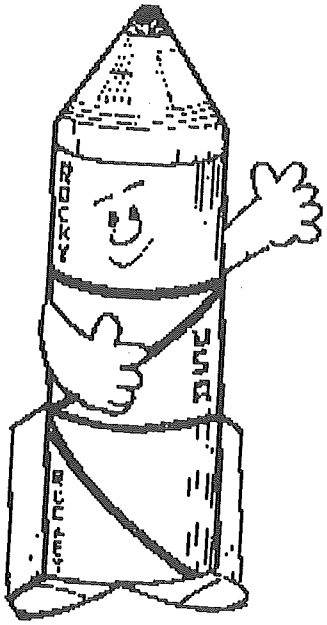
http://www.yahoo.com/Science/Space/Missions/

http://www.star.le.ac.uk/edu/index.html

http://ae-www.usc.edu/bio/mikeg/spacecra/spaccrft.html

http://spacelink.nasa.gov/Spacelink.Cool.Picks/.index.html

http://www.yahoo.com/Science/Space/Spacecraft/Space_Shuttle/



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MITOSIS/MEIOSIS SOCKS

I use models for investigative purposes whenever I can in my Biology and Genetics classes. Students seem to be able to better understand concepts when they can manipulate with their hands. One of the best models I use is this one for showing the movement of chromosomes through mitosis and meiosis. I like this model because it can be adapted to be used at the skills level in Biology as successfully as I have used it at the junior/senior level of an elective Genetics/Biotechnology class I teach. I have also used this model with prospective science teachers in a college methods course. No one seems too young or too old to benefit from this model and so I share it with you. I wish to give credit for the original idea to Claudya Lum, who planted the seed for this model at an ISTA convention in 1997. Her original model centered on the cell and its contents and I have focused only on the chromosomes and their movement through mitosis and meiosis. I have had seniors say that they only really learned nuclear cell division when I brought out those socks. Besides being a lot of fun and allowing the whole class to participate, we get to sit on the floor and interact with the chromosomes. The best part of it all is that this is a student-centered way to approach mitosis and meiosis and I never plan on lecturing on mitosis and meiosis again.

Figure 1

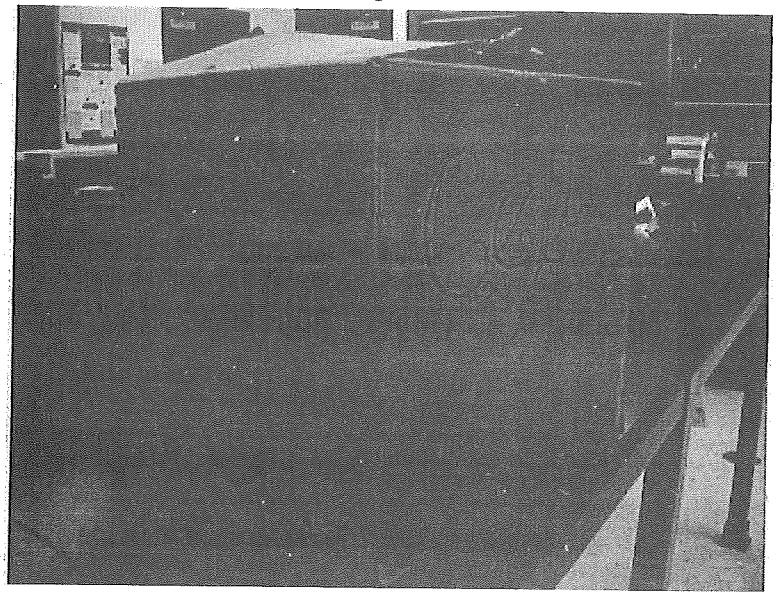
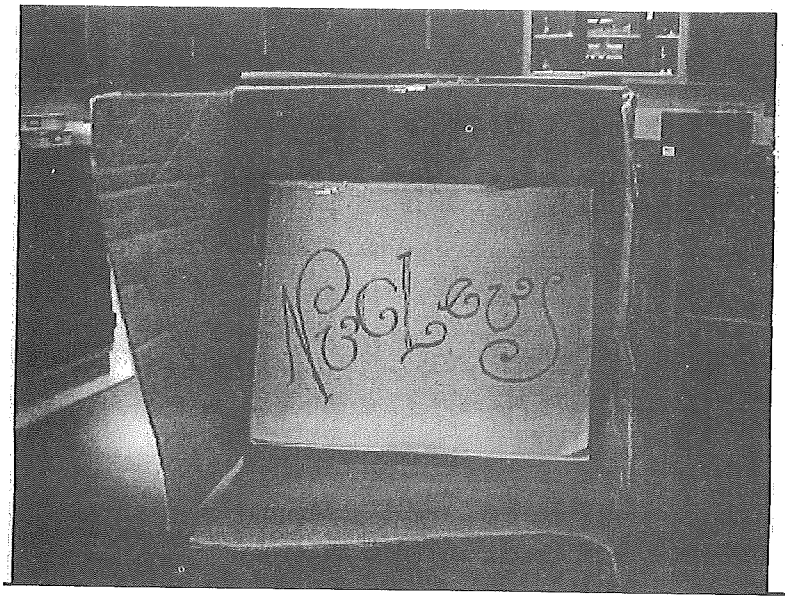


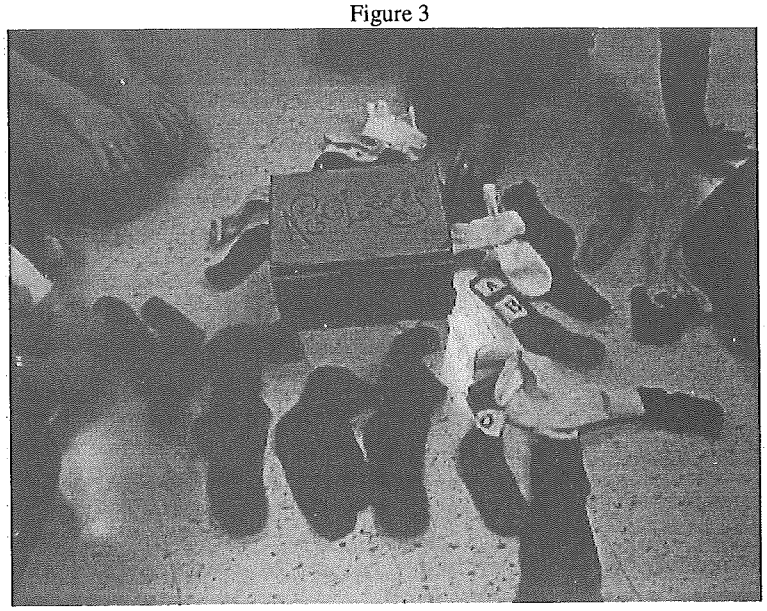
Figure 2



To use this model you will need:
One large box (cell) (See Figure 1)
One smaller box (nucleus) (See Figures 2 &3)
Two sets of 22 pairs of the most colorful of children's socks in different sizes (maternal and paternal autosomes with sister chromatids) (watch for a sale at a local budget department store or offer extra credit for students to bring in socks till you have the sets you need)
Two identical pairs of tiny pink socks (X chromosomes with sister chromatids)
One pair of tiny blue socks (Y chromosome and sister chromatid)
List of important terms mounted on cardboard and cut up
Cut out alleles: AAAA, aaaa, BBBB, bbbb, CCCC, cccc, DDDD, dddd
Optional: nucleotide sequence on a string to represent the coding of an allele
String to represent centromeres
Tape or Velcro attachments for the alleles

When I first used this model, I did not have a decorated box, used tape to attach the alleles and had a nucleotide sequence printed on paper with string. Over the years I would ask the students for suggestions on how the model could be improved. The list of important terms, the decorated boxes and the embroidered letters and Velcro were all suggested, designed and made by my students. Some students really got into this model and wanted to take the model home and improve it for me. So after we were done with the unit, I would let them take it home and embellish it with their ideas. I had one student very interested in sewing who insisted on the embroidery and Velcro. Today I would say I have the "deluxe" model thanks to my students.

Figure 3

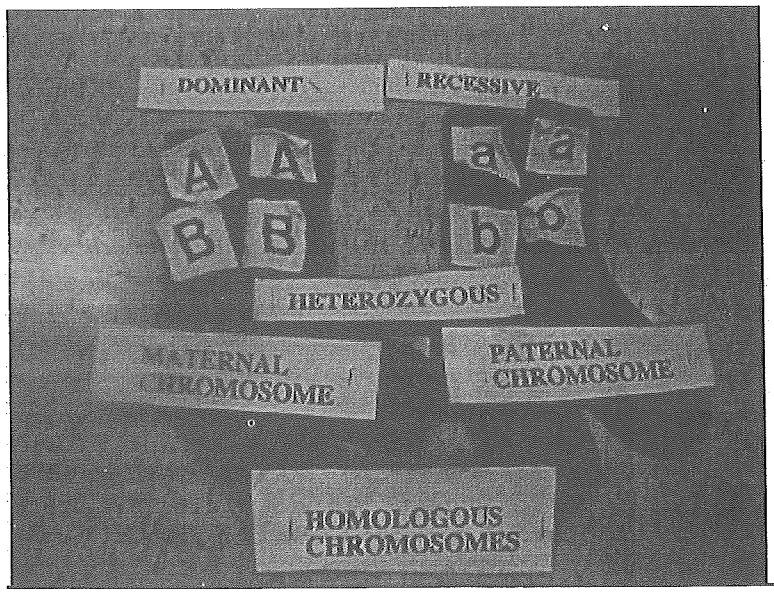


MITOSIS ACTIVITY:

DAY 1: You might find the first few times you go through this activity, it will take you two days. If need be it is worth the extra day to get the concepts across. I use this activity as an inquiry introduction to mitosis and through manipulation of the socks, the students see how the chromosomes must duplicate and move in order to maintain the same amount of genetic material from generation to generation.

Set-up: 1. Choose to work with a female cell first.
2. On one half of a pair put a capital A and B and on the other half of the pair put a lower case a and b to represent the two different alleles on the paternal and maternal chromosomes. Do the same with the Cc and Dd pair. Also insert the nucleotide sequence representing the genes into these socks.
3. Put 45 autosomes and one X chromosome inside the box marked nucleus.
4. Put the complementary set of 45 autosomes and X chromosome in a bag. (This will be the duplicated sister chromatids to be added at the appropriate time.)

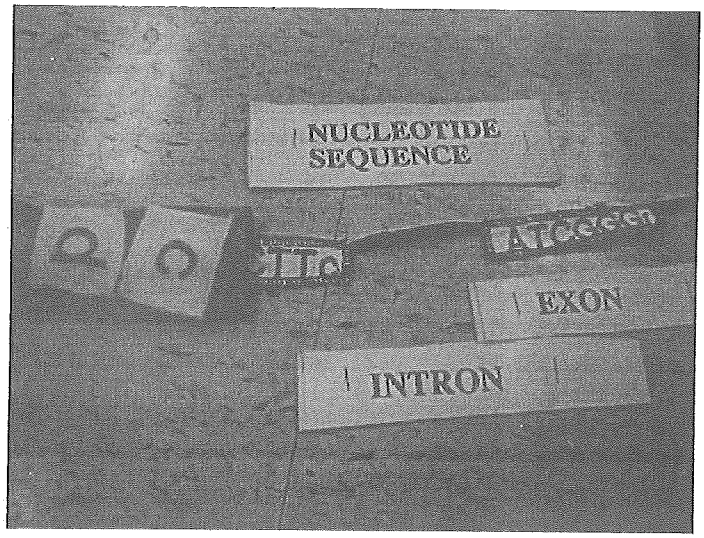
Figure 4



5. Put the nucleus box into the cell box.
6. Group the terms for yourself so that you can place the words on the socks at the appropriate times.
7. Move class into a large circle on the floor. Perhaps you can move the desks or go out into the hallway.

Begin with:
"What do I have here?" (a cell)
"What would you expect to be inside? (nucleus, organelles, etc.)
Have a student open the box and pull out the nucleus.
"What would you expect to be inside the nucleus? (chromosomes, chromatin, genetic material etc.)
Have a student open the nucleus and dump the contents.
"What do you think the socks represent?" (chromosomes, chromatin)
"Are they chromosomes or chromatin?" (chromosomes) Have students explain why. (condensed)
"Make some observations about the socks." (sizes, colors, shapes, number, sex of cell, some have letters on them.)
"Can you group the socks in any way?" (size, pairs)
"What organism do you know that has 46 chromosomes?" (human)
"Why do the socks (chromosomes) come in pairs?" (*paternal, maternal chromosomes, homologous pairs) Note: Especially take time with the idea of homologous pairs. Use the socks with the alleles to show same gene loci but different alleles.* Pull out the nucleotide sequence inside these socks and relate it to genes. You can even go into exon and intron for higher level classes. (See Figures 4 & 5)
"Where do the maternal and paternal chromosomes originally come from?" (sperm and egg, *gametes*)
"After a sperm fertilizes an egg, what must happen to that original cell called the zygote?" (It must grow, divide.)
"Is this cell ready to divide?" (Yes or no.) (If the students say "yes", let them determine how the nucleus will divide the genetic material. They can manipulate the socks and will soon realize the genetic material needs to be duplicated to conserve the number of chromosomes. Stress the importance of two identical daughter cells by conserving chromosome number.)

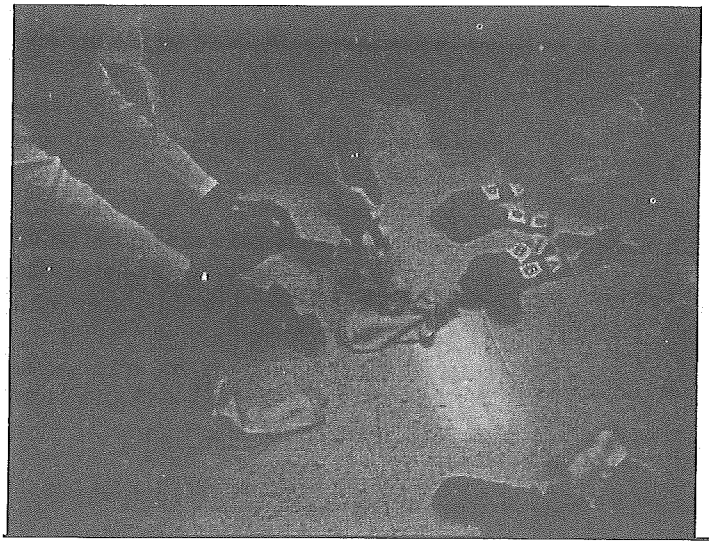
Figure 5



When students determine the genetic material needs to duplicate, then "duplicate". Dump the bag with the complementary set of socks on the floor and have all the students help to find each socks complementary pair.

"How would the original and duplicated chromosomes be joined? (*centromere,* for advanced include *metacentric submetacentric, etc.)* Here you can use string or just have students fold over the top end of the socks. You will find this image of the joined socks will be important when you study meiosis later and in which stage the centromeres split in both mitosis and meiosis. Make sure the socks with the alleles of ABab and CDcd have been duplicated correctly.
"When in the cell's cycle do chromosomes duplicate?" (*interphase,* advanced: *S phase of cell cycle)*
Ask for volunteers to pattern the socks through a division into two identical daughter cells. (See Figures 6 & 7). Let students have input on this. Errors in patterning help students to sort out the right sequence. After someone has shown the correct sequence, start using the words *prophase, metaphase, anaphase and telophase.* Make sure they count 46 chromosomes in each cell at the end. You can divide the students into smaller groups and have them use a smaller number of socks to work through the stages. At the end of the class have students help put the socks back into the nucleus and duplication bag to be set up for next class.

Figure 6



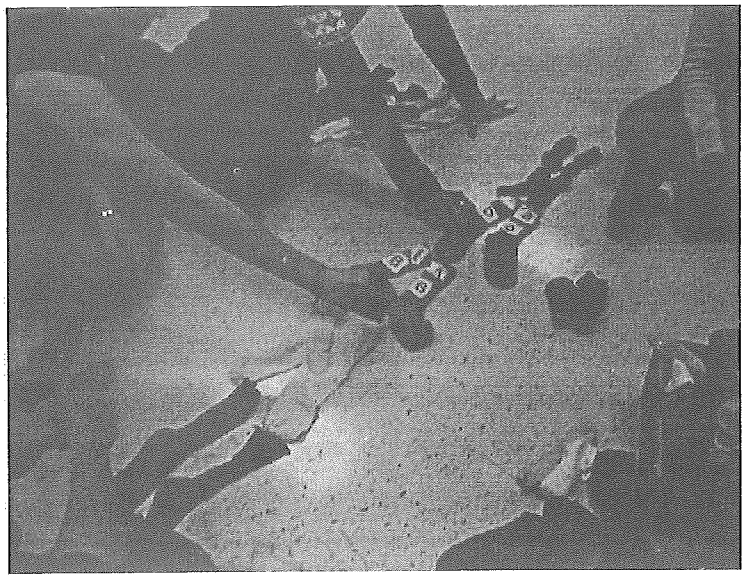
Day 2
Get into the circle again. Bring out the cell, pass out the terms to the students and have student volunteers walk through mitosis with the socks, labeling as many terms as they can. Give a twist to the new cell and make it a male cell replacing one X chromosome for a Y chromosome.

Post-assessment:
Taking two or three homologous chromosomes and starting with prophase, have students draw a cell going through mitosis, labeling the stages.

MEIOSIS ACTIVITY

1 or 2 days
Begin with "Where did the homologous chromosomes in mitosis come from?" (sperm and egg)
"What might our next question be?" (How does an organism make sperm or egg cells.) Here you might want to introduce the terms spermatogenesis and oogenesis.
"List some things we might want to consider about the sperm and egg cell in terms of their nuclear material." (Half the number of chromosomes, *haploid vs. diploid cells.)*
Start with a diploid cell that has just finished telophase. (Single stranded, 46 chromsomes, use male cell with X and Y.)
Let students hypothesize the movement of the chromosomes. Let them realize that duplication must also occur before meiosis can occur. Again, errors lead to finding the correct sequence. Let them follow through on all suggested patterning.
The goal: to have cells with only 23 chromosomes. Eventually they will find the following:
1. Duplication must occur. Dump the bag and let students duplicate.
2. Homologous pairs line up in metaphase I.
3. Homologs separate at anaphase I resulting in reduction division. (This must be verified by counting chromosomes at the end of this division.)
4. Sister chromatids separate at anaphase II.
5. The end result is 4 gametes.
6. The gametes at the end are sperm and they are not identical and also depending on which sperm fertilizes the egg, sex of the individual is determined.

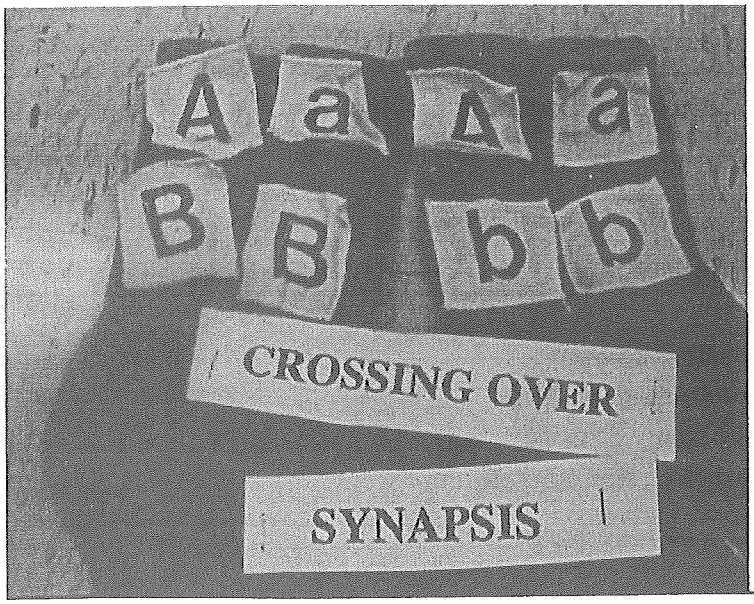
Figure 7



At this point ***variation*** is introduced in sexual reproduction. You will want to then go back to prophase I and show the ***tetrad***, crossing over at ***synapsis*** and using the socks with the AB,ab,CD,cd alleles further variation will occur. (See Figure 8). This leads to a whole realm of discussion on variation if you let the alleles represent different features like hair or eye color or attached earlobes or bushy eyebrows or whatever. Make sure you stress you are oversimplifiying allele expression, however.

Introduce ***independent assortment*** of homologs and ***separation of alleles*** to add to the variation along with ***fertilization*** and ***random mating.*** The students see the impact of possibilities during sexual reproduction.

Figure 8



7. Repeat the activity with a female cell. Introduce polar bodies and result of only one functional ovum. (*For advanced classes:* add the stage of arrest of female oocytes at birth in prophase I and in metaphase II at ovulation in puberty. Mention that females produce only about 400 ovum in their lifetime with the only ones finishing meiosis being those that are fertilized –very different than spermatogenesis.)

Here is a list of the terms I have mounted on cardboard:

Homologous chromosomes	Prophase I
Paternal chromosome	Metaphase I
Maternal chromosome	Anaphase I
Segregation of alleles	Telophase I
Nucleotide sequence	Prophase II
Gene	Metaphase II
Intron	Anaphase II
Exon	Telophase II
Ovum	Interkinesis
Sperm	Prophase
Diploid	Metaphase
Haploid	Anaphase
Reduction division	Telophase
Equational division	Meiosis I
Independent assortment	Meiosis II
Dominant	Mitosis
Recessive	Interphase
Homozygous	A A A A
Heterozygous	B B B B
Gamete	C C C C
Sex cell	D D D D
Germ cell	a a a a
Alleles	b b b b
Tetrad	c c c c
Synapsis	d d d d
Crossing over	

You might also want to print out a nucleotide sequence of A,C, G,T to represent the alleles AaBbCcDd.

Post-Assessment: Using three homologous pairs, diagram meiosis labelling the various stages.

Call for Papers

The March 2001 issue of *Science Scope* will be dedicated to opportunities for teachers to reenergize, revitalize, and recommit themselves to science education.

How do you stay on ***the cutting edge*** of science education? What ***opportunities*** are available that teachers should know about? What ***funding*** is available for enrichment opportunities? What ***groups/programs*** are you involved with? How do you ***obtain funding***? What support is available from your ***school, community, and state***? What does your department do to facilitate ***networking and training***? What ***listserves/ websites*** are your favorites? If a teacher could only ***take advantage of one opportunity*** this year, what would you recommend? Take some time this summer to share your definition of

"The Dynamic Teacher."

Suitable topics include but are not limited to

- National Board Certification
- University Programs
- Mentoring
- Grants
- Awards/Competitions
- Professional Organizations
- Workshops
- Conventions
- Grants
- Corporate Outreach Programs
- Networking
- Support Systems

Manuscripts must be received by **October 1, 2001,** to be considered for the Special Issue. Send three copies of your manuscript (along with one set of photos, illustrations, or other graphics) to

Pat Warren
Special Issue 2001
37 Pine Street
Freeport, ME 04032

Brian Poelker
Midwest Central Middle School
Green Valley, IL 61534
bpoelker@ntslink.net

Mark Renz
Fossil Expeditions / Everglades Eco-Tours
213 LIncoln Avenue
Lehigh Acres, FL 33972
1-800-304-9432
http://www.fossilexpeditions.com

FOSSIL HUNTING IN FLORIDA

Over Christmas Breaks my wife and I often go to Florida to visit relatives. There are many wonderful science related destinations in the state, but I found a new one on a sunny Sunday afternoon. Earlier in the week, I read an advertisement in the Arcadia, FL Newspaper, "Guided Fossil Hunting in Florida's Peace River." I called Mark Renz, the tour guide. He usually takes groups out and wasn't planning on going out on Sunday. However, since a science teacher was calling, he decided an afternoon would work well for both of us. It would give him a chance to hunt as well.

Mark is an active amateur paleontologist, having discovered and donated Cenozoic fossils to the Florida Museum of Natural History, and was beginning his business as a field guide. We met at the local McDonald's and began our journey to the Peace River.

Wintertime and spring in Florida is the dry season, the rivers are low and fossil hunting is prime time. The river has the color of weak tea, from the tannins of the tree lined banks. We drove past Wachula and put the canoe in at a convenient boat ramp. A short distance upstream we met a couple of fossil hunters. Asked if they found anything interesting, they produced a perfect gem spear point found within the hour. I knew it was going to be an interesting day.

Boat on the Peace River in Central Florida

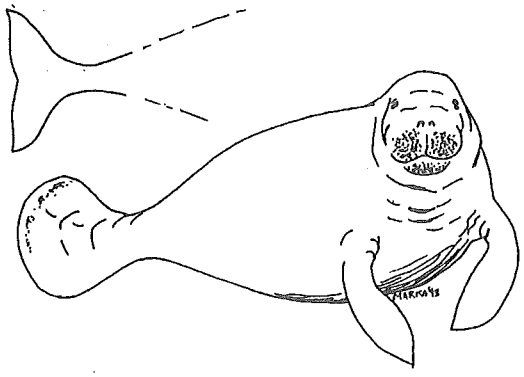
Screening for fossils in a shallow creek.

We went a few miles upstream to a location Mark had noted on previous expeditions but had not explored in detail. Mark looks for deep spots in the river bed. Fossils erode out of the bank during the high water of the winter rains. They travel with the current downstream and are deposited on the river bottom. The heavier fossils often collect in the deeper spots in the river.

Mark brought his SCUBA gear to search this new spot. He was hoping to find more of the mammoth fossils that he collected upstream on a previous trip. I waded in waist deep water with a shovel and floating screen. Each shovel bought up the possibility of treasure. The fossils are easy to pick out. The tannins that color the water stain the fossils. They are a beautiful jet black. We hunted all afternoon, Mark didn't get his mastodon but I came away with a large boxfull of a great variety of Cenozoic fossils for classroom use.

Teeth are among the most common fossils encountered because of the hardness of the enamel. Fossils were collected included the teeth of seven species of sharks; Tiger, Lemon, Dusky, Mako, Giant White, Snaggletooth, and Sand. We also found Mastodon and Mammoth tooth fragments, as well as equus (horse) teeth and Eagle Ray teeth. Among the other fossils found were scutes of turtle and a giant ground tortoise.

We also located pieces of armor from the Giant Armadillo. These weren't the armadillos that we see in the American Southwest. These extinct giants were the size of a Ford Escort! Also uncovered was a whale ear bone, a jaw section from a long beak dolphin and an equus toe bone. Many large pieces of dugong (sea cow) ribs were found. The dugong is an extinct ancestor of the Manatee. A highlight of the afternoon were shovels that uncovered mammoth bone fragments. One was a section of skull and the other was a piece of the kneecap. All of the fossil organisms found on our trip have been superbly documented in Mark's book, "Fossiling in Florida" (see resources below).

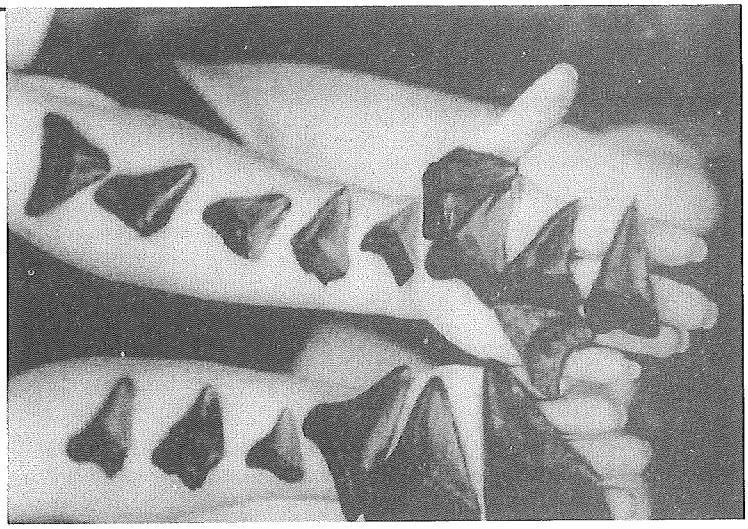


Comparison of dugong (top) and manatee (bottom) tail.

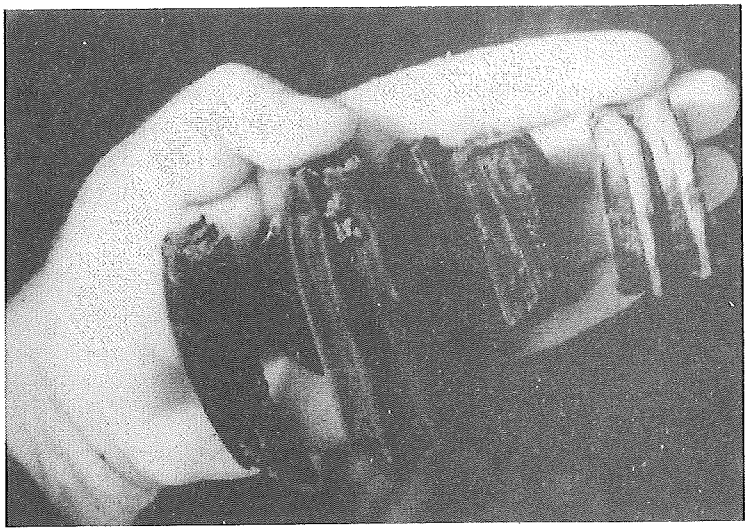
Mark has uncovered many bones of exceptional quality and importance to the paleontolgical record in Florida. The photo far right shows Mark on a very successful hunt holding two claws from the giant ground sloth. These were found in a DeSoto County, Florida creekbed. Eremotheriums arrived in Florida during the Pleistocene (1.8 million to 10,000 years ago). The giant ground sloth grew to 20 feet from head to tail. It probably weighed about 5 tons! With its long arms it could reach another 7 feet to pull down the branches of trees to eat the tender vegetation. Giant ground sloths were also a Pleistocene inhabitant of Illinois.

Ten million years ago camels and horses once roamed North America. They became extinct at the end of the last ice age, about 10,000 years ago. Horses were subsequently reintroduced to the continent.

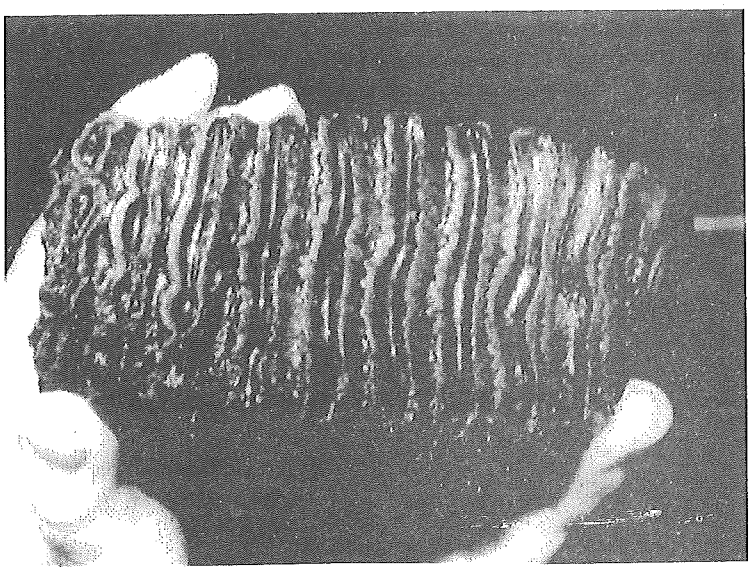
How far back do you want to travel in time? Ten thousand years? A hundred thousand year? A million years or more? Florida fossils provide you with the opportunity. The ease by which one can locate the fossilized teeth and bones of extinct animals is one of the best kept paleontological secrets.



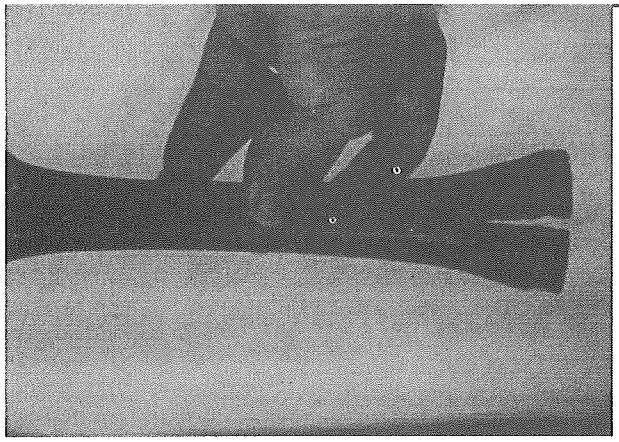
Extinct Great White Shark Teeth



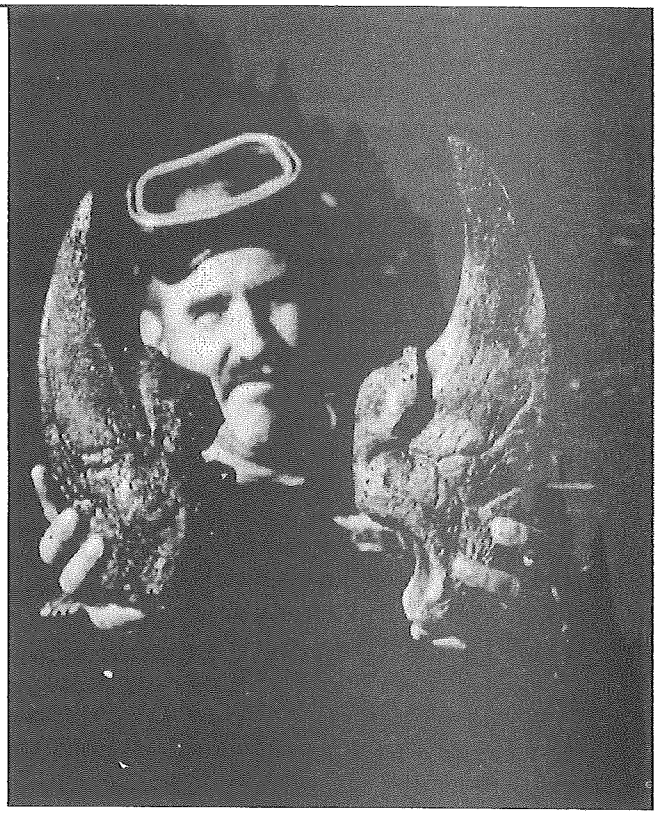
Equus teeth



Mammoth tooth



Camel limb bone



Giant ground sloth claws

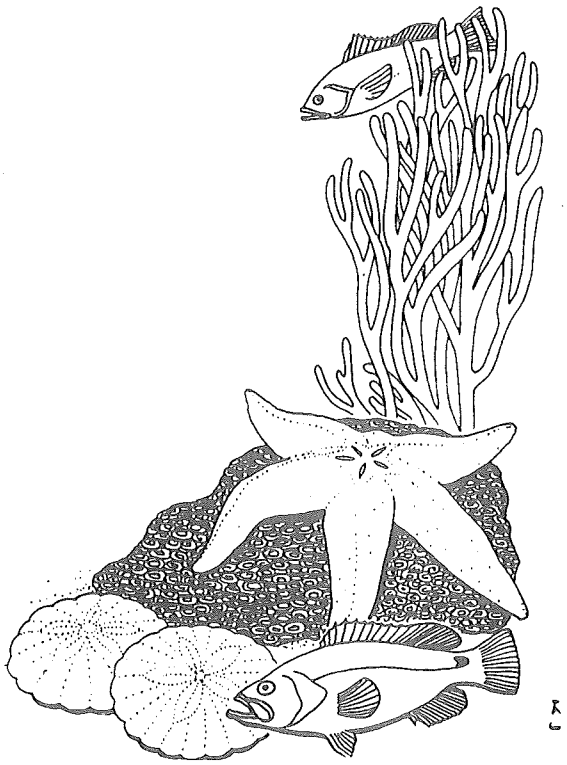
Throughout the numerous glacial cycles in Florida's 54 million year history, the state was ocean, then land, then ocean again, countless times. Early-on the shallow seas supported long-beaked dolphins, dugongs, whales, and giant white sharks half the size of a blue whale. As the waters receded and exposed the land mass a multitude of terrestrial life forms invaded state. Eventually, land animals from South America, Mexico, and the North converged on the sunny warm climate of Florida.

Florida had no geological upheavals, no earthquakes, no volcanism to destroy is fossil record. However, in many areas, terrestrial fossils have become mixed with marine fossils by fluctuating sea levels. Research on a find can place the fossil in its proper time period. From a teacher and student point of view, the mixture provides evidence of great environmental changes that have occurred in the state over time.

Resources:

Renz, Mark. 1999. Fossiling in Florida: A Guide for Diggers and Divers. University Press of Florida. ISBN 0-8130-1677-0 202pp. Contact Mark at the address given at the beginning of this article.

Florida Paleontological Society, Contact Eric Taylor, Florida Museum of Natural History, Gainesville, Fl 32611



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HOW TO CREATE AN UNSAFE SCIENCE CLASSROOM

Blowing up a classroom or poisoning a few students would certainly qualify as having an unsafe classroom. Thankfully these situations seldom occur but science classrooms can still be unsafe. Just what is an unsafe classroom and how do you make a science classroom unsafe? A starting definition of an unsafe classroom is that it is one in which a student comes to harm. Most commonly that harm is thought of as being physical but it can also be mental or emotional. It is often the case that the emotional harm a child suffers will last much longer and have a more profound effect than the physical harm they experience. As the state institutes the licensure system, I would like to make recommendations regarding the preparation and retention of teachers who teach science. These recommendations are aimed at ensuring that students will be safe in the science classroom as well as improving the quality of their education. Three factors need to considered if safe science classrooms are to exist. The three factors are the teacher's knowledge of the subject, the teacher's attitude toward the subject and the teacher's knowledge of how to teach the subject.

One reason few classrooms are blown up or students poisoned by their teacher is that teachers do not attempt dangerous activities. The problem is that what is considered dangerous depends on the skill and knowledge of the teacher. Driving a car would be extremely dangerous if attempted by my 10 year old but not when I do it. Many science teachers know they don't know enough science and thus consider many activities as "beyond" them. This leads to the practice of teaching science purely from the textbook and avoiding "doing" science. When this approach is followed, science becomes boring and simply another reading course. The effectiveness of hands-on, activity-based or discovery-based (choose your favorite descriptor as long as it means that students "do" science) has been well documented. Such courses can only be taught by those who know science and possess the skills of science. Experiments and demonstrations don't work unless the teacher knows how to make them work and aren't meaningful unless the teacher knows why they work. If a teacher doesn't know the subject well enough to teach it safely, what does the teacher do? The answer to that question depends on the attitude of the teacher toward science.

I would argue that the greatest harm to students in science classes occurs because of the attitude of the teacher toward science or to their students' interest in science. The more a teacher likes what is being taught the more likely that teacher is to inspire students with the same attitude. Nearly every student I deal with who wants a career in science has had an outstanding teacher who played a significant role in motivating the student. All of those inspirational teachers seemed to love science. Those teachers learn what they need to teach effectively and safely in part because of their love of the subject. But for every teacher who inspires a student to enter science, there are many more who turn the student off to science or simply do a poor job of teaching science. Turning students off to science limits their future choices, decreases the likelihood that they will use the processes of science in their everyday life and thus harms students. Doing a poor job of preparing students for future courses results in students who are more likely to perform badly in those courses and thus be turned off to science.

What best demonstrates the attitude that teachers have toward science? One good indicator is the number and type of science courses the teacher takes. The more an individual likes a subject, the more likely that the individual will take courses in the subject. Finson and Beaver in 1994 reported that 72% of Illinois teachers in K-6 surveyed said they had taken fewer than 6 hours of "pure" science courses. That trend has not appeared to have changed significantly. The Illinois State Board of Education minimum requirements for an Elementary certificate was 12 hours of physical/biological science including one lab course. Many of the courses that may be used to meet certification requirements are not "pure"science courses but rather can be any course offered by a science department. This would appear to explain the difference between state requirements and the courses teachers say they have taken. Courses such as "Science and Society" or "Human Nutrition" which future teachers may take for science credit at some institutions may be valuable courses but do not in my opinion teach enough about the subject of science. Rather, they tend to concentrate on the effects of science. This can be a valuable goal and can significantly affect attitudes toward science but most people would not consider them to be "pure" science courses. How such courses affect attitudes depends greatly on who is teaching such a course. The instructor has to be careful so that the negative aspects of science or technology is not the focus. Such courses also have a negative effect when future teachers take them to avoid "pure" science courses.

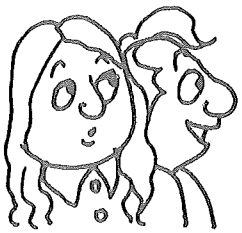
The courses that can be used to meet the science requirement for a teaching certificate are largely determined by the school that offers the certificate program. The total number of hours of science courses that teachers are supposed to obtain is usually larger than the general education requirements of the college or university they attend. The minimum number of hours of science courses that the state requires depends on the type of certificate sought. The Elementary certificate requires 12 hours of science (including a laboratory course) and the Secondary and Standard Special certificates require only 9 hours (including a laboratory course). More hours of science are required at the elementary level because the self-contained elementary classroom means that all elementary teachers have to teach some science. At the secondary level, teachers only teach science if they are certified in science or are endorsed to do so. If an individual seeks a Secondary certificate in a science area such as chemistry, the number of hours in that area (eg., chemistry) jumps to 32. The state says little about what a course must contain to be considered a science course. In general, if a course is taught by a science department or if the institution offering the certificate program says the course should count, it does.

If a teacher seeks an endorsement in an area of science the number of hours required vary considerably from subject to subject. The courses that are used toward an endorsement in science teaching are not up to the institutions with certificate programs. The state does not allow institutions to specify which courses must be taken. The evaluation of the courses for use toward an endorsement is done by individuals (usually at a Regional Office of Education) who have little or no idea of the course content. The guidelines given for an appropriate course in the area of physical science state it should be "study of the history, philosophy and methodologies used to describe the physical universe, including coursework in astronomy, chemistry, earth science, physics, geology and physical geology." (ISBE Minimum Requirements) Does that mean that a course on the history of science or the philosophy of science can be counted as meeting the requirements for a science teaching endorsement? The application of such definitions has resulted in individuals teaching science who are poorly prepared.

Illinois state law currently does not require those who teach science to take any coursework in the teaching of science. It doesn't matter whether the individual is seeking an endorsement or a teaching certificate. This practice is contrary to the recommendations of the National Science Teachers Association (NSTA) which were adopted by the National Council for the Accreditation of Teacher Education (NCATE) in fall 1998. The NSTA Standards for Science Teacher Preparation (or NCATE Program Standards) in the area of teaching skills stated that "while generic methods preparation for teachers across fields can lay the groundwork for further learning, NSTA regards specific preparation in science methods as essential for science teachers and specialists, and also elementary generalists."

Thankfully, many universities require some exposure to the teaching of science in their elementary teacher training programs regardless of the teacher's interests. This is important because an elementary teacher can teach science without anything other than the minimum number of hours of science if teaching science is not a major portion of their assignment. It is still possible to become a secondary level science teacher without taking a science teaching methods course.

To meet the NSTA standards for learning environments "teacher preparation programs must give candidates the knowledge needed to maintain a safe environment for students by avoiding or controlling chemicals, plants and animals that may be hazardous to students; storing, cleaning up spills and disposing of chemicals safely; give safety instructions and use safety equipment properly; avoiding hazards of improperly shielded electrical equipment; properly instructing on field trips, and teaching students to avoid fire hazards and biological contaminants. The need



for such preparation varies with the grade level and discipline for which the teacher is earning licensure." If science teacher certification programs must meet NSTA standards, will the state raise its minimum requirements so that all teachers must meet those same standards? Will teachers who qualify to teach science by obtaining an endorsement be held to the same standards as those that qualify by completing a certification program?

The concept behind the NSTA recommendations is that teaching science is inherently different than teaching other subjects. Teachers who know how to teach social studies do not necessarily know how to teach science and vice versa. A more subtle problem is the teacher who prepares to teach in one area of science but has to teach in another area. A question to be considered is whether teaching biology requires different skills and knowledge than are required to teach chemistry or physics. I know that as a physics teacher I was not qualified to teach biology. In my ignorance, I would have probably exposed my students to *Salmonella* by improperly managing the turtles in my classroom or other similar problems. Large numbers of biology teachers are told that they will teach physical science however with little or no knowledge of specific problems in the physical science classroom. Chemical and electrical safety problems are addressed in physical science methods courses but seldom in biology methods courses. Thankfully very few physical science teachers are ever told that they must teach biology.

Teachers often complain about the amount of influence that outside factors such as television, peers, society, etc. have on students. It must be realized that teachers do have influence. Just as science teachers influence a student's attitude toward writing by how they discuss laboratory writing assignments, English teachers can affect a student's attitude toward science. More likely to do harm are teachers who are supposed to teach science but exhibit a bad attitude toward science. One reason these science teachers have a bad attitude toward science (or lack knowledge of the science they are to teach) is that they are required to teach outside the subject areas in which they were trained. I have met many biology teachers who have been told that they will be teaching chemistry or physics in four months so "take a course and be ready."

Why do teachers have a bad attitude toward science? One reason is probably the same reason that most people don't like liver and onions. They just haven't had it cooked the right way. By that I mean that they haven't taken a science course that has motivated them. Another possible reason is that they don't possess the attitudes or skills necessary to be successful in science. Based on my experience in teacher certification, many teachers have weak math and science backgrounds and avoid taking science courses at college. Every student can be successful in science but not every student will be. The lack of necessary skills and attitudes becomes a bigger and bigger problem as students proceed from elementary to high school or beyond. Not being able to be successful is a guarantee of disliking the subject. Their attitude toward the science being taught is bad and often is not improved by those science courses they do take in college which tend to be large courses without laboratories. Most importantly, if a future teacher is turned off to science by a particular course or experience, that teacher will be less likely to like the subject, won't want to learn more about the subject and certainly won't spend the time to learn how to teach the subject safely.

This above is certainly not a complete description of the problem but it provides enough information for some important recommendations for change. How do attitudes get changed and teachers motivated to become more effective teachers? First, all teachers who teach science should be required to take a science methods course. The course should be taught by someone who knows science content. Such a course should address issues pertinent to the subject (e.g., every chemistry teacher should know chemical safety.)

Second, science courses that most teachers take at colleges and universities are not models of how science should be taught. There is probably no better way to instill a bad attitude toward science than to pack 150-200 students in a lecture room and attempt to teach science. Science courses for teachers-to-be should be offered. Those courses should model best teaching practices. Teachers have to possess the basic science skills to teach science skills effectively. They also need knowledge of resources from which they can obtain help when presented with unfamiliar ideas. A positive correlation exists between a teacher's attitude toward science and the teacher's science process skills. (Downings, Filer, Chamberlain, 1977) A well-taught, science course can improve both attitudes and science process skills.

Third, standards for endorsements in science should be revised. This has been unsuccessfully attempted before. Criteria for course content and selection should be improved.

Fourth, membership *and* participation in organizations such as the ISTA should be required for retention as a science teacher as part of the licensure process. This is not just to build up membership in the ISTA. It recognizes that not all training comes from formal courses. Active membership in a professional organization means a teacher is exposed to new ideas in science and ways of teaching science more effectively and safely.

Fifth, courses and workshops for in-service teachers offered at colleges and universities should be taught by someone who knows how to teach in K-12 *and* trainings offered by districts should be taught by someone who knows the subject. More partnerships should exist between subject experts and pedagogical experts.

These recommendations will not solve all the problems in the science classroom. They should help improve the quality of training that science teachers possess and as a result the attitude of teachers toward science. If teacher attitudes are improved, students will be less likely to have negative experiences and thus will they will have "safer" science classrooms.

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READING ACHIEVEMENT IN SCIENCE

Reading in the curriculum area of science is vital. It is a way of identifying problems within the context of science units of study. Reading, along with concrete and semiconcrete materials of instruction, can serve as an approach used to develop an hypothesis as well as test hypotheses. Reading is a skill that complements a hands on approach in learning relevant facts, concepts, and generalizations pertaining to different units of study in science (Ediger, 1997).

In this article, I am going to relate some of my teaching experience to student learning as it pertains to reading and science instruction. The reader should note that there is a large body of research literature which deals with reading. The intent of this article is not to review that literature, but to illustrate some ways my experience has taught me that good reading skills are important to students' successful learning in science.

Guiding Science Reading

School administrators and teachers working together might well harmonize a quality reading program and hands on experiences in science. I have supervised student teachers and cooperating teachers in public schools for numerous years and have observed what appears to assist learners to achieve well when engaging in reading activities in the science curriculum. These teachers guided learners to be able to identify unknown words prior to their actual reading of subject matter in science. Possible new words to be encountered by students in reading science content were printed in neat manuscript letters on the chalk board. A few teachers would print the unknown words within a sentence. In either case, these teachers would observe pupils to see that they looked carefully at each word being introduced. Sometimes, the teachers showed a picture or object directly related to the new word printed on the chalk board. Meaningful learning is very important. Thus, pupils should understand what is read and taught. This was in further evidence when the teachers had pupils use the new words in sentences. If necessary, the student teacher/cooperating teacher would use the new word in a sentence that would harmonize with the content to be read in the science textbook(s) (Ediger, 1995).

Pupils tended to make minimal mistakes in word recognition when teachers introduced assumed unknown words to pupils prior to the actual reading of content. I believe strongly that pupils who do well in science tend to be good readers also. If pupils do not read as well as is necessary, they should be assisted by the science teacher to comprehend abstract symbols effectively so that meaningful learning takes place. Scientists in a laboratory setting do much reading since this is an important way of acquiring needed information. The teaching of science is not a reading course, but pupils need direction to identify needed words so that necessary subject matter can be found in a problem solving situation. When words are introduced to pupils prior to the actual reading of content, learners sometimes make interesting discoveries, such as words that are antonyms or synonyms. Vocabulary growth and development are important in reading science materials.

Prior to reading science content, the teacher should use pictures, audio- visual materials, and hands on experiences assist learners to secure background information. The necessary background information guides pupils to attach meaning to subject matter read. Pupils should not be word callers. They must understand what has been read. Using visuals or real objects that directly relate to the facts, concepts, and generalizations read will help pupils to understand abstract words encoun-

tered. I find that learners very frequently identify problem areas when viewing the pictures and objects which make the abstract comprehendible.

After learners have completed the reading activity for the designated lesson, they may then pursue follow up experiences. Thus, pupils might use seminar methods to discuss in depth the subject matter read as well as relate the results to hands on learning activities. The seminar stresses depth, not survey learning.

Science teachers should always notice the kinds of errors pupils make in reading. Diagnosis is then in evidence. The following kinds of pupil errors in reading science content are the most frequent in occurrence:

1. mistakes made in sound/symbol relationships in reading. The science teacher might then provide pupils with help in phonics as it is needed to understand content read.
2. weaknesses in or inability to divide words into syllables so that each word is identified in a meaningful manner. There are common prefixes and suffixes which pupils may learn to recognize that have much transfer value from one situation to the next, e.g. "un" for a prefix and "ful" for a suffix. Once a word has been divided into meaningful syllables, a pupil may almost immediately identify the unknown due to knowing the pronunciation of selected parts, e. g. not being able to identify the word "uneasy," but identifying it when parts are recognized. Thus, when the pupil divides "uneasy" into component parts, he/she recognizes "un" and "easy." The prefix and the base word are then blended to pronounce correctly and identify the word "uneasy."
3. difficulties in using context clues. If a pupil does not recognize a word when reading science content, the teacher should ask learners to provide a word that fits in with the other words in the sentence. Too frequently, pupils provide a guess that is ridiculous for the unknown word. Certainly, pupils should provide a word that makes sense in relationship to the surrounding words in the sentence (See Ediger, 1999, 46-55).

Higher Levels of Cognition

Pupils should reflect upon subject matter encountered. To reflect requires thought. Thus pupils should think critically pertaining to ideas gleaned. When pupils think critically, they separate fact from opinion, fantasy from reality, and the relevant from the irrelevant. Learners may also detect content errors while reading. Pupils then must reflect upon the subject matter read so that understanding and concentration are in evidence. Also, learners will retain content longer if reflection upon ideas obtained is emphasized. Why? Pupils are using what has been learned in the reflective process. Science teachers realize that pupils need to become good readers since reading is one avenue of learning, among others.

Higher levels of cognition also require that pupils think creatively pertaining to ideas obtained, With, creative thinking, pupils secure originality of ideas. Uniqueness and novelty of response are salient in the creative thinking domain.

Problem solving procedures as skills are vital for all pupils to develop. To solve problems, pupils need to be curious individuals who have a desire to learn. Reading is one way to obtain necessary information to solve problems. Thus, to solve problems, pupils need to identity a problem area, develop an hypothesis, test the hypothesis, and revise the hypothesis if needed. In each step of problem solving, learners may read from the science textbook or/and tradebooks e.g. pupils might identify one or more problems in science through reading. Additional learning activities, including internet, will be in the offing so that pupils may select and solve problems in depth rather than use survey approaches. However, one should be careful to not substitute the reading about science for the doing of science.

In Conclusion

A quality program of reading in science stresses learners acquiring vital facts, concepts, and generalizations in ongoing lessons and units of study. Reading, along with other activities and experiences, should provide a variety of endeavors to secure pupil interest. Various endeavors also guide the science teacher, in providing for individual differences in the classroom so that each pupil might learn as much as possible, be it from concrete, semiconcrete, and/or abstract learnings.

Reading in science needs to emphasize higher levels of cognition. Thus pupils develop skills in critical and creative thinking as well as in problem solving. Learners need to achieve optimally in science. The world of science surrounds everyone and has made for inventions and technology that truly are outstanding and revered. Reading of science content may certainly be incorporated into experiments and demonstrations that are the heart of a hands on approach in learning (Ediger, 1999, 50-56).

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WHAT TEACHERS SHOULD KNOW ABOUT THE POWER OF STUDENT EFFICACY

If you are looking for a potential way to improve your students' performance in science, we believe you may want to consider your students' beliefs about their academic self-efficacy as a key to student motivation and perseverance in science. There is a growing body of research suggesting that students' beliefs in their own abilities may influence their achievement.

Your Sense of Teaching Efficacy as an Example

Do you believe you have the skills to help children learn science? If so, what has led you to believe that? More than likely you have seen evidence of your skill in the form of improved student science achievement or perhaps you have received positive feedback from your students, parents, or colleagues about your science teaching. Such experiences lead you to believe you can teach science, whether or not you actually possess exemplary science teaching skill. In other words, your belief that you "can teach science" is derived from the act of teaching or experiences related to it. In this case you have some evidence of your ability to teach science and consequently feel more confident about continuing to teach science. As a result of this belief, you may be more motivated to teach science and spend more time preparing appropriate science learning experiences for your students.

If, over a period of time, your science teaching efforts are not positively affecting your students' science learning, you may begin to develop negative judgements about your ability to teach science. As your sense of futility increases, and your confidence decreases, you find more reasons to avoid teaching science or you spend less time in preparing science lessons. Soon, even if you may have skill in teaching science, you come to believe that you cannot do it. This sense of confidence to perform a particular task is often referred to as self-efficacy. How we think we can perform affects how we actually do perform. Of course this is only true if the belief is derived from a source that is consistent with the task. In this example, the teacher's belief is derived from the science teaching experience. Our beliefs about our ability to teach have the power to affect our teaching behavior.

A Little Background on Self-Efficacy

Probably the most widely cited theorist regarding performance self-efficacy is Albert Bandura (1977, 1981, 1982, 1986, 1989a, 1989b, 1996, and 1997). His work reveals the ways in which belief about ability influences performance. In general, he reports that expectation about cause and effect results from experience and that the most powerful efficacy beliefs are situation-specific as illustrated in the teaching example above. The teacher in the above example may not have these same efficacy beliefs about her ability to teach mathematics or reading. Bandura (1986, p. 391) defines the construct of self-efficacy as "people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances. It is concerned not with the skills one has but with the judgments of what one can do with whatever skills one possesses."

In sum, self-efficacy is defined by two components: 1. Our sense of self efficacy does not refer to our actual ability, or skill, but instead to what we believe we can do with whatever skill we have, and 2. Efficacy information is learned from experience. In describing the multifaceted impact of self-efficacy beliefs, Bandura, et al (1996, p. 1206) state that "unless people believe that they can produce desired effects by their actions they have little incentive to act."

Student Self-Efficacy and Academic Achievement

One of the earliest researchers to apply Bandura's self-efficacy theory to the problem of children's academic achievement was Dale Schunck (1981, 1982, 1983) who showed that efficacy perceptions accounted for significant amounts of mathematics achievement among sixth graders. In other words, self-efficacy beliefs are among the most important of all of the possible factors that lead to student achievement in mathematics. He concluded that having high self-efficacy beliefs sustains task involvement. On the other hand, a lower sense of efficacy leads to less persistence, which lowers achievement. His work, along with that of others, paints a fairly clear picture of the role of self-efficacy perception in achievement. Higher self-efficacy leads to the behaviors that are probably most consistent with success in school æ trying and persevering. These behaviors are in fact prerequisite to successful performance in school.

Enhancing Self-Efficacy Beliefs

Teachers, even with limited teaching experience, are likely to agree that the student who makes a legitimate effort and who sticks with assigned tasks is likely to be successful in school. A major challenge to many teachers is finding ways to motivate these behaviors in their students. Considerable research over the past several years has shown that beliefs of efficacy play a role in heightening motivation (Bandura, 1992; Schunck 1989; Zimmerman, 1995). It seems that children's beliefs in their efficacy to regulate or influence their own learning activities and to persevere in the face of difficult learning situations may affect their academic behaviors and ultimately their scholastic achievement (Bandura, 1996; Schunk & Zimmerman, 1994).

If self-efficacy beliefs play such a powerful mediating role in motivating behaviors and enchancing achievement, the question then becomes are there ways to enhance students' self-efficacy? A review of the research literature indicates that self-efficacy beliefs are developed through three forms of experience:

1. Direct experience with the task at hand, which is the most powerful source of efficacy information.
2. Experience with similar tasks is also a powerful source but not as powerful as experience with the specific task.
3. Observation of peers performing the task is also a good source of efficacy information but not as strongly motivating as personal experience.

Findings From Our Research

After reviewing the relevant literature, we decided to take another look at a variety of different studies (Frazier, 1998; Harris, 1999; Jinks and Morgan, 1996: Lorsbach and Jinks, 1999) in which the Morgan-Jinks Student Efficacy Scale (MJSES) (Morgan and Jinks, 1994) was used to collect data about student efficacy beliefs. The MJSES measures three sub-scales including students' perceptions of talent, (alpha.78) the context of the school (alpha .70), and students' beliefs about their effort (alpha .66). The overall reliability of the scale during field tests was .82 (Jinks and Morgan, 1999).

An analysis of the data from the above referenced studies uncovered the following general findings about the relationship between student self-efficacy and achievement:

- Self-efficacy belief is positively correlated with both teacher-assigned grades and ITBS scores.
- The relationship exits between achievement and self-efficacy in urban, suburban, and rural schools.
- The relationship exists with both African-American and Caucasian children.
- The relationship exists with both females and males.
- The relationship exists regardless of socioeconomic status.

There are some interesting variations in the ways that the dynamic plays out with the different groups (male/female, African-American/ Caucasian) and circumstances (urban/rural/suburban, socioeconomic status) in each of the studies. However, in general, we can say that self-efficacy seems clearly involved with achievement and is a factor with all learners regardless of setting, ethnic background, gender, or socioeconomic status. Higher self-efficacy and higher achievement go hand-in-hand. (A more detailed discussion of our results has been submitted for publication). Our focus here is to bring this important concept to the attention of teachers of science and suggest ways in which student efficacy can be enhanced by curriculum, instruction and assessment with the possible outcome being improved science achievement.

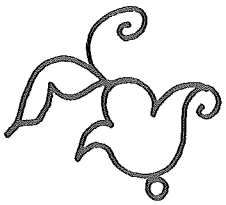
Implementing Self-Efficacy in Your Science Classroom

It isn't always easy to see when and where research findings can be implemented in the classroom setting, but we believe there are a variety of ways in which the teacher can use the power of students' efficacy beliefs to enhance the teaching/learning process. As we come to understand more about the self-efficacy/achievement relationship, we believe that there are three major implications for science teachers:

1. We believe there are implications for the science curriculum.
2. We believe there are implications for the ways in which instruction occurs.
3. We believe that there are implications for the ways in which assessment is conducted.

Science Curriculum That Supports Student Science Self-Efficacy

In order to increase student beliefs about their ability to succeed in science we suggest that the need for discreet, success-oriented experiences that build upward in sophistication particularly for those that are not the highest achievers. In other words, teachers need to provide small concrete experiences in the domain (in this case, science) that requires self-efficacy enhancement. As success grows, so too should the sophistication of the task. This is in opposition to the traditional approaches in science curriculum, which usually present content in an analytical way by proceeding from big ideas to the evidence that verifies the truth of the big idea. Although the traditional approach appeals to some students many, probably most, are intimidated by it and never develop the self-efficacy beliefs necessary to be successful in a subject as intellectually demanding as science. Curriculum structured around the notion of solving problems that are sequenced in ascending sophistication seem more consistent with building the self-efficacy that is associated with high achievement.



Such a curriculum would not require students to make big leaps in thinking about abstract concepts without the necessary background knowledge to do so. This approach may lead to a better alignment between the "taught" curriculum and the "learned" curriculum since it would focus more on a progression of understanding rather than a progression of curriculum. Realizing the importance of developing a sense of efficacy at one level of sophistication before expecting students to successfully move to the next level of sophistication, we can no longer ignore the preconceptions our students bring to each learning experience.

The idea of a developmentally-appropriate curriculum has long been with us but perhaps the role that students' sense of efficacy may play in such a curriculum has been underestimated, if considered at all. Motivation for learning should be enhanced by a developmentally-appropriate curriculum that is derived from student's natural curiosity and desire to make sense of their world. How can students be motivated to pursue science learning if the curriculum isn't built on the students' questions? How can students be motivated to pursue science learning if their past experiences with science have lead them to believe they cannot "do" science? Bandura et al (1996) have found that "Children who believe they can exercise some control over their own learning and mastery of coursework achieve success in their academic pursuits" (p.1217). The curriculum should help them to develop this belief.

Science Teaching That Supports Student Science Self- Efficacy

We submit that teachers would be well served to consider performance self-efficacy as the key to student motivation to engage in the student behaviors consistent with achievement æ willingness to try and willingness to persevere. An emphasis on academic self-efficacy shifts the focus from one where the teachers have the onerous responsibility of creating a learning environment satisfactory to dozens of individuals to one that enhances self-determination and self-monitored learning, which are characteristics of students with higher self-efficacy. In such an environment, teachers could identify those students who are highly efficacious and therefore more likely to take a risk and create opportunities for them to engage in more self-determined learning. By the same token, creating an environment that is structured with small and obvious incremental steps that provide opportunities for frequent and cumulative success could help low self-efficacy students. Such enactive attainment leads to enhanced self-efficacy. Higher self-efficacy beliefs allow students to contribute to the learning environment because they exhibit more emancipatory behaviors than low-efficacy students do and are less troubled by variations in the preferred and actual learning environment. Highly efficacious students are much more independent (Pajares, 1996).

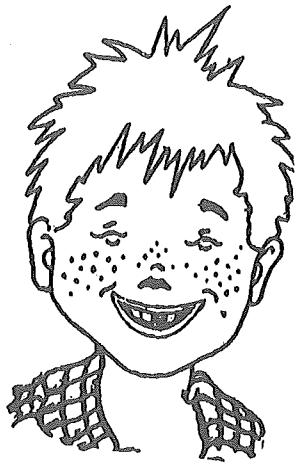
We believe a primary purpose of schooling should be student growth toward greater self-determination. Such an idea is consistent with a constructivist perspective of teaching science called for in state and national standards. Bandura (1997) insists that "Good schooling fosters psychosocial growth that contributes to the quality of life beyond the vocational domain. The major goal of formal education should be to equip students with the intellectual tools, efficacy beliefs, and intrinsic interests to educate themselves in a variety of pursuits throughout their lifetime" (p. 214). It is apparent that growth in student autonomy is at the center of self-efficacy research. Following are a few strategies teachers might use to increase self-efficacy and consequently, student autonomy:

- Construct opportunities for students to reflect, evaluate, and discuss their performances in science. Lead the students to identify those factors that may be affecting their learning.
- Incorporate more problem-based learning. Nothing enhances efficacy belief quite like solving a problem.
- Solicit student opinion about topics that could be incorporated into the science curriculum. Include these where possible.
- Focus on learning experiences that contribute to long-term growth and point out the relevance of these to the students. No one feels elevated by busy work so be watchful of activities/experiences that are isolated and trivial even though they may have tradition or entertainment value on their side.
- Provide and encourage collaboration among students as an integral feature of the science classroom environment.
- Incorporate more individualized and small group learning formats.

Let's look at a scenario that incorporates these strategies with two students representing extremes of the efficacy spectrum:

Jackie has a high appraisal of her abilities in biology, while Darryl does not. Jackie's highly efficacious beliefs lead her to be more open to taking risks in tackling new and/or challenging content. She welcomes autonomy from her teacher and is not particularly troubled by variations in classroom routine. It takes little motivation to get Jackie to try new content or to accept the challenge of an academic problem. Even when she runs into difficulty she perseveres until a solution is found. Darryl, on the other hand, does not like changes in the classroom routine or environment and he becomes uncomfortable with teachers who ask him to undertake autonomous assignments. "I'm confused!" "Tell me what I am supposed to do." "How long does it have to be?" "I don't understand what you want me to do." These are the sort of questions Darryl can be counted on to ask anytime the teacher asks him to be self-determined regarding his learning. To Darryl successful learning is giving the teacher what she wants and failure is a result of the teacher's lack of clarity.

What can be done for Jackie and Darryl and all of the other students whose efficacy ranges somewhere in between? First, the teacher needs to rethink what happens in science classrooms. The teacher centered, large group concept of instruction cannot be anything other than a "one size fits all" event. Generations of science teachers have struggled with this reality with generous amounts of rationalization used to justify whatever focus the teacher takes. One view is that a science education is only for the best and the brightest. This is the "science is a national security" issue and should focus on a talent hunt for prospective scientists, engineers and the like. Another view is that of the minimalist who structures instruction around the Darryls of the world. Such teachers build a rigid structure where following directions "to-the-letter" is of the highest virtue. A Jackie is viewed as not as needful of the teacher's instruction as the other students might be so as long as she doesn't create problems it's ok to leave her largely to her own devices and "concentrate on the kids who really need my help." A slight variation on this view is what allows many elementary teachers to ignore science teaching altogether.



Obviously the "one-size-fits-all" learning environment is inconsistent with the growing awareness that learning is strongly influenced by individual attributes. Students like Jackie need opportunities for more self-directed learning, perhaps through problem/project-based experiences. She needs to test her abilities and push her limits. Darryl, however, is not yet ready for that and needs an environment structured around small and obvious incremental steps that provide frequent successes (regardless of how small). He also needs immediate feedback that ties his success to his expenditure of effort. Darryl needs to experience the revelation that trying and sticking with it pays off. This comes with guidance and reflection and when this is learned Darryl, too, will be ready to explore his abilities and find new ways of applying them.

Being aware of the science efficacy of her students, Jackie and Darryl's teacher has decided to restructure her science learning environment to feature small group science centers instead of using large group instruction. The centers are based upon project work and problem solving. Jackie's group includes other students with sufficient self-efficacy to accept the challenge of solving a problem rather than following a recipe. The teacher holds short meetings with Jackie's group to help them think through their strategies and interpret their findings. Frequently, her instruction to this group is focused on teaching a technique rather than something directly connected to the problem at hand. For example, she has helped the group to learn to conduct more effective on-line searches so they could find information that might be pertinent to their project but is technically beyond their laboratory capability to test directly. She has also spent time helping them to understand the concept of scientific skepticism so they can more effectively define problem statements that allow them to explore topics that arouse their interest.

With lower self-efficacy groups the teacher has provided much more structure in working through science activities and experiments. These are punctuated with frequent meetings in which the teacher leads the students in reflecting both upon the steps of the activity as well as self-ability reflections. She uses many questions in these meetings and tries to lead the students to discover that success results from their effort and, consequently, that there are underlying meanings. For example, "Why do you think the experiment is organized as it is?" (The structure is a function of decision, not something that is beyond control.) "Of the two kinds of measuring you had to do with this experiment, volume and mass, which do you think you did the best?" (A focus on positive accomplishment.) "Why do you think that?" (The positive accomplishment is a result of my effort.)

As can be seen from these scenarios our teacher is implementing many of the strategies suggested earlier. Her instruction has changed dramatically from one in which she was trying to fit the same approach to everyone to one in which she has found a way to be more responsive to the variety represented by her students.

Assessment Practices that Support Student Science Self-Efficacy

In addition to implications for instruction we also believe that self-efficacy theory has something to say about assessment. Teachers may assess their students' self-efficacy beliefs by asking students to report: 1. How well they expect to perform in science; 2. If they feel competent as well as confidant in their understanding; and 3. If they think they are capable of learning science. Students should also be asked to support their responses with reasons, or rationales, for why they think they have these beliefs. Asking for such rationales helps to determine if their beliefs are actually derived from experience or are merely guesses or false bravado. According to Bandura (1986), people evaluate and alter their thinking and behavior based on self-reflection. If this is the case, then teachers should be prepared to realize the important motivating role that student self-evaluation (which includes self-efficacy perception) can play in student achievement. There is growing evidence that self-efficacy beliefs serve as internal standards students use to determine what effort they will put forth on a particular task and how long they will persist at it. Low self-efficacy students are not likely to be motivated by assessment practices that focus on pointing out inadequacies such as is usual with traditional approaches. Low self-efficacy students believe that they cannot perform and traditional methods of grading merely reinforce the low self-efficacy instead of serving as a wake-up call as it might with a high efficacy student. A low test score verifies what the student already knows to be true—"science is not something I can do". It appears that low self-efficacy students need assessments that provide concrete evidence of incremental gains that are tied directly to the student's effort. On this point the research is very clear, recognizing that achievement has come as a result of personal performance is the most influential source of efficacy information.

Self Efficacy and the National Science Teaching Standards

One of the assumptions in which the standards for science teaching are grounded, is that the "actions of teachers are deeply influenced by their understanding of and relationships with students" (National Research Council, 1996). If students do not feel that they can be successful in science, is this not likely to effect their ability to succeed in science? If so, shouldn't knowing that students have these beliefs, influence the actions of the teacher in that classroom? We believe by assessing and using student science self-efficacy information, teachers are extending their understanding of students and using it to inform their practice.

We believe that by implementing some of the strategies we have suggested, teachers would address several National Science Teaching Standards. For example, Standard A suggests "that teachers plan an inquiry-based science program in which they adapt and design curriculum to meet the interests, knowledge, understanding, abilities and experiences of the student" (p. 30). Teaching for understanding requires responsiveness to students. Clearly, the teacher that utilizes efficacy information in curriculum planning is, incorporating insights into the understandings and abilities of students.

Standard B recommends that "teachers guide and facilitate learning by challenging students to share responsibility for their own learning" (p. 32). Helping students to reflect upon and evaluate their own achievement, as previously suggested, allows students to gain insight into their efficacy beliefs and how these influence success. Certainly coming to recognize that we, to a great extent, author our own success (or lack thereof) addresses the responsibility standard.

Teachers are encouraged by Teaching Standard C to "engage in ongoing assessment of student learning by gathering data about students' understanding and ability" (p. 37). Assessments should take many and varied forms, including the assessment of students' beliefs about their ability to succeed in science. When choosing to assess such beliefs and then modifying instruction to reflect and enhance students' science self-efficacy beliefs, teachers are engaging in ongoing assessment and using it to guide their teaching

Self-Efficacy and the Illinois Learning Standards for Science

According to the Illinois Learning Standards for Science, "Asking questions and seeking answers are at the heart of scientific inquiry," (Illinois State Board of Education, 1997). Students, through the experiences their teachers provide, should come to appreciate the efforts and effects of scientific discovery and have a "useful sense of the scientific enterprise." In other words, teachers should be providing ample opportunities for their students to ask their own science related questions and encourage them to persevere in finding answers to those questions. What better way to increase student autonomy, ownership of knowledge, and enhance students' sense of science self-efficacy.

The Illinois Learning Standards for Science also address the importance of learning and contributing productively as individuals citing that "Individuals bring unique insight and focus to the work of inquiry and problem solving" (ISBE, 1997). This suggests that teachers need to provide a forum in which students learn from each other and feel safe in contributing their own unique ideas about science. Teachers who create learning environments that provide opportunities for each student to safely risk confronting their naïve conceptions about science and challenges them to gradually move to higher levels of sophistication in their thinking, will be helping to equip students with the efficacy beliefs that seem to be so closely related to academic success.

What Further Study is Needed?

Based on the existing research about self-efficacy beliefs and academic performance it is clear that an empirical connection between the two exists. However, most of the research has relied on quantitative self-report data about beliefs and performance. To complement this body of research, longitudinal observational research is needed that will better capture the sources of self-efficacy beliefs and their potential for motivating academic performance. But, perhaps most importantly, research is needed in which students' self-efficacy beliefs are altered and the effects of those changes on academic performance measured.

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WHAT IS PLAN-IT EARTH?

PLAN-IT EARTH is a program designed to involve high schools in a hands-on, minds-on tested environmental sciences program designed to specifically encompass Illinois Learning Goals 11, 12 13, 16 and 17 (including their associated standards and benchmarks for early and late high school). It is specifically tailored to meet the needs of high school teachers who wish to incorporate environmental science and field activities in their classrooms.

Primary Goals

- to provide teachers and students with an interdisciplinary set of inquiry-based investigations that focus on Illinois ecology;
- to develop an involved group of Illinois citizens who are interested in the environmental health and assessment of the state's and their own local ecosystems, beginning in their high-school years and continuing through life;
- to regularly monitor the changes in these ecosystems on a long-term basis, contributing to the Governor's Report on the State of the State's Ecosystems.

Training

Regional training will be offered on the Forests and Stream Ecosystems. Teachers also have the opportunity to participate in field experiences as well as curriculum planning. Past participants' field work has had a direct impact on scientific research and students' learning of science.

Involvement

Participants in each training session will be provided the following:

- interdisciplinary curricular materials, including authentic assessment and technology integration experiences
- essential field equipment and materials for each ecosystem
- access to the statewide network of Illinois teachers and schools already participating in EcoWatch
- Opportunity to obtain 2 hrs graduate credit

You Will Receive

- A stipend ($200)
- Lodging and Meals
- Materials
- Input from talented teachers

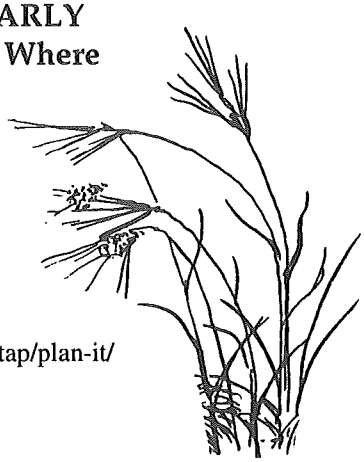
How is PLAN-IT Unique?

- specific focus on Illinois ecosystems
- interdisciplinary modules that are developed by teachers and are aligned with Illinois Science Goals and Standards
- authentic assessment opportunities
- use of state of the art technology
- partnership statewide with the Illinois EcoWatch Network

Partnerships and Funding

- National Science Foundation
- Illinois State Board of Education
- Illinois Dept. of Natural Resources
- Illinois Board of Higher Education
- Eastern Illinois University

LIMITED SPACES AVAILABLE
APPLY EARLY
When and Where



5-9 July 2000
Eastern Illinois University
Charleston

11-15 July 2000
Northern Illinois University
Oregon Taft Campus

PLAN-IT Web Address:
http://dnr.state.il.us/orep/inrin/ctap/plan-it/

To apply contact:
Dr. Marylin Lisowski
Eastern Illinois University
600 Lincoln Ave.
Charleston, IL 61920
Phone: 217-581-7830
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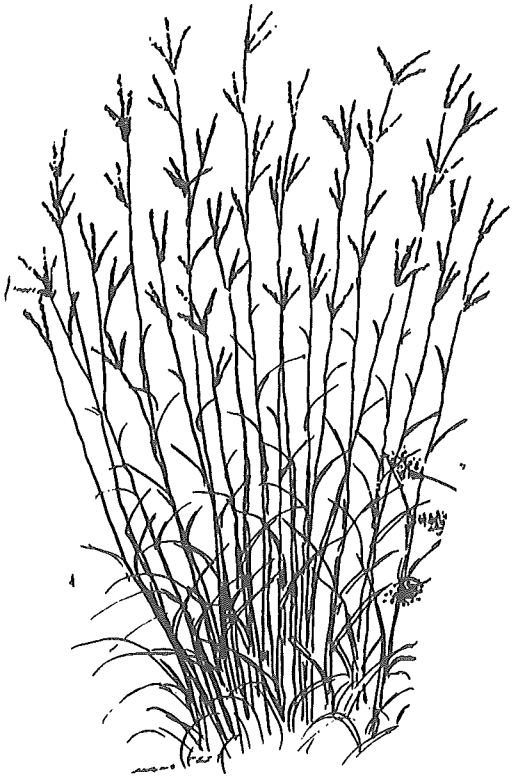
E-mail: cfmfl@eiu.edu



CHECK OUT THESE INTERESTING WEB SITES

Illinois state academy of science
http://www.il-st-acad-sci.org/

Linked web siteof living things.
http://phylogeny.arizona.edu/tree/phylogeny.html

Here is a web site for earthquakes and some earth information links to other sites.
http://www.dc.peachnet.edu/~pgore/seismic.htm

Mineral Resources - great free materials for K-12
http://www.mii.org

Topographic Maps
http://www.topozone.com

Over 200 aeronautics & space programs chronicling NASA's state-of-the-art research & technology efforts. These videocassette, slide, & CD-ROM programs can serve as a springboard for discussing life science, physical science, space science, energy, Earth science, mathematics, technology, & career education.
http://core.nasa.gov/

"The Show-Me Center" provides information & resources needed to support selection & implementation of middle grades mathematics curricula that use standards recommended by the NCTM. The site features five curricula projects that focus on problem solving, data analysis, geometry, & algebra as well as sample lesson plans for educators to examine.
http://showmecenter.missouri.edu

"Oceanography: A Science & Technology Focus Site" explores ocean habitats, regions, & more. Learn how waves are created & where hydrothermal vents are found, or conduct one of the site's experiments to find out why big ships don't sink.
http://www.onr.navy.mil/focus/ocean/

"The Why Files" feature the latest news in science, math & technology. Learn how infrared "vision" works, the science behind cloning, or the statistical calculations that make political polling possible. Visitors can also join the site's online forum to participate in various science related discussions such as why the night sky is dark, interstellar distances, Einstein's influence, & much more.
http://whyfiles.news.wisc.edu/

For information about the location of clinical trials, their design & purpose, criteria for participation, & information about the disease & treatment under study. It contains over 4,000 clinical studies on various medical conditions such Alzheimer's disease, cancer, & diabetes. (NIH)
http://clinicaltrials.gov/ct/gui

Images from the History of Medicine is a collection of nearly 60,000 images that illustrate the social & historical aspects of medicine. The collection includes portraits, pictures of institutions, caricatures, genre scenes, & graphic art in various media. (NLM)
http://wwwihm.nlm.nih.gov/

MEDLINEplus enables users to find information about hundreds ofdiseases, conditions, & wellness issues. It includes links to information resources of the National Institutes of Health, as well as dictionaries & lists of hospitals & physicians.
http://medlineplus.gov/

"Captured Wisdom CD-ROM Library" is a collection of stories about teachers who have integrated technology into their instruction. These CD-ROMs, which contain video descriptions & demonstrations of how technology is used in classrooms, help show what technology can accomplish in schools.
http://www.ncrel.org/cw/

"Parent Tech" provides resources for families & educators of middle school children. The site includes interviews with high-tech professionals, educators, & families about how they are using technology & a "Discussion Corner" where visitors can participate in an online forum on technology.
http://www.parentech.org/

"Children's Books" provides books that will capture & cultivate a child's interest in art. The site features several books such as the "Getting to Know the World's Greatest Artists" series by Mike Venezia, "Family Guide: Portraits & Personalities" which introduces portraiture in French & American paintings & sculpture, & "Marc Chagall: Life Is a Dream" by Brigitta Hopler. These books share stories about famous artists & full-color reproductions of their paintings.
http://www.nga.gov/shop/bookkids.htm

"U.S. Patent & Trademark Kids Pages" invites kids to learn about inventors & intellectual property -- patents, trademarks, copyrights & trade secrets. Kids can take a patent trivia quiz, read fun facts, & learn how to apply for a patent for their own inventions.
http://www.uspto.gov/go/kids

OPPORTUNITIES

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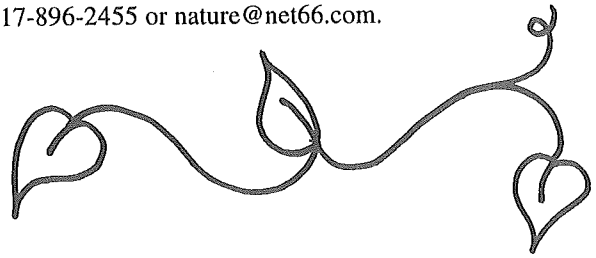
ATTENTION REGION IV HIGH SCHOOL SCIENCE INSTRUCTORS HIGH SCHOOL NATURALIST- IN-CLASSROOM PROGRAMS OFFERED

Do you find it difficult to bring life science curriculum to life? Realizing the difficulty with getting High School students outdoors, the Champaign County Forest Preserve District, Department of Environmental Education began a new approach to reach this audience by bringing the outdoors, indoors. Four programs were piloted Fall 1999 at various region IV high schools. For each of the programs, a preserve educator visited each class for a series of three to five visits. Each visit was comprised of lectures and hands-on activities filled with visual and auditory examples. The preserve educator provided all information, materials and instruction free of charge.

These programs include "Ecology 101", a "first-look" at ecological terminology, theory and relationships between our abiotic and biotic environment. Group activities included outdoor display of Red-Winged Blackbird (*Agelaius phoeniceus*) puppets for a study on territoriality and competition. The next program, "Illinois Ecosystems", gave an in-depth study into Illinois' wetlands, woodlands and grasslands using live plant specimens from each ecosystem. Some of the activities required students to identify various bird and frog species by their call and witness seasonal prairie burns, while still in the classroom! The additional two programs, "All About Birds" and 'Mammal Morphology", focused on the anatomy, physiology, natural history and behavior of these animals. One activity included learning techniques used to age mammals. For this activity, each student was assigned a deer jaw and asked to age and present findings. Each program is correlated to the 1997 Illinois Learning Standards. For further information, program outlines, learning standards correlation or reservations, please contact Sarah Livesay at 217-896-2455 or nature@net66.com.



MY NAME IS SUE SUE UNVEILED MAY 17, 2000

An interactive Electronic Field Trip intended for grades K-12 All day broadcast Sue is the real thing. If you let your imagination wander back to a moment in time 67 million years ago, you can almost hear the echoing roar of an ancient beast. Back then, the 7-ton, 42 foot-long Tyrannosaurus rex was ruler of its domain. Now Sue, the largest, most complete and best preserved Tyrannosaurus rex ever found, will reign once again -- this time at The Field Museum in Chicago! Join The Field Museum and Ball State University for the ultimate electronic field trip as Sue, the most famous T. rex in the world, is finally unveiled! This all-day, multimedia learning adventure will take you and your students on an exciting journey of scientific discovery. During this field trip, your whole class will: - witness the unveiling of Sue, a moment in the process of scientific discovery and exploration; - learn how Sue adds to our picture of T. rex and other dinosaurs; - see the impact of Sue on popular, scientific and educational images of T. rex. Tune in for an hour, two hours, or all day-it's FREE! Interact via a toll-free phone number or e-mail to turn this field trip intoa virtual classroom. Enhance your experience with web-based curriculum materials, including information, activities, and experiments, for only $75 per school. But most of all, have fun! All electronic field trips are broadcast live via Ku-band satellite, Vision Athena, and Webcast through the Apple Learning Interchange. Electronic Field Trips will also be available on VHS videocassette. In addition, selected PBS stations plan to air Sue Unveiled. The standards-based curriculum materials are available on CD-ROM for Macintosh and Windows.
To register or for more information on local viewing options, call 800/316-3163. Raissa A. Jose Project Coordinator, Educational Media The Field Museum Department of Education and Outreach Roosevelt Road at Lake Shore Drive Chicago, IL 60605 Telephone/Fax: 312/665-7307
e-mail: rjose@fmnh.org

Join us for the Teachers Summer Institute

Focus: Sue and Paleontology
June 26-28, 2000 8:30 a.m. - 4:30 p.m.
Fee $100 and $20 Lane Placement credit fee
Graduate credit offered through Aurora University
Contact John Frazier at the Field Museum for this and other summer workshops.
312-665-7513
jfrazier@fmnh.org

RIVERS PROJECT 2000 SUMMER TRAINING

During July and August 2000, the Rivers Project of Southern Illinois University at Edwardsville (SIUE) will conduct its annual summer training.
Educators and environmental professionals are encouraged to attend and help us achieve our goal of increasing scientific literacy through river study.
Attendees will focus on one of the six curricula while receiving interdisciplinary training in all. The six units, now published by Dale Seymour Publications, are Biology, Chemistry, Earth Science, Geography,
Language Arts, and Mathematics. The units were developed under a grant from the National Science Foundation. Trainers for the week-long sessions are practicing Rivers Project teachers who are supported by university and other professionals.

Two local sessions are offered for 2000:

July 23-28 Joliet Junior College, Joliet, IL
Co-sponsored by Friends of the Chicago River and Friends of the Fox River, this session will focus on Midwestern urban rivers and streams.

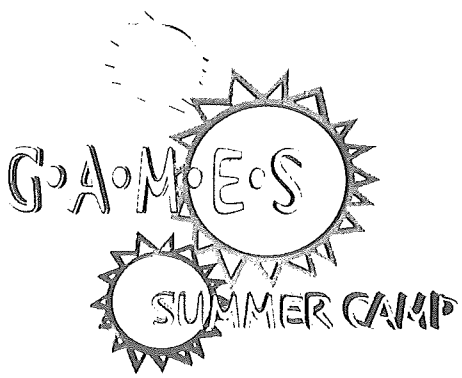
July 31-Aug 4 Southern Illinois University

Edwardsville, IL

This 10th Anniversary training was partially funded by the IL Board of Higher Education, Dwight D. Eisenhower, Title II funds for Illinois teachers. Applied technology and computer applications are the focus. Tuition (two semester graduate credit, summer 2000) and curricular materials will be available. A non-credit option is also available for $200. Lodging and food will be provided at a low cost. Interdisciplinary teaching teams from the same school are encouraged to attend.

Interested persons should check the Rivers Project Web Page for information and details on the training as well as information on the curriculum units. If you are interested in training in your area, call or Email Dr. Bob Williams at the Rivers Project.

http://www.siue.edu/OSME/river
Call 618.650.3788
FAX 618.650.3359
Email: rivers@siue.edu
Box 2222
Southern Illinois University, Edwardsville, IL 62026



GAMES Summer Camp for Middle School Girls in Math, Engineering and Science

University of Illinois at Urbana-Champaign

August 6-12, 2000

This one-week residential program is designed to give academically talented young women an opportunity to explore math, engineering, and science through demonstrations, classroom presentations, hands-on activities, and contacts with other women in these technical fields. The program was initiated in the summer of 1998 with a start-up grant provided by the Engineering Information Foundation. The previous two years (1998 and 1999), the camp was called "Camp 21st" to signify the coming of the new millennium. With 2000 now here, this year the name of the camp has been changed to better reflect the purpose of the program. "GAMES", an acronym for "Girls' Adventures in Mathematics, Engineering & Science" was chosen upon which to build the future of the camp.

The GAMES Summer Camp will be conducted from August 6-12, 2000, at the University of Illinois at Urbana-Champaign (UIUC). The camp is organized and coordinated by the Women in Engineering Program (WIE) in the College of Engineering (COE).

The cost of registration for the camp is $550. This amount covers all required class and lab materials, housing, meals, and all required transportation and fees for camp social and sports activities. To learn more about the camp, visit the website at ***http://www.engr.uiuc.edu/wie/games/summercamp5a.htm.***

ELIGIBILITY & APPLICATION

If you are a young woman currently in the 6th or 7th grade (and will enter the 7th or 8th grade in the fall of 2000), you are eligible to apply. Applicants should be interested in math and science and have demonstrated high academic achievement in these subjects. The camp will be limited to seventy two (72) qualified participants on a first-come, first-served basis. Application forms can obtained by printing one from the website at ***http://www.engr.uiuc.edu/wie/games/summercamp5e.htm,*** or by calling the WIE office at 217-244-3517. Applications must be mailed NO LATER THAN JUNE 30, 2000, to the WIE office at:: Women in Engineering Program, 322 Ceramics Bldg., MC-272, Urbana, IL 61801, Attn: GAMES

REVIEW

Sunday Murray Cummins
Dr. Howard Elementary School
Champaign Illinois

PLANT GROWTH: A PARTNERSHIP OF PARTS

Plant Growth: A Partnership of Parts is an appealing new resource tool from the Midwest Public Garden Collaborative. This investigation into plant science is geared toward grades 2-4. Lessons are designed to help students better understand the essential role roots and stems play in providing water, nutrients, and support to the entire plant system. The activities have been aligned with the National Science Standards and the Benchmarks for Science Literacy developed at the American Association for the Advancement of Science Project 2061.

For more information, contact The Evergreen Project, 500 South Ewing, Suite C, St. Louis, MO 63103 or call 1-800-927-9229.

Features:

- Lessons and activities include such topics as the parts of a plant, the interrelationship of plan parts in growth, what plant part takes in water, osmosis, the root system of a plant, different types of germinating seeds, how stems transport water through the plant, a plant's response to light, and how to estimate the age of a tree.
- An entertaining fifteen minute video shows how different types of seeds find places to germinate. The students will see how seeds are blown by the wind and carried by animals or water to just the right spot for germination. The host even discusses how some very special plants scatter their own seeds.
- The teacher's manual includes a unit timeline, assessment tools, and detailed lesson plans. The multisensory and interdisciplinary lesson plans are outlines neatly with a summary of the lesson, a materials list, and procedures. There and many engaging activities including assembling a flashlight as a metaphor for plant parts working together, hands-on experiments with bean seedlings, raisins, corn seeds, celery, and carnations, games, and role playing activities.
- The CD has interactive pages with activities that supplement most of the lessons. The activities include an interactive story, diagrams for plants and experiments with simple explanations, directions for student investigations, and games. The activities area attractive, fun, and will be easily navigated by students.
- There is also an optional multimedia component to the CD that requires computer access to the Internet. The students can send articles they have written about plants to the Evergreen Dispatch, an online newspaper published by the Missouri Botanical Garden. All articles received will be posted.
- Student journals and transparencies are also included on the CD.

AWARDS AND RECOGNITION

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NATIONAL BOARD CERTIFICATION IS IT RIGHT FOR YOU?

I recently attended a meeting at my local teachers Union. At this meeting there was considerable talk about how there will be many teachers pursuing the National Board for Professional Teaching Standards Certification. As a recent National Board Certified Teacher (1999) in Adolescent and Young Adulthood Science, I was asked by the editor of Spectrum to write about the process of certification and offer some advise on the process.

First, I strongly urge all teachers to think about National Board Certification. The process is a tremendous learning experience and I truly believe the process makes you a better teacher. There are of course some rewards when you become a National Board Certified Teacher—namely, a new Illinois Master Teaching Certificate that has a ten-year period of validity. Some districts do offer additional finical compensation, but by far the biggest benefit that is being talked about it the ten year teaching certificate.

Those teachers interested in the National Board process need to understand that it is a comprehensive assessment of your teaching ability. Additionally, it is a comprehensive assessment of your ability to interpret and implement the National Science Standards within your classroom. The first piece of advice that I offer to those interested in receiving a Master Teaching Certificate is that you need to critically examine your teaching practices within your classroom. Read the National Science Standards, re-read the Standards and then internalize the Standards. There are six portions to the portfolio that you submit to the National Board for Professional Teaching Standards. Teaching a Major Idea Over Time, Assessing Student Work, Active Scientific Inquiry, Whole Class Discussion about Science, Documented Accomplishments in the Community, and Documented Accomplishments in Outreach to Families and Community. All of the entries need to be firmly tied to the National Science Standards. Additionally, candidates need to take comprehensive 90-minute exams during the summer.

The second piece of advice that I offer to those interested in a Master Teaching Certificate is to think about why you want it! National Board Teachers have been surveyed about how much time they have invested in the process and on average teachers have reported more than 200 out-of-class hours spent solely on the portfolio entries! When most candidates are finished they file reports of feeling very relieve and exhausted. As a National Board Certified Teacher, I have heard those who do not have certification say that the National Board process is nothing more than "jumping" though a series of hoops and that if you have the stamina you will receive National Board Certification. I can only say that last year only three teachers in Illinois received certification in the Adolescent and Young Adulthood Science certification and quite a few did not.

I have one observation to share with Spectrum readers. As a National Board Certified Teacher and a new Master Certificate holder with ten-year validity, I can not image not pursuing professional development and taking it easy for the next few years. This is contrary to all the things that are required of National Board Certified teachers. This summer I am planning to attend (on my own time) a one month long research opportunity at the National Optic Observatories at Kitt Peak, AZ to participate in Research Based Science Education in Astronomy – so much for taking it easy.

During the course of my certification process and as part of being a National Board Certified Teacher I have meet many other National Board Certified teachers and overwhelmingly they all share a deep commitment to education and improving their ability to deliver the best form of education they can. I caution those who are considering certification for the sole purpose of receiving ten years of no professional development.

In conclusion, I urge all teachers to consider becoming a National Board Certified Teacher. The positive impact that it has had on my own teaching practices has been profound, and all of the National Board Teachers that I have contact with report the same. I personally offer to help any of my science colleagues who are interested pursuing certification. Please feel free to e-mail with questions or comments at the above address.

DON'T FORGET TO APPLY FOR THE ISTA TEACHER AWARDS

CONTACT AWARDS CHAIR HEATHER HENDRIX TODAY
hhendrix70@hotmail.com

or Diana Dummitt
<ddummitt@uiuc.edu> 217-244-0173

WRITE FOR *SPECTRUM*

The quality of *The Spectrum* is directly proportional to the relevance of its contents to your classroom. This invitation is a request for you to help colleagues across the state to take advantage of your experience.

In responding to this invitation, you will get a three-fold return on the opportunity. You will: 1) obtain experience in publishing; 2) receive some "feed-back" from the teachers across the state about your idea(s), and; 3) participate in the responsibility that is key to science: The communication of ideas!

With this in mind, share with us your teaching ideas for curriculum, laboratory experiences, demonstrations, assessment, portfolios and any innovations you have found to be successful with science students. Photographs for the cover are also needed. Please send:

- a typed or printed, double-spaced copy with standard margins.
- if possible, the article on disk (IBM or Mac) saved in RTF format, in addition to a hard copy, or sent electronically as an attached RTF document. Email to: ddummitt@uiuc.edu
- a title page with the author's name and affiliations, a brief biographical sketch ofthree or four sentences, home address, home telephone number (If there is more than one author, send all information for each), and e-mai address (if applicable).
- black and white photographs that are of good composition and high contrast.
- sketches, figures, and tables when appropriate.
- references if necessary—format is your choice.
- indicate whether or not the article has been published or submitted elsewhere.

Spectrum is published 3 times a year. Materials submitted must reach the editor by the following dates: June 15, October 1, February 15. Materials, including photographs, will be returned only if accompanied by a request in writing and a self-addressed stamped envelope.

CALENDAR YEAR 2000 MEMBERSHIP CATEGORIES

Any person interested in science education is eligible for membership. All memberships include a subscription fo the SPECTRUM and a subscription to the Newsletter, the ACTION. Write the number of the option for the membership category on the Membership Form on the back cover. Join now and your 2000 dues will be in force until January 2001. Membership year runs for the calendar year January 1 through December 31.

Option 1: Full Membership Dues- $35.00

Full Membership entitles individuals interested in Illinois science education to the following benefits: a one year subscription to the SPECTRUM, and ISTA ACTION. publications of the Illinois Science Teachers Association; notification of regional conferences and meetings; invitations to science issues activities; a reduced registration fee for the Annual ISTA Conference; voting privileges; and the opportunity to hold an ISTA Officer position.

Option 2: Two Year Full Membership Dues- $60.00

Two Year Full Membership entitles member to Full Membership benefits for two years.

Option 3: Five Year Full Membership Dues- $125.00

Five Year Full Membership entitles member to Full Membership benefits for five years.

Option 4: Associate Membership Dues- $15.00

Associate Student Membership applies to full-time students who are not currently employed as professional educators (Requires the signature and institutional affiliation of the student's professor). Entitles member to Full Membership benefits, with the exception of voting privileges and the opportunity to hold an ISTA Officer position. Associate Retired Membership applies to individuals who are on retirement status. Entitles member to Full Membership benefits, with the exception of voting privileges and the opportunity to hold an ISTA Officer position

Option 5: Institutional Membership - $75.00

Institutional Membership entitles the member institution, for a period of one year, to two subscriptions to the SPECTRUM and ISTA ACTION; notification of regional conferences and meetings; invitations to science issues activities; and a reduced registration fee for the Annual ISTA Conference for a maximum of three members of the institution.

COUNTIES IN EACH REGION(FOR REGION NUMBER ON MEMBERSHIP FORM)

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Region III	Henderson, Warren, Knox, Stark, Peoria, Hancock, McDonough, Fulton, Tazewell, Schuyler, Mason, Adams, Brown, Cass, Menard, Pike, Scott, Morgan, Sangamon, Christian
Region IV	Woodford, Livingston, Ford, Iroquois, McLean, Logan, DeWitt, Piatt, Champaign, Vermillion, Macon, Shelby, Moultrie, Douglas, Edgar, Coles, Cumberland, Clark
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Region VII	City of Chicago only

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ILLINOIS SCIENCE TEACHERS ASSOCIATION
MEMBERSHIP APPLICATION

PLEASE PRINT OR TYPE AND FILL OUT COMPLETE FORM

Name	Day phone
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Address of above organization	Home address
City, State, Zip Code	City, State, Zip Code
e-mail and/or FAX	

CHECK APPLICABLE CATEGORIES IN EACH COLUMN

o Elementary Level	o Elementary Sciences	o Teacher
o Middle Level	o Life Science/Biology	o Administrator
o Senior High School	o Physical Sciences	o Coordinator
o Community College	o Environmental Science	o Librarian
o College/University	o Earth Science/Geology	o Student
o Industry/Business/ Government	o Chemistry	o Retired
	o Physics	
o Other_____	o General Science	
	o Integrated Science	
	o Other_____	

Send form and check or money order made payable to Illinois Science Teachers Association to: Diana Dummitt, ISTA Membership, College of Education, University of Illinois, 1310 S. Sixth Street, Champaign, IL 61820

REGION (FROM INSIDE BACK COVER) _____

MEMBERSHIP OPTION (See page 48)_____

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