EDCI 42100/BIOL 59500: The Teaching of Biology in Secondary Schools

I. General Information

Instructor: David C. Eichinger
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Class Times & Locations:
Tu, Th 3:30-4:45 PM  BRNG 3276
Tu  5:00-5:50 PM  BRNG 3276

Office Hours: Tu, Th 2:30-3:20 PM  WTHR 221B

Required reading:
- Series of readings to be distributed in class*
- National Science Education Standards (NSES), 1996, NRC*
- Inquiry and the National Science Education Standards (I & NSES), 2000, NRC*
- Next Generation Science Standards (NGSS), 2013, NRC*
- America’s Lab Report: Investigations in High School Science (ALR), 2005, NRC*

*Look on our Blackboard site for links to on-line versions of these documents as well as other readings.

Additional Course Resources
I am in the process of creating a Blackboard Learn site for this class. To access Blackboard Learn, go to https://mycourses.purdue.edu/. You will need your career account login and your password to access the site for our class. You should get a list of all of your classes that have Blackboard Learn sites set up. Click on EDCI 42100 (or BIOL 59500 for TTT and STEM Goes Rural students), and you’ll get access to our page and information. This site will be “Under Construction” so we will be talking about and adding to the site all semester long.

Another website of interest is the “Teacher Education” site on the College of Education’s webpage http://www.teach.purdue.edu/. Check here for the latest teacher education information.

Adaptive Programs Statement
Students with disabilities must be registered with Adaptive Programs in the Office of the Dean of Students before classroom accommodations can be provided. If you are eligible for academic accommodations because you have a documented disability that will impact your work in this class, please schedule an appointment with me as soon as possible to discuss your needs.

Emergency Statement
In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances. Here are ways to get information about changes in this course: Blackboard page, my email address: deich@purdue.edu, and my office phone: (765) 494-0711.

Students are required to visit http://www.education.purdue.edu/emergency/ to review the response procedures for emergencies in Beering Hall. It is necessary that you review these directions within the first week of your Beering classes. If you have any questions see your instructor.

Academic Dishonesty Statement
Purdue prohibits “dishonesty in connection with any University activity. Cheating, plagiarism, or knowingly furnishing false information to the University are examples of dishonesty.” [Part 5, Section III-B-2-a, University Regulations] Furthermore, the University Senate has stipulated that “the commitment of acts of cheating, lying, and deceit in any of their diverse forms (such as the use of substitutes for taking examinations, the use of illegal cribs, plagiarism, and copying during examinations) is dishonest and must
not be tolerated. Moreover, knowingly to aid and abet, directly or indirectly, other parties in committing dishonest acts is in itself dishonest." [University Senate Document 72-18, December 15, 1972]

Cheating is a problem that we hope never arises in this course, especially in a course involving future teachers. However, here is the course policy. For a first instance of academic dishonesty of any kind, the person(s) involved will receive a zero on that assignment or exam, and lose any benefit of the doubt for a borderline grade. In the case of a second instance, the person(s) involved will receive an F for the course, and the instance will be reported to the Office of the Dean of Students. The instructor also reserves the right to implement part or all of these more severe penalties in the case of a serious instance of academic dishonesty, even if it is the first such instance. If you have any questions at all about what is permissible behavior, save yourself some heartache and ask before acting.

II. Course Description

This course is about teaching science, specifically, about teaching biology. It is in part a practical course; you will be learning how to carry out the practical activities of science teaching: laboratory activities, developing worksheets, holding class discussions, developing and grading tests, using textbooks, and so forth. It is also in part a theoretical course; you will be learning about the nature of scientific understanding and of classroom communities, and about how to use theoretical knowledge of learners and communities to guide your teaching.

Most of your work for this course will be organized around three types of outcomes that you will want to promote for your students, individually and as a classroom community. The first of these is conceptual understanding of science. You will want to help all of your students gain access to communities of scientifically literate adults and to the knowledge that they possess. To achieve this goal, you will need to understand ways in which both students and members of adult communities organize their scientific knowledge, use their knowledge, and communicate it. You will also need to develop ways of organizing, using, and communicating knowledge that "bridge the gap" between students and scientifically literate adults.

The second major goal is that of developing a learning community in your classroom. You will want your students to feel that they are members of a community where you are working together on shared problems that are interesting and important to you and to them, where collaboration among students is normal and accepted, and where members of the community engage in formal and informal symbolic exchange, communication that benefits the community and its members. To achieve these goals you will need to learn how to maintain order, manage your classroom efficiently and promote norms of cooperation, responsibility, and mutual respect.

We will also consider strategies that you use in light of a third major goal: educational equity. You will want all of your students to be treated fairly, both in terms of their roles in the classroom community and of the long-term benefits that they carry away with them. You will also want your students to perceive that they are being treated fairly and give their willing support to the classroom community.

Achieving all of these goals is a complicated process. No one ever achieves them completely, and even partial success demands an extensive repertoire of knowledge, skills, and resources. In this course you will begin to build that repertoire. Your most important task during the term will be to plan an instructional unit of 5-6 lessons and teach portions of it. In the course of planning and teaching this unit, you will practice many of the activities that you will have to master as a science teacher, including analyzing the scientific content that you will teach, assessing your students' prior knowledge, planning and carrying out instruction, evaluating your students' learning, and reflecting on what you learned from teaching the unit. The course will also include a variety of demonstrations, readings, discussions, and other written assignments designed to help you develop a repertoire of knowledge, skills, and resources.

At the end of the course, this repertoire-building process will be far from complete. Hopefully, you will continue to build your repertoire for as long as you remain a science teacher. There are many ways that you can do this. You can develop ways of reflecting on your teaching experience and using your reflections to improve your practice. You can also learn from your fellow teachers and other professionals, informally or
through formal mechanisms such as journals, professional meetings, and courses. All of these are means of continuing professional development, which is the final important goal of this course.

III. Objectives

The areas addressed above represent the major foci for our methods course this semester. The selection of these areas is determined by several factors: my own experience learning to become a secondary biology teacher, the pedagogical and philosophical emphases of the teacher education programs here at Purdue, and state and national guidelines and standards for teacher preparation. One set of guiding principles that serves as the foundation for science teacher education programs here at Purdue and across the country was developed by the National Science Teachers Association (NSTA) and adopted by the national teacher education accreditation organization (NCATE). More information about these NSTA Standards can be found at: http://www.nsta.org/preservice?lid=tnavhp. For now, it is important to recognize the interrelationship between these principles and the specific objectives that we will be addressing during this course. For each area of focus for our course below, the corresponding NSTA Standards have been noted. (For a summary of these ten standards, see pages 11-12 of this syllabus.)

By the time that you have completed this course, you should be able to do the following:

A. Conceptual understanding (NCATE/NSTA Standards 1, 2, 3, 4, 5, 6, 8)

1. List key concepts in science units that you teach and represent the relationships among them with statements and with concept maps.

2. Develop objectives that specify how your students should be able to (a) use the main ideas of the unit in real-world contexts, (b) reflect on the main ideas, their meanings, and relationships among them, and/or (c) construct new scientific knowledge on their own initiative.

3. State a central question that specifies the most important learning from a science unit.

4. Assess your students’ prior knowledge and understanding of speech genres using pretests or clinical interviews and describe the implications of your assessment for unit teaching.

5. Plan and carry out instructional strategies that help your students to learn with understanding.


B. Learning community (NCATE/NSTA Standards 5, 6, 9)

7. Create an orderly classroom environment where all of your students feel personally safe.

8. Manage classroom rules, materials, and procedures efficiently.

9. Develop classroom environments where you and your students work together on shared problems.

10. Develop social norms, rules, and procedures and support and encourage student collaborative work.

11. Develop classroom environments where all students participate in and contribute to symbolic exchange.

C. Educational equity (NCATE/NSTA Standards 3, 5, 7)

12. Develop classroom environments where all students contribute to and benefit from participation in the learning community.

D. Continued professional learning (NCATE/NSTA Standards 5, 6, 8, 10)
13. Reflect on your teaching experiences and the results of your evaluation to improve your teaching practice.


15. Participate in professional activities of science educators.

IV. Field Experience

All students will be required to complete an instructor-approved field experience during the semester. This experience is designed to give you an opportunity to apply some of the concepts, methods, and strategies that we will be discussing and practicing in this class and from your other education courses in a hands-on teaching situation. “Teaching” is very broadly defined for this field experience - any time you are working with one or more learners on a regular basis, either in or out of a formal classroom, I consider this to be an example of teaching. Students in the past have worked in a variety of situations and contexts as they have fulfilled this requirement: working as a TA on campus, serving as a tutor for one or more people either on or off campus, volunteering in local schools or community institutes such as the Lafayette Adult Resource Academy, teaching a church or Sunday school class, coaching a team, etc. You will be asked to begin identifying an appropriate field experience during the first week of class, and to discuss and confirm your choice of field experience with your instructor. Once this is done, you will need to spend a minimum of twelve hours participating in the activity of your choice during the semester to fulfill this requirement.

For some of you, your field experience will be the first formal teaching experience you will encounter; for others, it will serve as a continuation of previous teaching activities. In either case, it should provide a very valuable opportunity for you to try out new teaching methods and approaches and to reflect on issues being discussed in class.

V. Course Assignments

The following is a brief description of each of the assignments that will be completed during the course. A detailed description of each activity will be provided as it is introduced by the instructor.

Lab Procedure Assignment: You will develop curriculum materials appropriate for one or more common lab procedures used in a secondary biology laboratory class. These materials will be shared via Blackboard with the rest of the class so that you each have a packet of curriculum materials.

**Unit Plan (Taskstream upload required): This will be the most significant, and most time-consuming, assignment for the semester. Each student will develop a set of instructional materials on a topic of his/her choice, following a format described and modeled by the instructor. The unit plan will be developed in pieces, with each piece designed to highlight one major component of the entire unit planning process. Lesson plans developed for the unit plan will serve as the basis of instruction during the microteaching sessions, so that students will have a chance to "field-test" their instructional materials prior to using them in an actual classroom setting during student teaching. Students may work individually or in groups on this project, but each student must ultimately turn in his/her own individual unit plan.

**Microteaching Reports: Each student will have a minimum of two microteaching, or practice teaching, experiences during the semester. Each of these sessions will be digitally recorded for later analysis by the student. Each session will be evaluated in three ways: by fellow students, by the instructor, and by the student him/herself. Following each session, students will view the recording of their own teaching and prepare a brief report that incorporates peer evaluations and self evaluation.

Midterm and Final Exams: Each of these exams will provide opportunities for students to analyze and synthesize issues related to biology teaching in light of the methods, materials, and strategies that have been presented in class. Exams will be given in essay format, and will either be done in class, as take-home exams, or in some combination of the two.
** ** = Key Assessments

<table>
<thead>
<tr>
<th>Name of Assessment</th>
<th>Form of Assessment</th>
<th>When the Assessment is Administered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment of candidate’s ability to plan, implement, and assess instruction</td>
<td>Unit plan</td>
<td>Four parts developed in stages during entire semester</td>
</tr>
<tr>
<td></td>
<td>Microteaching lessons &amp; reflections</td>
<td>Twice during the course</td>
</tr>
</tbody>
</table>

VI. Grading

Grades will be assigned on the following basis:

<table>
<thead>
<tr>
<th>Type of assignment</th>
<th>Total Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microteaching reports</td>
<td>60</td>
</tr>
<tr>
<td>Lab procedure assignment</td>
<td>40</td>
</tr>
<tr>
<td>Midterm exam</td>
<td>50</td>
</tr>
<tr>
<td>Final exam</td>
<td>75</td>
</tr>
<tr>
<td>Unit plan</td>
<td>125</td>
</tr>
<tr>
<td>TOTAL</td>
<td>350</td>
</tr>
</tbody>
</table>

Chronic late work is a sign of unprofessional behavior, either in this class or in the science classroom. You will be allowed only one late assignment during the semester. After that, assignments will be deducted 10% of the total possible points for each weekday they are late.

Grading will be based on a straight ten-point scale as follows:

A = 90 - 100 % OF TOTAL POSSIBLE POINTS
B = 80 - 89 %
C = 70 - 79 %
D = 60 - 69 %
F = < 60 %

The instructor reserves the right to lower the scale, with the guarantee that it will not be raised. If everyone earns an A by getting a 90% or higher, everyone will receive that grade.
VII. Tentative Course Schedule (First half of the semester)

<table>
<thead>
<tr>
<th>DATE</th>
<th>TOPICS</th>
<th>ASSIGNMENT DUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tu Aug. 26</td>
<td>Introductions, Discussion of course assignments &amp; projects</td>
<td>None</td>
</tr>
<tr>
<td>Th Aug. 28</td>
<td>Nature of science</td>
<td>R: <em>15 Myths of Science</em> (McComas)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>R: <em>NSES, Overview &amp; Chap. 1</em> (NRC)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>R: <em>NGSS, Executive Summary &amp; Introduction</em> (NRC)</td>
</tr>
<tr>
<td>Tu Sep. 2</td>
<td>Scientific &amp; biological literacy</td>
<td>R: <em>Fulfilling the Promise – Chaps. 1, 2, &amp; 3</em> (NRC)</td>
</tr>
<tr>
<td></td>
<td><strong>Lab</strong>: Video - <em>A Private Universe</em></td>
<td></td>
</tr>
<tr>
<td>Th Sep. 4</td>
<td>Science as Inquiry</td>
<td>R: <em>A Conceptual Change Model of Learning Science</em> (Smith)</td>
</tr>
<tr>
<td></td>
<td>Overview of unit planning for conceptual change</td>
<td></td>
</tr>
<tr>
<td>Tu Sep. 9</td>
<td>UP Part I - Analysis of science content</td>
<td>R: Chapter 3 (BSCS)</td>
</tr>
<tr>
<td></td>
<td><strong>Lab</strong>: Visit Technology Resource Center</td>
<td>R: *NSES, Chap. 6: Content Standards K-4: Life Science (127-129)</td>
</tr>
<tr>
<td></td>
<td>Choosing a topic for unit planning</td>
<td>R: *Content Standards 5-8: Life Science (155-158)</td>
</tr>
<tr>
<td></td>
<td>(3:30-4:00 PM)</td>
<td>R: <em>Content Standards 9-12: Life Science(181-187)</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td>R: <em>NGSS Life Science Core Ideas</em> (NRC)</td>
</tr>
<tr>
<td>Th Sep. 11</td>
<td>UP Part I cont’d - Objectives and central question</td>
<td></td>
</tr>
<tr>
<td>Tu Sep. 16</td>
<td>UP Part I cont’d - Concept mapping</td>
<td>R: <em>Concept Mapping for Meaningful Learning</em> (Novak &amp; Gowin)</td>
</tr>
<tr>
<td></td>
<td>Jessica Weller, Guest Speaker <strong>Lab</strong>: Discussion of format &amp; topic</td>
<td></td>
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<tr>
<td></td>
<td>selection for Microteaching Session I</td>
<td></td>
</tr>
<tr>
<td>Th Sep. 18</td>
<td>UP Part II: Developing pre-tests &amp; clinical interviews</td>
<td>R: Unit Planning packet</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Part II – p. 8</td>
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<tr>
<td></td>
<td></td>
<td>Appendix B – pp. 22-25</td>
</tr>
<tr>
<td></td>
<td></td>
<td>R: Chapter 4 (BSCS)</td>
</tr>
<tr>
<td>Tu Sep. 23</td>
<td>Microteach Session I</td>
<td><strong>UP Part II plans</strong> – pretest or interview?</td>
</tr>
<tr>
<td></td>
<td><strong>Lab</strong>: Microteach cont’d</td>
<td></td>
</tr>
<tr>
<td>Th Sep. 25</td>
<td>Microteach Session I cont’d</td>
<td><strong>Unit Plan Part I (Draft) due</strong></td>
</tr>
<tr>
<td>Tu Sep. 30</td>
<td>Guest Speaker – Bill Bayley, Chemistry Dept. Outreach Coord</td>
<td></td>
</tr>
<tr>
<td>Th Oct. 2</td>
<td>Microteaching Session I cont’d</td>
<td></td>
</tr>
<tr>
<td>Tu Oct. 7</td>
<td>Microteaching Session I cont’d</td>
<td></td>
</tr>
</tbody>
</table>
**Lab**: Microteaching cont’d

**Th Oct. 9**  
UP Part III - Teaching strategies: List of tasks, lessons by objectives chart

**Unit Plan Part I (Draft & Final) due**

**Tu Oct. 14**  
October Break

**Th Oct. 16**  
Collaborative learning

**R: Chapter 10 (BSCS)**

**Tu Oct. 21**  
Midterm Course Evaluations  
Classroom Management & Discipline

**Unit Plan Part II (Draft) due**

**Th Oct. 23**  
Midterm exam

None

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### Tentative Course Schedule for the Second Half of the Semester

<table>
<thead>
<tr>
<th>DATE</th>
<th>TOPICS</th>
<th>ASSIGNMENT DUE</th>
</tr>
</thead>
</table>
| **Tu Oct. 28** | Laboratories & Lab Safety I  
**Lab:** Lab procedure assignment | **R:** Rethinking Laboratories (Volkmann & Abell)  
R: NABT Position Statement - Role of Laboratory and Field Instruction in Biology Education |
| **Th Oct. 30** | Labs & Lab Safety II  
Distribute Take Home Safety Quiz  
Discuss 2nd microteaching | Chapter 9 (BSCS)  
**R:** The Science Teacher, Sept. 2005, pp. 24-33, 39-45 |
| **Tu Nov. 4**  | In-class Lab Safety Quiz  
UP Part IV - Evaluating students’ learning | **Take Home Safety Quiz due**  
**R:** Assessing Student Understanding of Biological Concepts (Anderson)  
**R:** The ABCs of Assessment (Wright) |
| **Th Nov. 6**  | Microteaching Session II | **Unit Plan Part II (Draft & Final) due** |
| **Tu Nov. 11** | Microteaching Session II  
**Lab:** Microteaching cont’d |
| **Th Nov. 13** | Microteaching Session II – cont’d | **Unit Plan Part III (Draft) due** |
| **Tu Nov. 18** | Microteaching Session II – cont’d  
**Lab:** Microteaching cont’d |
<p>| <strong>Th Nov. 20</strong> | Evolution vs. Creationism | <strong>R:</strong> The Creation/Evolution Continuum (Scott) |</p>
<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tu Nov. 25</td>
<td>Student teaching: A view from the trenches</td>
</tr>
<tr>
<td>Th Nov. 27</td>
<td>Thanksgiving break</td>
</tr>
<tr>
<td>Tu Dec. 2</td>
<td>Professional development Teacher-community relations Lab: Dissection debate teams meet</td>
</tr>
<tr>
<td>Th Dec. 4</td>
<td>The great dissection debate</td>
</tr>
<tr>
<td>Tu Dec. 9</td>
<td>Motivation &amp; Discipline - Joe Ruhl Meet at Lafayette Jefferson H.S.</td>
</tr>
<tr>
<td>Th Dec. 11</td>
<td>Advanced Placement Biology Course wrap-up/Final evaluations</td>
</tr>
<tr>
<td>Th Dec. 18</td>
<td>Final Exam Due by 5:00 PM</td>
</tr>
</tbody>
</table>

**R:** The Science Teacher, Nov. 2003

**Unit Plan Part IV (Draft) due**

**R:** Forum: Dissection - The Case For & The Case Against (The Science Teacher)

**Lab procedure handouts due**

**Unit Plan Part III (Draft & Final) due**

**Distribute take home final exam** (Due Thursday, Dec 18 by 5:00 PM)
Materials on Reserve in WTHR 221

**BOOKS**

A *Short Guide to Writing about Biology*, by Jan A. Pechenik

A *Sourcebook for the Biological Sciences (3rd Edition)*, by Evelyn Norholt and Paul Brandwein

*Children's Ideas in Science*, edited by Rosalind Driver, Edith Guesne, and Andree Tiberghien

*Designing Groupwork*, by Elizabeth G. Cohen

*Developing Biological Literacy: A Guide to Developing Secondary and Post-Secondary Biology Curricula*, by the Biological Sciences Curriculum Study (BSCS)

*Discipline Survival Kit for the Secondary Teacher*, by Julia G. Thompson

*Doing Biology*, by Joel Hagen, Douglas Allchin, and Fred Singer

*IABT Quick Hits 2000: A Compilation of Biology Teaching Ideas and Activities*, by the Indiana Association of Biology Teachers (IABT)

*Inquiry and the National Science Education Standards: A Guide for Teaching and Learning*, by the National Research Council


*MicrobeWorld Activities*, by the Microbial Literacy Collaborative, Texas Instruments.

*Science and Creationism: A View from the National Academy of Sciences*, by the National Academy of Sciences

*Science for All Americans*, an Overview Report by the American Association for the Advancement of Science. Also included are separate subject area reports:
  - Biological and Health Sciences
  - Mathematics
  - Physical and Information Sciences and Engineering
  - Social and Behavioral Sciences
  - Technology

*Science for Children: Resources for Teachers*, by the National Science Resources Center, National Academy of Science

*Sourcebook for Biological Sciences*, by Donald Troyer, Maurice Kellogg, and Hans Andersen

*Talking Science: Language, Learning, and Values*, by Jay L. Lemke

*Teaching Genetics: Recommendations and Research Proceedings of a National Conference*, edited by Mike U. Smith and Patricia E. Simmons

The Power Plant, by Kathleen J. Roth and Charles W. Anderson

The Responsible Use of Animals in Biology Classrooms, Including Alternatives to Dissection, National Association of Biology Teachers

Vivisection and Dissection in the Classroom: A Guide to Conscientious Objection, by Gary Francione and Anna Charlton

JOURNALS

HASTI SCI-ED-O-GRAM - HOOSIER ASSOCIATION OF SCIENCE TEACHERS, INC. (HASTI)

INDIANA ASSOCIATION OF BIOLOGY TEACHERS NEWSLETTER – (IABT)

JOURNAL OF SCIENCE TEACHER EDUCATION - ASSOCIATION FOR SCIENCE TEACHER EDUCATION (ASTE)

JOURNAL OF RESEARCH IN SCIENCE TEACHING - NATIONAL ASSOCIATION FOR RESEARCH IN SCIENCE TEACHING (NARST)

SCIENCE EDUCATION

THE AMERICAN BIOLOGY TEACHER - NATIONAL ASSOCIATION OF BIOLOGY TEACHERS (NABT)

THE HOOSIER SCIENCE TEACHER - HOOSIER ASSOCIATION OF SCIENCE TEACHERS, INC. (HASTI)

THE SCIENCE TEACHER - THE NATIONAL SCIENCE TEACHERS ASSOCIATION (NSTA)

NSTA Standards

1. **Content** - Teachers of science understand and can articulate the knowledge and practices of contemporary science. They can interrelate and interpret important concepts, ideas, and applications in their fields of licensure; and can conduct scientific investigations.

2. **Nature of Science** - Teachers of science engage students effectively in studies of the history, philosophy, and practice of science. They enable students to distinguish science from non-science, understand the evolution and practice of science as a human endeavor, and critically analyze assertions made in the name of science.

3. **Inquiry** - Teachers of science engage students both in studies of various methods of scientific inquiry and in active learning through scientific inquiry. They encourage students, individually and collaboratively, to observe, ask questions, design inquiries, and collect and interpret data in order to develop concepts and relationships from empirical experiences.

4. **Issues** - Teachers of science recognize that informed citizens must be prepared to make decisions and take action on contemporary science- and technology-related issues of interest to the general society. They require students to conduct inquiries into the factual basis of such issues and to assess possible actions and outcomes based upon their goals and values.

5. **General Skills of Teaching** - Teachers of science create a community of diverse learners who construct meaning from their science experiences and possess a disposition for further exploration and learning. They use, and can justify, a variety of classroom arrangements, groupings, actions, strategies, and methodologies.

6. **Curriculum** - Teachers of science plan and implement an active, coherent, and effective curriculum that is consistent with the goals and recommendations of the National Science Education Standards. They begin with the end in mind and effectively incorporate contemporary practices and resources into their planning and teaching.

7. **Science in the Community** - Teachers of science relate their discipline to their local and regional communities, involving stakeholders and using the individual, institutional, and natural resources of the community in their teaching. They actively engage students in science-related studies or activities related to locally important issues.

8. **Assessment** - Teachers of science construct and use effective assessment strategies to determine the backgrounds and achievements of learners and facilitate their intellectual, social, and personal development. They assess students fairly and equitably, and require that students engage in ongoing self-assessment.
9. **Safety and Welfare** - Teachers of science organize safe and effective learning environments that promote the success of students and the welfare of all living things. They require and promote knowledge and respect for safety, and oversee the welfare of all living things used in the classroom or found in the field.

10. **Professional Growth** - Teachers of science strive continuously to grow and change, personally and professionally, to meet the diverse needs of their students, school, community, and profession. They have a desire and disposition for growth and betterment.