

COURSE SYLLABUS

ELED 4314
Spring 2022
METHODS OF TEACHING ELEMENTARY SCIENCE

Semester: Spring 2022

Time: 2:00 – 4:45 p.m

Day: Wednesday

Location: BEP 218

Instructor Information: Beatrice Taylor, Ph.D.
Instructor STEM Education

Office: HPR 263– U Teach/Ingenuity Center
Office Hours: email for individual appointment or zoom session
Office Telephone: 903-566-7132 (share with Dr.Odell)
E-mail: contact through Canvas or BeatriceTaylor@uttyler.edu

Course Catalog Description:

A process approach will be emphasized in the study of selected science programs drawn from the biological, earth and physical sciences. **Prerequisite:** EDUC 3310 and EPSY 3330, three four credit hours of life science and three four credit hours of physical science with labs, admission to the School of Education.

Student Learning Outcomes:

This course is designed to prepare you to teach science in grades K-6. To achieve this goal, you will have the opportunity to explore science as a way of knowing the world and as a tool for problem solving. We will be actively engaged in *doing* science as well as talking and reading about science. We will be exploring science as it relates to the formal classroom setting and the informal settings outside the classroom. We will also be examining science as it relates to and integrates with other subject areas.

Course Topics and/or Student Learning Outcomes	Activities	Assessment (including performance-based)	Standards Alignment
1. Integrate content standards in a variety of curricula that are developmentally appropriate, interesting, and relevant to student's lives, organized around inquiry, and connected with other school subjects	<ul style="list-style-type: none">StemscopesTEKS ResourcesGLOBEFieldtrips	<ul style="list-style-type: none">5th gd STAARLesson PlansDiscussionsReflections	TES; 1A,B, C, E, 2A, B, C ISTE: 1c INTASC: 1, 2, 3, 4, 5, 7, 8, 9] TEKS: 112.11, 112.12,112.13, 112.14, 112.15, 112.16
2. Create and teach lessons that reflect accurate knowledge of science content, the nature of science, science process skills, use of technology in science teaching, assessment, and science pedagogy	<ul style="list-style-type: none">5 E Lesson Plan	<ul style="list-style-type: none">Peer ReviewLesson Plan Format	TES 3 A B C, 4 B,C, 5, A,B,C,D ISTE: 1 b, 1c, 2c, 4a, 4b, 4c INTASC: 1,2,3,4,5,6,7,8 TEKS: 112.11, 112.12,112.13, 112.14, 112.15, 112.16

3. Reflect upon their teaching experiences noting areas of strength and weakness and develop plans to improve their practice.	<ul style="list-style-type: none"> Peer Review Lesson plan review State accountability data 	<ul style="list-style-type: none"> Reflections Discussion Boards 	TES 6 a,b,d ISTE: 4a, 4b, 4c , 7c INTASC 9
4. Choose from a variety of activity types in order to teach science in a way to address student needs including collaboration with colleagues, other school professionals, and the community	<ul style="list-style-type: none"> GLOBE Stemscopes Online TEKS Resource 	<ul style="list-style-type: none"> Lesson Plan Format 	TES: 3 A B C, 4 B,C, 5, A,B,C,D ISTE: 4,a,b,c 5. B, 7a INTASC: 2,3,4,5,7,8,10 TEKS: 112.11, 112.12,112.13, 112.14, 112.15, 112.16

Expectations:

Class Participation: This course is designed as a hybrid format. This course utilizes small-group learning activities, whole-class discussions, demonstrations, and outside-of-school activities to model best science teaching practice and effective strategies for students. The outside-of-class experiences include completing assignments and visiting field trip sites that would be useful for science teaching. Regular attendance is very important since much of what we will learn will be condensed this semester.

The class will be divided with groups meeting alternate weeks. Interspersed will be online or fieldtrip classes. Group classes may have to be adjusted to accommodate field trip date. **Dates for classes and outside/online activities will be given at the first class meeting.** Class groups will be established once the total enrolment has been determined. Face-to-face classes begin promptly at the scheduled class time. **Please e-mail me before class if you plan on being absent.** A doctor's excuse **must be presented** for it to be an Excused Absence. Please allow up to 24 hours for response to an email. **IF YOU ARE TARDY MORE THAN 15 MINUTES AFTER CLASS HAS STARTED, POINTS WILL BE DEDUCTED FOR ATTENDANCE ON THAT DAY.**

Attendance: This course is part of your professional practice. You are expected to attend every face-to-face class meeting. Course objectives and performance outcomes cannot be met unless you attend class and participate in class activities. If you are absent for an extended period of time, you should make arrangements to explore options such as retaking the course or taking an incomplete grade. If you miss more than two in-class periods, you will need to make an appointment with the instructor for a possible Disposition Conference. If you are going to be absent for an exam, you must contact the instructor on or before the scheduled time the exam is to be given. **A sign in sheet will be available the first 15 minutes of the class. Entrance after 2:15 will have to be signed in with the professor.**

You are responsible for all information given in class, online, and in the syllabus. **Upcoming due dates will be written on the board at each class. They supersede the syllabus or Canvas.**

Read assigned articles prior to each class meeting.

You are responsible for this information on tests as well as discussions during class participation.

Late work: **Assignments will be locked after the due date.** Late work may be accepted for some submissions upon approval by the professor. Reflections are meant to be a way to think about your learning and build upon it. If turned in at the end of the semester, this opportunity to learn is lost. Due dates for everything will be posted on

the classroom board each class period. You may want to take a picture for later reference as this will be the most current information.

Fieldtrips/Outside Activities:

Academic Rodeo: Students will participate in the judging of the Science Fair on **Wednesday, February 2**. Information will be given in class prior to this date. Class will meet at the **East Texas Fair Grounds** off Front Street.

Camp Tyler (Fieldtrip): You will be expected to participate in a Camp Tyler Fieldtrip. The experiences will occur during class hours on **(dates to be determined by the first class)**. Dress for the weather as you will be outside the entire time.

Discovery Science Place Experience (Fieldtrip): You will be expected to participate in a DSP Fieldtrip. The experience will occur during class hours **(date to be determined by the first class)**.

Course Grading/Evaluation:

<i>Lesson plans</i>	<i>(25%)</i>
<i>Participation: Discussions/In-Class activities/Attendance</i>	<i>(25%)</i>
<i>Classroom Assessments</i>	<i>(5%)</i>
<i>Online activities</i>	<i>(25%)</i>
<i>Final Exam or Project</i>	<i>(20%)</i>
	<i>100%</i>

NOTE: Unexcused absences will receive no points for attendance for that day. Excused absences will not be counted as a grade. Late Assignments, if accepted, may carry a (-10%) penalty per assignment. Signing in for an absent/late classmate is prohibited and considered academic dishonesty.

Course Grading/Evaluation Details

Lesson plans (25%)	Points
▪ 5E Drafts- producing (25 +75 pts + 50 pts)	150
▪ 5E Unit/Lesson Plan (Summative Product)	130
Total Points	280
Participation: Reflections/In-Class activities/Workshops (25%)	
<i>Fieldtrips and Associated Activities</i>	
○ Fieldtrip: Camp Tyler	50
○ Fieldtrip: Discovery Science Place/Academic Rodeo	50
○ Reflections on Fieldtrips/GLOBE 3@20	60
<i>Class Curriculum Workshops: Attendance</i>	
• Module #1 –	15
• Module #2 –	15
• Module #3 –	15
• Module #4 –	15
• Module #5 –	15
▪ Total Points	235

Classroom Assessments (5%)	
Content quizzes (3) @10	30
5 th Grade Science STAAR Test -for taking	25
Total Points	55
Online Activities (25%)	
Globe	30
TCTA	30
Websites (3)	30
TEKS vertical alignment	20
Total Points	110
Grand Total Points	680
Final Exam/Product (20%):	100
Websites into Google Docs	10
Lesson Plan into Google Docs	10
TOTAL POINTS FOR COURSE	800

A = 90-100% of total points
 B = 80-89% of total points
 C = 70-79% of total points
 D = 60-69% of total points
 F = 59% or below of total points

Required Text, Materials/Supplies, and Related Readings:

Suggested Resource

TexES Core Subjects EC-6: Texas Examinations of Educator Standards. Luis A. Rosado, Ed.D. 978-0-7386-1199-0. This book will help you pass the Texas Core Subject exam to be certified in Texas. (In the bookstore.)

Related Readings

Texas Education Agency (TEKS) – <http://ritter.tea.state.tx.us/rules/tac/chapter112/ch112a.html>

The Texas Higher Education Coordinating Board College and Career Readiness Standards –

College and Career Readiness Standards <http://www.theccb.state.tx.us/files/dmfile/CCRS081009FINALUTRevisions.pdf>

Texas Educator Standards

[https://texreg.sos.state.tx.us/public/readtac\\$ext.TacPage?sl=R&app=9&p_dir=&p_rloc=&p_tloc=&p_ploc=&pg=1&p_tac=&ti=19&pt=2&ch=149&rl=1001](https://texreg.sos.state.tx.us/public/readtac$ext.TacPage?sl=R&app=9&p_dir=&p_rloc=&p_tloc=&p_ploc=&pg=1&p_tac=&ti=19&pt=2&ch=149&rl=1001)

Suggested Class Web Sites

<http://www.BIE.org>

<http://www.Learner.org>

<http://www.edutopia.org>

<http://essea.strategies.org/>

<http://www.globe.gov>

<https://www.teachingchannel.org/>

<http://www.teachertube.com/>

Additional selected readings may be provided by the instructor.

Additional Information:

Field Requirement: You are required to complete 30 hours of field at an assigned elementary classroom. You are evaluated on two observed lessons by a university supervisor using the SOE Clinical Observation Rubric (COR). You must successfully complete the practicum according to your university supervisor in order to pass this course.

Other Course Policies and Guidelines:

Mobile Devices (e.g. iPads, Cell Phones)/Laptops:

All electronic devices need to be set to silent mode during class time. Devices may be used for science class activities ONLY

Laptops are necessary each class for your class experience but should be closed unless needed during the activity. **Cell phones may not have a screen that is large enough to do the activities required in class.** It is a sign of respect to work only on the class in which you are in attendance.

Assignment Submission:

- Put your name, title of the assignment and date submitted on your paper.
- **Upload written assignments on Canvas.**
- * When assignments/reflections have numbered questions, **write the number and question when answering.**
- * When referencing a TEKS, **write the number and the written description of the TEKS (5.4A).**

Papers that do not meet these specifications will have points deducted for not following instructions. Papers that are returned so that concerns can be addressed will be given a 0 until they are resubmitted. Additional points may be earned but only total points will be given for the first submission. Please do not send a message stating that you really want an A in the class; everyone does.

Read assigned articles prior to the class meeting.

You are responsible for this information on tests as well as be able to discuss during class participation.

Criteria for all assignments will be available in class and posted online unless otherwise notified by the instructor.

Canvas– You are responsible for enrolling in **Canvas** prior to the second class meeting and monitoring the course site regularly for course information. Assignments for Canvas will be turned in through the assignment tab.

Turnitin is a tool that will be used to check a document for plagiarism. The tool provides feedback as to whether or not the text in a document is a close match with other documents on the Internet, in journal databases, and submitted to Blackboard. If a student is caught plagiarizing, a grade of zero will be given as well as a disposition for cheating.

Reflections – Students are expected to provide well thought out responses to discussion questions. Sometimes the professor will make comments or ask follow-up questions. **Students are expected to respond to follow-up questions.**

Rubric for Reflections

Contributions	Description	Points Assigned
Provocative	Response goes beyond simply answering the prompt; attempts to stimulate further thought and discussion.	20
Substantial	Response provides most of the content required by the prompt but does not require further analysis of the subject.	15
Superficial	Response provides obvious information without further analysis of the concept; lacks depth of knowledge or reasoning	10
Incorrect	Response does not accurately address the prompt; rambling and/or without consistency	5
None	No response provided to the prompt	0

Dispositions - All students in the UT Tyler Teacher Preparation Program must adhere to the professional behaviors outlined in the *UT Tyler School of Education Dispositions*. These dispositions are listed at the following website:
<http://www.uttyler.edu/education/documents/Dispositions.pdf>

Last day to withdraw from course: March 28, 2022.

Due to the structure of this course being hybrid, the following schedule will be followed:

	Week 1: January 12	(A/B)
	Week 2: January 19	(A)
	Week 3: January 26	(A/B)
	Week 4: February 2	ACADEMIC RODEO
	Week 5: February 9	(B)
	Week 6: February 16	(A) Camp Tyler/(B)TCTA Articles Online
	Week 7: February 23	(A)
	Week 8: March 2	(B)
	March 7-11	Spring Break
	Week 9: March 16	(A) TCTA Articles Online/ (B) Camp Tyler

	Week 10: March 23	(A)	
	Week 11: March 30	(B)	
	Week 12: April 6	(A/B) GLOBE Online	
	WEEK 13: April 20	(A)	
	Week 14: April 27	(B)	
	Week 15: April 28	Final	
Date	Class	Due Group A	Due Group B
January 12, 2022 Module #1	*Syllabus *Sign up TCTA *Intro TEKS/Vertical alignment *Study groups *Pick a TEKS based on your grade obs *Begin STAAR	Class – January 12	Class – January 12
Jan 17		*TEKS vertical alignment K-5. Canvas *Reflection on your TEKS alignment. Canvas	*TEKS vertical alignment K-5. *Reflection on your TEKS alignment. Canvas
Jan 19 & Feb 9 Module #2	*Analyze STAAR *Stemscope *Lead4ward *Intro 5E Lesson Plan	Class – Jan 19	Class – Feb 7
Jan 26		*Finish STAAR *Grade your test *STAAR Reflection - Canvas	*Finish STAAR *Grade your test *STAAR Reflection - Canvas

Jan 26 & Feb 2 Module #3		Class – Jan 26	Class – Feb 2
Sept 20		*Beginning lesson plan from <i>Author’s Name</i> through <i>Vocabulary</i> - Canvas	
Sept 27			*Beginning lesson plan from <i>Author’s Name</i> through <i>Vocabulary</i> - Canvas
Feb 16 Module #4		GROUP A – CAMP TYLER	GROUP B – online TCTA Articles (3) *Texting Your Way Into Trouble *First Impressions *A.L.I.C.E.
Oct 4		*Camp Tyler Reflection Canvas	*TCTA Reflections – Canvas
Feb 23 & Mar 2 Module #5	*Engage, Explore & Explain *Lesson – Ecosystem Interactions	Class – Feb 23 Quiz: Ecosystem Interactions - class	Class – Mar 2 Quiz: Ecosystem Interactions - class
Oct 11		5E – Engage, Explore & Explain. Canvas	
Oct 18			5E – Engage, Explore & Explain. Canvas
Mar 16 Module #6		Camp Tyler GROUP B	TCTA articles (3)
Oct 25		Camp Tyler Reflection Canvas	TCTA Reflection on articles - Canvas
Mar 23 & 30	* Peer Review first 5E’s	Class- Mar 23	Class – Mar 30

Module #7	*Elaborate & Evaluate *Lesson – Insulators & Conductors *Websites	Quiz: Insulators & Conductors - class	Quiz: Insulators & Conductors - class
-----------	---	---------------------------------------	---------------------------------------

Nov 1		Elaborate & Evaluate Submission - Canvas	
Nov 8			Elaborate & Evaluate Submission - Canvas
Nov 10	GLOBE	Online- Canvas	Online - Canvas
Nov 15		GLOBE Reflection - Canvas	GLOBE Reflection - Canvas
April 6 Module #8	*Peer Review Elaborate & Evaluate *Share websites *Lesson – Structures & Functions	Class – Nov 17 Quiz: Structures & Functions – class	Class – Dec 1 Quiz: Structures & Functions - class
Nov 22		*5E Final submission *3 Websites that support your lesson at the bottom of your lesson	
April 27			*5E Final Submission *3 Websites that support your lesson at the bottom of your lesson

***APRIL 27, 2022 FINAL EXAM – ONLINE. TIME SCHEDULE MAY BE 4:15 – 6:15. MUST BE SUBMITTED BY 6:15 PER UNIVERSITY REGULATIONS!!!!

****Changes to this syllabus may be made due to community organization or at the discretion of the instructor. It is the student's responsibility to keep up with the changes.***

COLLEGE OF EDUCATION AND PSYCHOLOGY (CEP) VISION AND MISSION

Vision: The College of Education and Psychology is nationally recognized and respected for its academic programs and opportunities. It is a center of academic excellence, scholarly inquiry, and public service. The College prepares leaders to meet the critical challenges of the 21st Century through productive contributions to local and global communities and toward individual and cultural equity.

Mission: The mission of the College of Education and Psychology is to provide a positive environment that fosters the acquisition of knowledge and skills. The mission is individually and collectively realized through a community of scholars that contributes to knowledge through scholarly inquiry; organizes knowledge for application, understanding and communication; and provides leadership and service. We affirm and promote global perspectives that value individual and cultural diversity to enhance learning, service, and scholarship.

Course Policies:

Canvas. Students will access all components of the course through Canvas. Any changes to the course schedule, schedule of assignments, or any special assignments will be posted on Canvas. Students are expected to regularly check Canvas for updates and to download class handouts.

Make/Up Discussions and Quizzes. There will be NO make/up activities or exams for this course unless missing online work is due to an emergency or other reason previously discussed with the professor.

Academic Dishonesty. To be successful in this class, you must invest time for study. Honesty is expected. Academic dishonesty (cheating, plagiarism, collusion) will NOT be tolerated and will result in a grade of zero (0) for the assignment. A second infraction will result in automatic failure of the class. Dishonesty is defined as (i) the use of unauthorized materials, (ii) any communication with peers during quizzes, (iii) representing another's work as one's own (i.e. plagiarism) or (iv) fabricating information. The professor reserves the right to determine occurrences of cheating. Additional information on Academic Dishonesty is found in the Selected University Policies section of this syllabus.

Teacher Candidate Dispositions. The University of Texas at Tyler School of Education has developed a **Teacher Candidate Disposition Assessment** outlining professional behaviors educators are expected to demonstrate in their interactions with students, families, colleagues and communities. The process assumptions, dispositions to be assessed, and examples of deficiencies within each disposition assessment categories are available at the UT Tyler School of Education website: www.uttyler.edu/education (access School of Education; School of Education Disposition Assessment). It is expected that all students enrolled in EDSP 4269 will adhere to and demonstrate these teacher candidate dispositions at all times.

Safe Zone. The professor considers this online classroom to be a place where you will be treated with respect as a human being - regardless of gender, race, ethnicity, national origin, religious affiliation, sexual orientation, political beliefs, age, or ability. Additionally, diversity of thought is appreciated and encouraged, provided you can agree to disagree. It is the professor's expectation that ALL students consider our online classroom a safe environment.

UNIVERSITY POLICIES

UT Tyler Honor Code

Every member of the UT Tyler community joins together to embrace: Honor and integrity that will not allow me to lie, cheat, or steal, nor to accept the actions of those who do.

Students Rights and Responsibilities

To know and understand the policies that affect your rights and responsibilities as a student at UT Tyler, please follow this link: <http://www.uttyler.edu/wellness/rightsresponsibilities.php>

Campus Carry

We respect the right and privacy of students 21 and over who are duly licensed to carry concealed weapons in this class. License holders are expected to behave responsibly and keep a handgun secure and concealed. More information is available at <http://www.uttyler.edu/about/campus-carry/index.php>

Tobacco-Free University

All forms of tobacco will not be permitted on the UT Tyler main campus, branch campuses, and any property owned by UT Tyler. This applies to all members of the University community, including students, faculty, staff, University affiliates, contractors, and visitors. Forms of tobacco not permitted include cigarettes, cigars, pipes, water pipes (hookah), bidis, kreteks, electronic cigarettes, smokeless tobacco, snuff, chewing tobacco, and all other tobacco products. There are several cessation programs available to students looking to quit smoking, including counseling, quitlines, and group support. For more information on cessation programs please visit <http://www.uttyler.edu/tobacco-free>

Grade Replacement/Forgiveness and Census Date Policies

Students repeating a course for grade forgiveness (grade replacement) must file a Grade Replacement Contract with the Enrollment Services Center (ADM 230) on or before the Census Date of the semester in which the course will be repeated. (For Spring, the Census Date is January 29.) Grade Replacement Contracts are available in the Enrollment Services Center or at <http://www.uttyler.edu/registrar>. Each semester's Census Date can be found on the Contract itself, on the Academic Calendar, or in the information pamphlets published each semester by the Office of the Registrar.

Failure to file a Grade Replacement Contract will result in both the original and repeated grade being used to calculate your overall grade point average. Undergraduates are eligible to exercise grade replacement for only three course repeats during their career at UT Tyler; graduates are eligible for two grade replacements. Full policy details are printed on each Grade Replacement Contract.

The Census Date (January 29) is the deadline for many forms and enrollment actions of which students need to be aware. These include:

- ☑ Submitting Grade Replacement Contracts, Transient Forms, requests to withhold directory information, approvals for taking courses as Audit, Pass/Fail or Credit/No Credit.
- ☑ Receiving 100% refunds for partial withdrawals. (There is no refund for these after the Census Date)
- ☑ Schedule adjustments (section changes, adding a new class, dropping without a "W" grade)
- ☑ Being reinstated or re-enrolled in classes after being dropped for non-payment

☐ Completing the process for tuition exemptions or waivers through Financial Aid

State-Mandated Course Drop Policy

Texas law prohibits a student who began college for the first time in Fall 2007 or thereafter from dropping more than six courses during their entire undergraduate career. This includes courses dropped at another 2-year or 4-year Texas public college or university. For purposes of this rule, a dropped course is any course that is dropped after the census date (See Academic Calendar for the specific date).

Exceptions to the 6-drop rule may be found in the catalog. Petitions for exemptions must be submitted to the Enrollment Services Center and must be accompanied by documentation of the extenuating circumstance. Please contact the Enrollment Services Center if you have any questions.

Disability Services

In accordance with Section 504 of the Rehabilitation Act, Americans with Disabilities Act (ADA) and the ADA Amendments Act (ADAAA) the University offers accommodations to students with learning, physical and/or psychiatric disabilities. If you have a disability, including non-visible disabilities such as chronic diseases, learning disabilities, head injury, PTSD or ADHD, or you have a history of modifications or accommodations in a previous educational environment you are encouraged to contact the Student Accessibility and Resources office and schedule an interview with the Accessibility Case Manager/ADA Coordinator, Cynthia Lowery Staples. If you are unsure if the above criteria applies to you, but have questions or concerns please contact the SAR office. For more information or to set up an appointment please visit the SAR office located in the University Center, Room 3150 or call 903.566.7079. You may also send an email to cstaples@uttyler.edu

Student Absence due to Religious Observance

Students who anticipate being absent from class due to a religious observance are requested to inform the instructor of such absences by the second class meeting of the semester.

Student Absence for University-Sponsored Events and Activities

If you intend to be absent for a university-sponsored event or activity, you (or the event sponsor) must notify the instructor at least two weeks prior to the date of the planned absence. At that time the instructor will set a date and time when make-up assignments will be completed.

Missing Class Due to Certification Exams

Missing class to take a certification exam is not excused. All EC-6 related exams are offered on multiple days. Do not schedule during class time.

Social Security and FERPA Statement:

It is the policy of The University of Texas at Tyler to protect the confidential nature of social security numbers. The University has changed its computer programming so that all students have an identification number. The electronic transmission of grades (e.g., via e-mail) risks violation of the Family Educational Rights and Privacy Act; grades will not be transmitted electronically.

Emergency Exits and Evacuation:

Everyone is required to exit the building when a fire alarm goes off. Follow your instructor's directions regarding the appropriate exit. If you require assistance during an evacuation, inform your instructor in the first week of class. Do not re-enter the building unless given permission by University Police, Fire department, or Fire Prevention Services.

Student Standards of Academic Conduct: Disciplinary proceedings may be initiated against any student who engages in scholastic dishonesty, including, but not limited to, cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or in part to another person, taking an examination for another person, any act designed to give unfair advantage to a student or the attempt to commit such acts.

(i) "Cheating" includes, but is not limited to:

- copying from another student's test paper;
- using, during a test, materials not authorized by the person giving the test;
- failure to comply with instructions given by the person administering the test;
- possession during a test of materials which are not authorized by the person giving the test, such as class notes or specifically designed "crib notes". The presence of textbooks constitutes a violation if they have been specifically prohibited by the person administering the test;
- using, buying, stealing, transporting, or soliciting in whole or part the contents of an unadministered test, test key, homework solution, or computer program;
- collaborating with or seeking aid from another student during a test or other assignment without authority;
- discussing the contents of an examination with another student who will take the examination;
- divulging the contents of an examination, for the purpose of preserving questions for use by another, when the instructors has designated that the examination is not to be removed from the examination room or not to be returned or to be kept by the student;
- substituting for another person, or permitting another person to substitute for oneself to take a course, a test, or any course-related assignment;
- paying or offering money or other valuable thing to, or coercing another person to obtain an unadministered test, test key, homework solution, or computer program or information about an unadministered test, test key, home solution or computer program;
- falsifying research data, laboratory reports, and/or other academic work offered for credit;
- taking, keeping, misplacing, or damaging the property of The University of Texas at Tyler, or of another, if the student knows or reasonably should know that an unfair academic advantage would be gained by such conduct; and
- misrepresenting facts, including providing false grades or resumes, for the purpose of obtaining an academic or financial benefit or injuring another student academically or financially.

(ii) "Plagiarism" includes, but is not limited to, the appropriation, buying, receiving as a gift, or obtaining by any means another's work and the submission of it as one's own academic work offered for credit.

(iii) "Collusion" includes, but is not limited to, the unauthorized collaboration with another person in preparing academic assignments offered for credit or collaboration with another person to commit a violation of any section of the rules on scholastic dishonesty.

(iv) All written work that is submitted will be subject to review by SafeAssign™, available on Blackboard.

UT Tyler Resources for Students:

- UT Tyler Writing Center (903.565.5995), writingcenter@uttyler.edu, <http://www.uttyler.edu/writingcenter/>
- UT Tyler Tutoring Center (903.565.5964), tutoring@uttyler.edu, <https://www.uttyler.edu/tutoring/>
- The Mathematics Learning Center, RBN 4021, This is the open access computer lab for math students, with tutors on duty to assist students who are enrolled in early-career courses.
- UT Tyler Counseling Center (903.566.7254) <https://www.uttyler.edu/counseling/>

COLLEGE OF EDUCATION AND PSYCHOLOGY (CEP) VISION AND MISSION

Vision: The College of Education and Psychology is nationally recognized and respected for its academic programs and opportunities. It is a center of academic excellence, scholarly inquiry, and public service. The College prepares leaders to meet the critical challenges of the 21st Century through productive contributions to local and global communities and toward individual and cultural equity.

Mission: The mission of the College of Education and Psychology is to provide a positive environment that fosters the acquisition of knowledge and skills. The mission is individually and collectively realized through a community of scholars that contributes to knowledge through scholarly inquiry; organizes knowledge for application, understanding and communication; and provides leadership and service. We affirm and promote global perspectives that value individual and cultural diversity to enhance learning, service, and scholarship.

UT TYLER'S SCHOOL OF EDUCATION STANDARDS FOR EDUCATOR PREPARATION PROGRAMS

Texas Education Standards: The School of Education are committed to teaching and implementing the Texas Educator Standards at the highest level. The School of Education faculty use the Texas Education Standards, along with the Interstate New Teacher Assessment and Support Consortium (InTASC) standards used by educator preparation programs throughout the United States.

SCHOOL OF EDUCATION PROGRAM STANDARDS

The School of Education has adopted program standards that guide the development of teacher candidates in their understanding of the complexity of teaching. These standards are based on those developed by the Interstate New Teacher Assessment and Support Consortium (InTASC) and shared by other accredited universities in Texas and across the United States. The Standards are broad understandings and practices gained throughout the program using a constructivist model in which new learnings are assimilated and attached to prior understandings, thus, over time, building a mental structure (schema) of educational concepts.

Standard #1: Learner Development (students in general)

The teacher understands how learners grow and develop, recognizing that patterns of learning and development vary individually within and across the cognitive, linguistic, social, emotional, and physical areas, and designs and implements developmentally appropriate and challenging learning experiences.

Texas Teacher Practice Standards: 1.2, 2.1, 2.2, 2.3, 4.1

Standard #2: Learning Differences (individual students)

The teacher uses understanding of individual differences and diverse cultures and communities to ensure inclusive learning environments that enable each learner to meet high standards.

Texas Teacher Practice Standards: 1.3, 2.1, 2.2, 2.3, 4.1

Standard #3: Learning Environments

The teacher works with others to create environments that support individual and collaborative learning, and that encourage positive social interaction, active engagement in learning, and self motivation.

Texas Teacher Practice Standards: 1.3, 1.4, 1.6, 2.3, 4.1, 4.2, 4.3, 4.4

Standard #4: Content Knowledge

The teacher understands the central concepts, tools of inquiry, and structures of the discipline(s) he or she teaches and creates learning experiences that make these aspects of the discipline accessible and meaningful for learners to assure mastery of the content.

Texas Teacher Practice Standards: 1.2, 1.5, 1.6, 3.1, 3.2, 3.3, 5.2

Standard #5: Application of Content

The teacher understands how to connect concepts and use differing perspectives to engage learners in critical thinking, creativity, and collaborative problem solving related to authentic local and global issues.

Texas Teacher Practice Standards: 1.5, 3.2, 3.3

Standard #6: Assessment

The teacher understands and uses multiple methods of assessment to engage learners in their own growth, to monitor learner progress, and to guide the teacher's and learner's decision making.

Texas Teacher Practice Standards: 1.6, 5.1, 5.2, 5.3, 5.4, 6.2

Standard #7: Planning for Instruction

The teacher plans instruction that supports every student in meeting rigorous learning goals by drawing upon knowledge of content areas, curriculum, cross-disciplinary skills, and pedagogy, as well as knowledge of learners and the community context.

Texas Teacher Practice Standards: 1.1, 1.2, 1.3, 5.1, 5.3, 5.4

Standard #8: Instructional Strategies

The teacher understands and uses a variety of instructional strategies to encourage learners to develop deep understanding of content areas and their connections, and to build skills to apply knowledge in meaningful ways.

Texas Teacher Practice Standards: 1.4, 1.5, 1.6, 5.4

Standard #9: Professional Learning and Ethical Practice

The teacher engages in ongoing professional learning and uses evidence to continually evaluate his/her practice, particularly the effects of his/her choices and actions on others (learners, families, other professionals, and the community), and adapts practice to meet the needs of each learner.

Texas Teacher Practice Standards: 3.2, 3.3, 6.1, 6.2, 6.4

Standard #10: Leadership and Collaboration

The teacher seeks appropriate leadership roles and opportunities to take responsibility for student learning, to collaborate with learners, families, colleagues, other school professionals, and community members to ensure learner growth, and to advance the profession.

Texas Teacher Practice Standards: 6.3, 6.4

Standard #11: Technology

The teacher is able to create, implement, and evaluate technology to enhance teaching, student learning, and other obligations (e.g. reports, grades, tests, etc.) required of teachers.

Texas Teacher Practice Standards: 1.5

Teacher Ethics: The School of Education is committed to producing highly ethical educators for the K-12 students of Texas. Our program interweaves the Code of Ethics and Standard Practices for Texas Educators throughout our program.

Code of Ethics and Standard Practices for Texas Educators

Texas Administrative Code

TITLE 19 EDUCATION

PART 7 STATE BOARD FOR EDUCATOR CERTIFICATION

CHAPTER 247 EDUCATORS' CODE OF ETHICS

RULE §247.2 *Purpose and Scope; Definitions*

(b) Enforceable Standards.

(1) Professional Ethical Conduct, Practices and Performance.

(A) **Standard 1.1.** The educator shall not intentionally, knowingly, or recklessly engage in deceptive practices regarding official policies of the school district, educational institution, educator preparation program, the Texas Education Agency, or the State Board for Educator Certification (SBEC) and its certification process.

(B) **Standard 1.2.** The educator shall not knowingly misappropriate, divert, or use monies, personnel, property, or equipment committed to his or her charge for personal gain or advantage.

(C) **Standard 1.3.** The educator shall not submit fraudulent requests for reimbursement, expenses, or pay.

(D) **Standard 1.4.** The educator shall not use institutional or professional privileges for personal or partisan advantage.

(E) **Standard 1.5.** The educator shall neither accept nor offer gratuities, gifts, or favors that impair professional judgment or to obtain special advantage. This standard shall not restrict the acceptance of gifts or tokens offered and accepted openly from students, parents of students, or other persons or organizations in recognition or appreciation of service.

(F) **Standard 1.6.** The educator shall not falsify records, or direct or coerce others to do so.

(G) **Standard 1.7.** The educator shall comply with state regulations, written local school board policies, and other state and federal laws.

(H) **Standard 1.8.** The educator shall apply for, accept, offer, or assign a position or a responsibility on the basis of professional qualifications.

(I) **Standard 1.9.** The educator shall not make threats of violence against school district employees, school board members, students, or parents of students.

(J) **Standard 1.10** The educator shall be of good moral character and be worthy to instruct or supervise the youth of this state.

(K) **Standard 1.11.** The educator shall not intentionally or knowingly misrepresent his or her employment history, criminal history, and/or disciplinary record when applying for subsequent employment.

(L) **Standard 1.12.** The educator shall refrain from the illegal use or distribution of controlled substances and/or abuse of prescription drugs and toxic inhalants.

(M) **Standard 1.13.** The educator shall not consume alcoholic beverages on school property or during school activities when students are present.

(2) Ethical Conduct Toward Professional Colleagues.

(A) **Standard 2.1.** The educator shall not reveal confidential health or personnel information concerning colleagues unless disclosure serves lawful professional purposes or is required by law.

(B) **Standard 2.2.** The educator shall not harm others by knowingly making false statements about a colleague or the school system.

(C) **Standard 2.3.** The educator shall adhere to written local school board policies and state and federal laws regarding the hiring, evaluation, and dismissal of personnel.

(D) **Standard 2.4.** The educator shall not interfere with a colleague's exercise of political, professional, or citizenship rights and responsibilities.

(E) **Standard 2.5.** The educator shall not discriminate against or coerce a colleague on the basis of race, color, religion, national origin, age, gender, disability, family status, or sexual orientation.

(F) **Standard 2.6.** The educator shall not use coercive means or promise of special treatment in order to influence professional decisions or colleagues.

(G) **Standard 2.7.** The educator shall not retaliate against any individual who has filed a complaint with the SBEC or who provides information for a disciplinary investigation or proceeding under this chapter.

(3) Ethical Conduct Toward Students.

(A) **Standard 3.1.** The educator shall not reveal confidential information concerning students unless disclosure serves lawful professional purposes or is required by law.

(B) **Standard 3.2.** The educator shall not intentionally, knowingly, or recklessly treat a student or minor in a manner that adversely affects or endangers the learning, physical health, mental health, or safety of the student or minor.

(C) **Standard 3.3.** The educator shall not intentionally, knowingly, or recklessly misrepresent facts regarding a student.

(D) **Standard 3.4.** The educator shall not exclude a student from participation in a program, deny benefits to a student, or grant an advantage to a student on the basis of race, color, gender, disability, national origin, religion, family status, or sexual orientation.

(E) **Standard 3.5.** The educator shall not intentionally, knowingly, or recklessly engage in physical mistreatment, neglect, or abuse of a student or minor.

(F) **Standard 3.6.** The educator shall not solicit or engage in sexual conduct or a romantic relationship with a student or minor.

(G) **Standard 3.7.** The educator shall not furnish alcohol or illegal/unauthorized drugs to any person under 21 years of age unless the educator is a parent or guardian of that child or knowingly allow any person under 21

years of age unless the educator is a parent or guardian of that child to consume alcohol or illegal/unauthorized drugs in the presence of the educator.

(H) **Standard 3.8.** The educator shall maintain appropriate professional educator-student relationships and boundaries based on a reasonably prudent educator standard.

(I) **Standard 3.9.** The educator shall refrain from inappropriate communication with a student or minor, including, but not limited to, electronic communication such as cell phone, text messaging, email, instant messaging, blogging, or other social network communication. Factors that may be considered in assessing whether the communication is inappropriate include, but are not limited to:

- (i) the nature, purpose, timing, and amount of the communication;
- (ii) the subject matter of the communication;
- (iii) whether the communication was made openly or the educator attempted to conceal the communication;
- (iv) whether the communication could be reasonably interpreted as soliciting sexual contact or a romantic relationship;
- (v) whether the communication was sexually explicit; and
- (vi) whether the communication involved discussion(s) of the physical or sexual attractiveness or the sexual history, activities, preferences, or fantasies of either the educator or the student

Source Note: The provisions of this §247.2 adopted to be effective March 1, 1998, 23 TexReg 1022; amended to be effective August 22, 2002, 27 TexReg 7530; amended to be effective December 26, 2010, 35 TexReg 11242

THE ISTE STANDARDS FOR EDUCATORS

1

Learner

Educators continually improve their practice by learning from and with others and exploring proven and promising practices that leverage technology to improve student learning. Educators:

1a

Set professional learning goals to explore and apply pedagogical approaches made possible by technology and reflect on their effectiveness.

1b

Pursue professional interests by creating and actively participating in local and global learning networks.

1c

Stay current with research that supports improved student learning outcomes, including findings from the learning sciences.

2

Leader

Educators seek out opportunities for leadership to support student empowerment and success and to improve teaching and learning. Educators:

VIEW INDICATORS

2a

Shape, advance and accelerate a shared vision for empowered learning with technology by engaging with education stakeholders.

2b

Advocate for equitable access to educational technology, digital content and learning opportunities to meet the diverse needs of all students.

2c

Model for colleagues the identification, exploration, evaluation, curation and adoption of new digital resources and tools for learning.

3

Citizen

Educators inspire students to positively contribute to and responsibly participate in the digital world. Educators:

[VIEW INDICATORS](#)

3a

Create experiences for learners to make positive, socially responsible contributions and exhibit empathetic behavior online that build relationships and community.

3b

Establish a learning culture that promotes curiosity and critical examination of online resources and fosters digital literacy and media fluency.

3c

Mentor students in safe, legal and ethical practices with digital tools and the protection of intellectual rights and property.

3d

Model and promote management of personal data and digital identity and protect student data privacy.

4

[Collaborator](#)

Educators dedicate time to collaborate with both colleagues and students to improve practice, discover and share resources and ideas, and solve problems. Educators:

[VIEW INDICATORS](#)

4a

Dedicate planning time to collaborate with colleagues to create authentic learning experiences that leverage technology.

4b

Collaborate and co-learn with students to discover and use new digital resources and diagnose and troubleshoot technology issues.

4c

Use collaborative tools to expand students' authentic, real-world learning experiences by engaging virtually with experts, teams and students, locally and globally.

4d

Demonstrate cultural competency when communicating with students, parents and colleagues and interact with them as co-collaborators in student learning.

5

Designer

Educators design authentic, learner-driven activities and environments that recognize and accommodate learner variability. Educators:

VIEW INDICATORS

5a

Use technology to create, adapt and personalize learning experiences that foster independent learning and accommodate learner differences and needs.

5b

Design authentic learning activities that align with content area standards and use digital tools and resources to maximize active, deep learning.

5c

Explore and apply instructional design principles to create innovative digital learning environments that engage and support learning.

6

Facilitator

Educators facilitate learning with technology to support student achievement of the ISTE Standards for Students. Educators:

VIEW INDICATORS

6a

Foster a culture where students take ownership of their learning goals and outcomes in both independent and group settings.

6b

Manage the use of technology and student learning strategies in digital platforms, virtual environments, hands-on makerspaces or in the field.

6c

Create learning opportunities that challenge students to use a design process and computational thinking to innovate and solve problems.

6d

Model and nurture creativity and creative expression to communicate ideas, knowledge or connections.

7

Analyst

Educators understand and use data to drive their instruction and support students in achieving their learning goals. Educators:

VIEW INDICATORS

7a

Provide alternative ways for students to demonstrate competency and reflect on their learning using technology.

7b

Use technology to design and implement a variety of formative and summative assessments that accommodate learner needs, provide timely feedback to students and inform instruction.

7c

Use assessment data to guide progress and communicate with students, parents and education stakeholders to build student self-direction.

Bibliography

- Berland, L.K., and McNeill, K.L. (2010). A learning progression for scientific argumentation: Understanding student work and designing supportive instructional contexts. *Science Education*, 94(5), 765-793.
- Berland, L.K., and Reiser, B.J. (2009). Making sense of argumentation and explanation. *Science Education*, 93(1), 26-55.
- Berland, L.K., and Reiser, B.J. (2011). Classroom communities' adaptations of the practice of scientific argumentation. *Science Education*, 95(2), 191-216.
- Lehrer, R., and Schauble, L. (2006). Scientific thinking and science literacy: Supporting development in learning in contexts. In W. Damon, R.M. Lerner, K.A. Renninger, and I.E. Sigel (Eds.), *Handbook of Child Psychology, Sixth Edition* (vol. 4). Hoboken, NJ: John Wiley and Sons.
- Lehrer, R., Schauble, L., and Lucas, D. (2008). Supporting development of the epistemology of inquiry. *Cognitive Development*, 23(4), 512-529.
- Metz, K.E. (2004). Children's understanding of scientific inquiry: Their conceptualization of uncertainty in investigations of their own design. *Cognition and Instruction*, 22(2), 219-290.
- Metz, K.E. (2008). Narrowing the gulf between the practices of science and the elementary school science classroom. *Elementary School Journal*, 109(2), 138-161.
- Osborne, J., Erduran, S., and Simon, S. (2004). Enhancing the quality of argumentation in school science. *Journal of Research in Science Teaching*, 41(10), 994-1,020.
- Sampson, V., and Clark, D. (2008). Assessment of the ways students generate arguments in science education: Current perspectives and recommendations for future directions. *Science Education*, 92, 447-472.
- Schwarz, C.V., Reiser, B.J., Davis, E.A., Kenyon, L., Acher, A., Fortus, D., Shwartz, Y., Hug, B., and Krajcik, J. (2009). Developing a learning progression for scientific modeling: Making scientific modeling accessible and meaningful for learners. *Journal of Research in Science Teaching*, 46(6), 632-654.
- Schwarz, C.V., Reiser, B.J., Kenyon, L.O., Acher, A., and Fortus, D. (in press). Issues and challenges in defining a learning progression for scientific modeling. In A. Alonzo and A.W. Gotwals (Eds.), *Learning Progressions for Science*. Boston, MA: Sense.
- Simon, S., Erduran, S., and Osborne, J. (2006). Learning to teach argumentation: Research and development in the science classroom. *International Journal of Science Education*, 28(2-3), 235-260.
- Windschitl, M., Thompson, J., and Braaten, M. (2008). Beyond the scientific method: Model-based inquiry as a new paradigm of preference for school science investigations. *Science Education*, 92(5), 941-967.

Physical Sciences

- Ashbrook, P. (2008). Air is a substance. *Science and Children*, 46(4), 12-13.
- Feher, E., and Rice, K. (2006). Shadows and anti-images: Children's conceptions of light and vision II. *Science Education*, 72(5), 637-649.
- Haupt, G.W. (2006). Concepts of magnetism held by elementary school children. *Science Education*, 36(3), 162-168.
- Lehrer, R., Schauble, L., Strom, D., and Pligge, M. (2001). Similarity of form and substance: From inscriptions to models. In D. Klahr and S. Carver (Eds.), *Cognition and Instruction: 25 Years of Progress* (pp. 39-74). Mahwah, NJ: Lawrence Erlbaum Associates.
- Palmeri, A., Cole, A., DeLisle, S., Erickson, S., and Janes, J. (2008). What's the matter with teaching children about matter? *Science and Children*, 46(4), 20-23.
- Smith, C.L., Solomon, G.E.A., and Carey, S. (2005). Never getting to zero: Elementary school students' understanding of the infinite divisibility of number and matter. *Cognitive Psychology*, 51, 101-140.
- Smith, C.L., Wiser, M., Anderson, C.W., and Krajcik, J. (2006). Implications of research on children's learning for standards and assessment: A proposed learning progression for matter and the atomic molecular theory. *Measurement: Interdisciplinary Research and Perspectives*, 4, 1-98.
- Stevens, S.Y., Delgado, C., and Krajcik, J.S. (2009). Developing a hypothetical multi-dimensional learning progression for the nature of matter. *Journal of Research in Science Teaching*, 47, 687-715.

Life Sciences

- Barrett, J.E., and Clements, D.H. (2003). Quantifying path length: Fourth-grade children's developing abstractions for linear measurement. *Cognition and Instruction*, 21(4), 475-520.
- Carey, S. (1986). *Conceptual Change in Childhood*. Cambridge, MA: MIT Press.
- Carpenter, T.P., Fennema, E., Franke, M.L., Levi, L., and Empson, S.B. (1999). *Children's Mathematics*. Portsmouth, NH: Heinemann.
- Catley, K., Lehrer, R., and Reiser, B. (2005). *Tracing a Prospective Learning Progression for Developing Understanding of Evolution*. Paper commissioned by the National Academies Committee on Test Design for K-12 Science Achievement.

- Available: <http://www7.nationalacademies.org/BOTA/Evolution.pdf> [June 2011]. Cobb, P., McClain, K., and Gravemeijer, K. (2003). Learning about statistical covariation. *Cognition and Instruction*, 21(1), 1-78.
- Demastes, S.S., Good, R.G., and Peebles, P. (1995). Students' conceptual ecologies and the process of conceptual change in evolution. *Science Education*, 79(6), 637-666.
- Evans, E.M. (2001). Cognitive and contextual factors in the emergence of diverse belief systems: Creation versus evolution. *Cognitive Psychology*, 42, 217-266.
- Freyberg, P., and Osborne, R. (1985). *Learning in Science: The Implications of Children's Science*. Portsmouth, NH: Heinemann.
- Gelman, S.A., Coley, J.D., and Gottfried, G.M. (1994). Essentialist beliefs in children: The acquisition of concepts and theories. In L.A. Hirschfield and S.A. Gelman (Eds.), *Mapping the Mind: Domain Specificity in Cognition and Psychology Reader* (pp. 222-244). New York: New York University Press.
- Golan Duncan, R., Rogat, A., and Yarden, A. (2009). A learning progression for deepening students' understandings of modern genetics across the 5th-10th grades. *Journal of Research in Science Teaching*, 46, 655-674.
- Kanter, D.E. (2010). Doing the project and learning the content: Designing project-based science curricula for meaningful understanding. *Science Education*, 94(3), 525-551.
- Kelemen, D., Widowsdon, D., Posner, T., Brown, A.L., and Casler, K. (2003). Teleo-functional constraints on preschool children's reasoning about living things. *Developmental Science*, 6(3), 329-345.
- Kyza, E.A. (2009). Middle-school students' reasoning about alternative hypotheses in a scaffolded, software-based inquiry investigation. *Cognition and Instruction*, 27(4), 277-311.
- Leach, J., Driver, R., Scott, P., and Wood-Robinson, C. (1995). Children's ideas about ecology 1: Theoretical background, design, and methodology. *International Journal of Science Education*, 17(6), 721-732.
- Leach, J., Driver, R., Scott, P., and Wood-Robinson, C. (1996). Children's ideas about ecology 2: Ideas found in children aged 5-16 about the cycling of matter. *International Journal of Science Education*, 18(1), 19-34.
- Lehrer, R., and Schauble, L. (2000). Inventing data structures for representational purposes: Elementary grade students' classification models. *Mathematical Thinking and Learning*, 2(1&2), 51-74.
- Lehrer, R., and Schauble, L. (2004). Modeling natural variation through distribution. *American Educational Research Journal*, 41(3), 635-679.
- Lehrer, R., and Schauble, L. (2010a). *Seeding Evolutionary Thinking by Engaging Children in Modeling Its Foundations*. Paper presented at the Annual Conference of the National Association for Research on Science Teaching.
- Lehrer, R., and Schauble, L. (2010b). What kind of explanation is a model? In M.K. Stein and L. Kucan (Eds.), *Instructional Explanations in the Disciplines* (pp. 9-22). New York: Springer.
- Lehrer, R., Carpenter, S., Schauble, L., and Putz, A. (2000). The inter-related development of inscriptions and conceptual understanding. In P. Cobb, E. Yackel, and K. McClain (Eds.), *Symbolizing and Communicating in Mathematics Classrooms: Perspectives on Discourse, Tools, and Instructional Design* (pp. 325-360). Mahwah, NJ: Lawrence Erlbaum Associates.
- Lehrer, R., Jaslow, L., and Curtis, C. (2003). Developing an understanding of measurement in the elementary grades. In D.H. Clements and G. Bright (Eds.), *Learning and Teaching Measurement: 2003 Yearbook* (pp. 100-121). Reston, VA: National Council of Teachers of Mathematics.
- Manz, E. (2010, March). *Representational Work in Classrooms: Negotiating Material Redescription, Amplification, and Explanation*. Poster presented at the Annual Meeting of the National Association for Research in Science Teaching, Philadelphia.
- Metz, K.E. (2000). Young children's inquiry in biology: Building the knowledge bases to empower independent inquiry. In J. Minstrell and E.H. van Zee (Eds.), *Inquiring into Inquiry Learning and Teaching in Science*. Washington, DC: American Association for the Advancement of Science.
- Metz, K.E., Sisk-Hilton, S., Berson, E., and Ly, U. (2010). *Scaffolding Children's Understanding of the Fit Between Organisms and Their Environment in the Context of the Practices of Science*. Paper presented at the 9th International Conference of the Learning Sciences, June 29-July 2, Chicago.
- Mohan, L., Chen, J., and Anderson, C.W. (2009). Developing a multi-year learning progression for carbon cycling in socioecological systems. *Journal of Research in Science Teaching*, 46(6), 675-698. (This reference also informed the earth and space sciences ideas.)
- Passmore, C., and Stewart, J. (2002). A modeling approach to teaching evolutionary biology in high schools. *Journal of Research in Science Teaching*, 39(3), 185-204.
- Sandoval, W.A., and Reiser, B.J. (2004). Explanation-driven inquiry: Integrating conceptual and epistemic scaffolds for scientific inquiry. *Science Education*, 88(3), 345-372.
- Shtulman, A. (2006). Qualitative differences between naïve and scientific theories of evolution. *Cognitive Psychology*, 52, 170-194.
- Smith, C.L., Wiser, M., Anderson, C.W., and Krajcik, J. (2006). Implications of research on children's learning for standards and assessment: A proposed learning progression for matter and atomic-molecular theory. *Measurement*, 14(1&2), 1-98.
- Tabak, I., and Reiser, B.J. (2008). Software-realized inquiry support for cultivating a disciplinary stance. *Pragmatics and Cognition*, 16(2), 307-355.

Zuckerman, G.A., Chudinova, E.V., and Khavkin, E.E. (1998). Inquiry as a pivotal element of knowledge acquisition within the Vygotskian paradigm: Building a science curriculum for the elementary school. *Cognition and Instruction*, 16(2), 201-233.

Earth and Space Sciences

Anderson, C.W. (March, 2010). *Learning Progressions for Environmental Science Literacy*.

Paper prepared for the National Research Council Committee to Develop a Conceptual Framework to Guide K-12 Science Education Standards. Available: http://www7.nationalacademies.org/bose/Anderson_Framework_Paper.pdf[June 2011].

Harris, P. (2000). On not falling down to Earth: Children's metaphysical questions. In K. Rosengren, C. Johnson, and P. Harris (Eds.), *Imagining the Impossible: The Development of Scientific and Religious Thinking in Contemporary Society* (pp. 157-178). New York: Cambridge University Press.

Hogan, K., and Fisherkeller, J. (1996). Representing students' thinking about nutrient cycling in ecosystems: Bio-dimensional coding of a complex topic. *Journal of Research in Science Teaching*, 33, 941-970.

Leach, J., Driver, R., Scott, P., and Wood-Robinson, C. (1996). Children's ideas about ecology 2: Ideas found in children aged 5-16 about the cycling of matter. *International Journal of Science Education*, 18, 19-34.

Lehrer, R., and Pritchard, C. (2003). Symbolizing space into being. In K. Gravemeijer, R.

Lehrer, L. Verschaffel, and B. Van Oers (Eds.), *Symbolizing, Modeling, and Tool Use in Mathematics Education* (pp. 59-86). Dordrecht, the Netherlands: Kluwer.

Lehrer, R., and Romberg, T. (1996). Exploring children's data modeling. *Cognition and Instruction*, 14, 69-108.

Lehrer, R., Schauble, L., and Lucas, D. (2008). Supporting development of the epistemology of inquiry. *Cognitive Development*, 23(4), 512-529.

Liben, L.S. (2009). The road to understanding maps. *Current Directions in Psychological Science*, 18(6), 310-315.

Panagiotaki, G., Nobes, G., and Banerjee, R. (2006). Is the world round or flat? Children's understanding of the Earth. *European Journal of Developmental Psychology*, 3, 124-141.

Rapp, D., and Uttal, D.H. (2006). Understanding and enhancing visualizations: Two modes of collaboration between earth science and cognitive science. In C. Manduca and D. Mogk (Eds.), *Earth and Mind: How Geologists Think and Learn about the Earth*. Denver, CO: Geological Society of America.

Schauble, L., Glaser, R., Duschl, R., Schulze, S., and John, J. (1995). Students' understanding of the objectives and procedures of experimentation in the science classroom. *Journal of the Learning Sciences*, 4(2), 131-166.

Uttal, D.H. (2005). Spatial symbols and spatial thought: Cross-cultural, developmental, and historical perspectives on the relation between map use and spatial cognition. In L. Namy (Ed.), *Symbol Use and Symbolic Representation: Developmental and Comparative Perspectives*(pp. 3-23). Mahwah, NJ: Lawrence Erlbaum Associates.

Uttal, D.H., Fisher, J.A., and Taylor, H.A. (2006). Words and maps: Children's mental models of spatial information acquired from maps and from descriptions. *Developmental Science*, 9(2), 221-235.

Vosniadou, S., and Brewer, W. (1994). Mental models of the day and night cycle. *Cognitive Science*, 18, 123-183.

Vosniadou, S., Skopeliti, I., and Ikospentaki, K. (2004). Modes of knowing and ways of reasoning in elementary astronomy. *Cognitive Development*, 19, 203-222.

Vosniadou, S., Skopeliti, I., and Ikospentaki, K. (2005). Reconsidering the role of artifacts in reasoning: Children's understanding of the globe as a model of the Earth. *Learning and Instruction*, 15, 333-351.

Windschitl, M., and Thompson, J. (2006). Transcending simple forms of school science investigation: Can pre-service instruction foster teachers' understandings of model-based inquiry? *American Educational Research Journal*, 43(4), 783-835.

Wiser, M. (1988). The differentiation of heat and temperature: History of science and novice-expert shift. In S. Strauss (Ed.), *Ontogeny, Phylogeny, and Historical Development* (pp. 28-48). Norwood, NJ: Ablex.

Wiser, M., and Amin, T.G. (2001). Is heat hot? Inducing conceptual change by integrating everyday and scientific perspectives on thermal phenomena. *Learning and Instruction*, 11(4&5), 331-355.

Engineering, Technology, and Applications of Science

Bolger, M., Kobiela, M., Weinberg, P., and Lehrer, R. (2009). *Analysis of Children's Mechanistic Reasoning about Linkages and Levers in the Context of Engineering Design*. Paper presented at the American Society for Engineering Education (ASEE) Annual Conference and Exposition, June, Austin, TX.

Kolodner, J.L. (2009). *Learning by Design's Framework for Promoting Learning of 21st Century Skills*. Presentation to the National Research Council Workshop on Exploring the Intersection of Science Education and the Development of 21st Century Skills. Available: http://www7.nationalacademies.org/bose/Kolodner_21st_Century_Presentation.pdf[June 2011].

Kolodner, J.L., Camp, P.J., Crismond, D., Fasse, B.B., Gray, J., Holbrook, J., and Ra, M. (2003). Promoting deep science learning through case-based reasoning: Rituals and practices in Learning by Design classrooms. In N.M. Seel (Ed.), *Instructional Design: International Perspectives*. Mahwah, NJ: Lawrence Erlbaum Associates.

Lehrer, R., and Schauble, L. (1998). Reasoning about structure and function: Children's conceptions of gears. *Journal of Research in Science Teaching*, 35(1), 3-25.

- Lehrer, R., and Schauble, L. (2000). Inventing data structures for representational purposes: Elementary grade students' classification models. *Mathematical Thinking and Learning*, 2(1&2), 51-74.
- Penner, D., Giles, N.D., Lehrer, R., and Schauble, L. (1997). Building functional models: Designing an elbow. *Journal of Research in Science Teaching*, 34(2), 125-143.
- Penner, D.E., Lehrer, R., and Schauble, L. (1998). From physical models to biomechanical systems: A design-based modeling approach. *Journal of the Learning Sciences*, 7(3&4), 429-449.
- Petrosino, A.J. (2004). Integrating curriculum, instruction, and assessment in project-based instruction: A case study of an experienced teacher. *Journal of Science Education and Technology*, 13(4), 447-460.
- Schauble, L. (1990). Belief revision in children: The role of prior knowledge and strategies for generating evidence. *Journal of Experimental Child Psychology*, 49(1), 31-57.
- Schauble, L., Klopfer, L.E., and Raghavan, K. (1991). Students' transition from an engineering to a science model of experimentation. *Journal of Research in Science Teaching*, 28(9), 859-882.