

**Campbellsville University**

**Science Division**

**BIO 550**

**METHODS OF SCIENCE TEACHING**

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**Conceptual Framework of Teacher Education:**

**THEME: “EMPOWERMENT FOR LEARNING”**

*Content, process and self-efficacy*

**Model:**

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**MISSION:**

Campbellsville University’s School of Education, in keeping with the spirit of Campbellsville University, seeks to prepare teachers by providing an academic infrastructure based on scholarship, service, and Christian leadership. The primary aim of the program is to advance scholars who are competent and caring educators committed to life-long learning in a diverse society.

**I. COURSE DESCRIPTION:**

BIO 550 is a methods course for prospective teachers of biology, chemistry and middle school science. This course provides practical information about the types of methods and materials available to the science teacher. Students will acquire 20 field hours. See Item VIII for additional requirements if taken for graduate credit.

**II. Course Materials:**

Several resources will be used during the course:

# **Cameron, S. & Craig, C. (2016) STEM Labs for Middle Grades, Grades 5 – 8. Mark Twain Media Publishing Company.**

Chiappetta, Eugene & Koballa, Thomas (2014). Science Instruction in the Middle and Secondary Schools, 8th Ed. Pearson

Benchmarks for Science Literacy: Project 2061, American Association for the Advancement of Science, Oxford University Press, 1994.

Science for All Americans; Project 2061, American Association for the Advancement of Science, Oxford University Press, 2013. [www.project2061.org](http://www.project2061.org)

Herr, Norman (2008) The Sourcebook for Teaching Science, Grades 6-12: Strategies, Activities and Instructional Resources, 1st ED. Jossey-Bass.

Teacher Materials-Scope, Sequence and Coordination <http://dev.nsta.org/ssc/pdf/v4-0902t.pdf>

**Supplementary Websites:**

NGSS: <http://www.nextgenscience.org/get-to-know>

NGSS: <http://www.nextgenscience.org/sites/default/files/Appendix%20K_Revised%208.30.13.pdf>

How to Read the NGSS: <http://www.nextgenscience.org/news/ngss-video-how-read-standards>

NGSS Newsletter: <http://www.nextgenscience.org/news/june-2016-ngss-now-newsletter>

<http://sites.nationalacademies.org/DBASSE/BOSE/Framework_K12_Science/index.htm>

Science Curriculum Mapping Cards: <http://education.ky.gov/curriculum/conpro/science/Pages/Next-Generation-Science-Standards.aspx>

Science Web Links: <http://education.ky.gov/curriculum/conpro/science/Pages/Science-Web-Links.aspx>

GRREC: Science Leadership Network: <http://www.grrecscinet.com/> & <http://www.grrecscinet.com/april-2016.html>

EQuiP Rubric for Lessons/Units: Science: <http://www.grrecscinet.com/uploads/2/3/7/9/23791026/equip_rubric_for_science_october_2014_0.pdf>

Pearson Resources for Science: <http://www.pearsonschool.com/index.cfm?locator=PS1p1u>

**III. Student Learning Outcomes** (Objectives related to mission and goals of CU and unit):

By the end of this course, the candidate will be able to:

1. Understand and apply the theory, research and national standards for teaching science.
2. Develop curriculum/instruction that applies powerful strategies and original ideas to enhance the teaching of physics, chemistry, biology, and the earth and space science.
3. Align instruction with the Next Generation Science Standards, KAS for science and the NSTA
4. Select activities that will help students develop scientific literacy, reasoning, understanding, problem solving, and research skills.
5. Become familiar with the science resources available on the KY Department of Education website and through GRRE.
6. Research issues associated with science education.
7. Develop lessons and units that incorporate the most current ideas related to science education.

**IV. Topics/Course Outline (not limited to the following)**

1. Scientific Literacy
2. Scientific Reading Skills
3. Science Writing Skills
4. Science Technology Society
5. Scientific Reasoning Skills
6. Developing Science Understandings
7. Problems Solving
8. Scientific Research

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| **V. Performance Assessments** | | |
| **Assessment** | **Points** | **Description** |
| **Folder of Contemporary Issues**  **SLO 6** | 50 | Develop a folder of articles provided in class and others that you research to share with the class. Provide evidence that you have read the articles to share. |
| **Teaching/Laboratory Supplies**  **SLO 4** | 50 | Create a list of contact information for some of the more reliable supply companies that provide science materials for class use. |
| **Court Cases**  **SLO 6** | 100 | Write a short synopsis of 10 major court cases about teaching creationism: Epperson v. Arkansas, Segraves v. State of California, McLean V. Arkansas board of Education, Edwards v. Aguillard, Webster v. New Lenox School District, John E. Peloza v. Capistrano Unified School District, Freiler v. Tangipahoa Board of Education, Rodney LvAake v. Independent School District 656, et. Al, Selman et al, v. Cobb County School District et. Al, Tammy Kitzmiller, et. Al, v. Dover Area School District, et. Al. |
| **Kentucky Academic Standards for Science**  **SLO 2, 3, 4** | 100 | Write a short paper about the history and rationale for the Next Generation Science Standards. Also, comment on the so called ‘controversial‘topics in the standards. |
| **How to Folder**  **SLO 2, 4, 7** | 50 | This folder will include a minimum of 30, preferably 100, science activities, experiments, laboratory exercises and demonstrations. It must include a wide variety of items, including ideas from teachers in the field and the Internet. Class activities will include some of these activities, particularly cleaning a microscope, extracting DNA, paper chromatography of plant pigments, etc. These activities should include the ELA for reading and writing and the Next Generation Science and NTSA standards. |
| **Science Unit**  **SLO 1, 2, 3, 4, 5, 6, 7** | 200 | This requirement has at least two goals or purposes. One is to introduce the process of planning a unit of study with five lessons and the second is to provide experience in teaching science lessons during field experiences and with peers. **The unit and lesson will utilize the Sources of Evidence and guidelines used by the School of Education, therefore including the appropriate ELA and KAS NGSS standards.** Select a science topic, in collaboration with your field assignment, and work with the P-12 teacher to develop a unit that can be taught. Use a variety of teaching techniques, including group activities, demonstrations, laboratories, recitation and problem solving. Use a variety of technology and possibly the Kahn Academy. |
| **Field Hours**  **SLO 2, 3, 4, 5, 7** | 50 | Students are required to get 20 field hours in a P-12 setting, working with science teacher/s. The unit is to be collaboratively planned and taught in the P-12 setting. The How to Folder will also include ideas from the P-12 teachers. |
| **Examination/s**  **SLO 1, 2, 3, 4, 5, 6, 7** | 150 | There will be one take-home exam. If appropriate, a second may be scheduled. |
| **Handout**  **SLO 6** | 20 | **Eugenia Scott’s Book**  *(Evolution vs. Creationism: An Introduction* published by the [University of California Press](https://en.wikipedia.org/wiki/University_of_California_Press))  Read Chapter One about science and complete a handout. |

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| **VI. Evaluation/Grading Scale** |  | **Total Points 770** |
| **Issues Folder** | 50 |  |
| **List of Science Suppliers** | 50 |  |
| **Court Cases** | 100 |  |
| **Next Generation Science Standards Paper** | 100 |  |
| **Science Unit** | 200 |  |
| **Field Experiences** | 50 |  |
| **Exam** | 150 |  |
| **Reflection/Eugenia Scott’s Book (Ch.1)** | 20 |  |
| **Grading Scale:**  90-100% A 693-770 points  80-89% B 616-692 points  70-79% C 539-615 points  65-69% D 501-538 points  Below 65% F Below 501 | | |
| All requirements must be completed to receive a grade. | | |

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| **VII. Alignment of Course Objectives/Assignments with National and State Standards** | | | | | |
| **ALIGNMENT OF COURSE OBJECTIVES** | | | |  |  |
|  | **Specific Course**  **Objectives** | **NSTA 2012**  **KTS**  **InTASC** | **EPSB**  **Themes** | **Conceptual**  **Framework** | **ILA Content**  **Standards** |
| **1.** | Become familiar with contemporary issues through development of a folder of issues (Scott’s Book) | NSTA 1-6  KTS 1, 9  InTASC 1-10 | Diversity, Assessment, Literacy Education, Closing the Achievement Gap | Theme:  C, P, SE  Model: All Components | ILA 2.1-2.3;  3.1-3.4; |
| **2.** | Become familiar with teaching and laboratory suppliers | NSTA 2, 3, 4  KTS 3, 4  InTASC 3 | Diversity,  Assessment | Theme: C, P, SE  Model: 1, 2, 3, 5, 6, 8 | ILA 4.1-4.3;  5.1-5.4 |
| **3.** | Become familiar with legal cases by writing a short synopsis of ten major court cases about teaching creationism: | NSTA 2, 5  KTS 4, 5  InTASC 6 | Diversity,  Assessment,  Closing the Achievement Gap | Theme: C, P, SE  Model: 1, 2, 3, 4, 5, 6, 8 | ILA 3.1-3.4 |
| **4.** | Paper on Next Generation Science Standards | NSTE 1, 2  KTS  1, 2, 4, 5, 6, 7  InTASC 8, 9 | Diversity,  Assessment,  Closing the Achievement Gap | Theme: C, P, SE  Model: 1, 2, 3, 4, 5, 6, 8 | ILA 2.1-2.3 |
| **5.** | "How To" folder of classroom activities, experiments, laboratory exercises and demonstrations, including the  GEMS curriculum and produce lessons plans & the Kahn Academy | NSTE 2, 4  KTS 8  InTASC 10 | Assessment | Theme: C, P, SE  Model: 7 | ILA 6.1-6.4 |
| **6.** | Science Unit of Study | NSTE 1, 2, 4, 5  KTS 10  InTASC 10 | Diversity,  Assessment | Theme: C, P, SE  Model: 1, 5, 6, 7, 8 | ILA 6.1-6.4 |
| **7.** | Field Hours  8. Exam | NSTE 1-6  KTS 7, 9  InTASC 9    NSTE 1-6  KTS 7, 9  Domain 4  InTASC 9 | Diversity  Assessment  Diversity, Assessment, Literacy Education, Closing the Achievement Gap | Theme: C, P, SE  Model: 1, 2, 6, 7, 8  Theme: C, P, SE  Model: 1, 2, 6, 7, 8 | ILA 6.1-6.4  ILA 2.1-2.3;  3.1-3.4; |

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| **KY Curricular Standards : Next Generation Science Standards**   * **Link to KAS Standards:** <http://education.ky.gov/curriculum/docs/pages/kentucky-core-academic-standards---new.aspx> * The KAS for English, Mathematics and Science; students in KY schools were assessed over the new core standards in spring, 2012. The English Language Arts and Mathematics standards were mandated for use in KY schools in fall 2011. The Next Generation Science standards were approved in 2013. All instructional units and lessons need to incorporate the ELA standards of reading and writing plus the requisite NGSS. |

**VIII. Attendance**

There are no "excused" absences; students are responsible for all material covered in class. It is the

student's responsibility to borrow notes when they are absent. **The University Undergraduate**

**Attendance Policy** **will be followed in this class.** Recording devices are not allowed in class.

**IX. Praxis Review**

The instructor will conduct:

A. a review of content knowledge for the middle school science component of the Praxis Test.

B. a review of content knowledge for the Praxis biology test. In both cases, study guide books will be

provided.

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| **X. POLICIES** |
| **Policy #1 CU Disability Statement:**  Campbellsville University is committed to reasonable accommodations for students who have documented learning and physical disabilities, as well as medical and emotional conditions. If you have a documented disability or condition of this nature, you may be eligible for disability services. Documentation must be from a licensed professional and current in terms of assessment. Please contact the Director of Disability Services at 270-789-5192 to inquire about services. |
| Policy #2 CU Plagiarism Policy:   * Campbellsville University’s policy on Academic Integrity states: “Each person has the privilege and responsibility to develop one’s learning abilities, knowledge base, and practical skills. We value behavior that leads a student to take credit for one’s own academic accomplishments and to give credit to others’ contributions to one’s course work. These values can be violated by academic dishonesty and fraud.” (2015-2017 Bulletin Catalog). * Plagiarism and cheating are examples of academic dishonesty and fraud and neither will be tolerated in this course. Plagiarism is quoting or paraphrasing a phrase, a sentence, sentences, or significant amounts of text from a web or print source, without using quotation marks and without a citation. The plagiarist submits the work for credit in a class as part of the requirements for that class. Examples of cheating include cheating on a test (copying off someone else’s paper) or an assignment (e.g., development of a lesson plan) and submitting the work as your own. * If a student commits plagiarism or cheats in this course, the professor will decide on one of two penalties: (a) an F on that assignment or (b) an F in the course. The student’s Dean and the Vice-President for Academic Affairs will be notified of either consequence. |
| **Policy #3 Progress:**   * Students are expected to complete all assignments in a professional manner. * All course information and grades will be added to TigerNet LMS. * Students will not be assigned a final grade until all course requirements, including field experiences are submitted. |
| **Policy #4 Incomplete Statement**  A grade of “I” is assigned to a student when the course requirements are not completed due to illness, accident, death in the immediate family, or other verifiable, extenuating circumstances. The course requirements to change the “I”; grade must be completed within 12 months from the time awarded. It is the student’s responsibility to complete requirements within the 12 month period. It is the professor’s responsibility to change the grade by filling out the proper forms in the Office of Student Records.  **Policy #5 Title IX Statement**  Campbellsville University and its faculty are committed to assuring a safe and productive educational environment for all students. In order to meet this commitment and to comply with Title IX of the Education Amendments of 1972 and guidance from the Office for Civil Rights, the University requires all responsible employees, which includes faculty members, to report incidents of sexual misconduct shared by students to the University's Title IX Coordinator.  Title IX Coordinator: Terry VanMeter; 1 University Drive; UPO Box 944; Administration Office 8A; Phone – 270-789-5016; Email – [twvanmeter@campbellsville.edu](mailto:twvanmeter@campbellsville.edu)  Information regarding the reporting of sexual violence and the resources that are available to victims of sexual violence is set forth at: [www.campbellsville.edu/titleIX](http://www.campbellsville.edu/titleIX)  **Policy #6 Student Academic Progress (SAP)**  Department of Education federal regulations require Campbellsville University to monitor its student's academic progress to ensure that they maintain a minimum standard GPA and make steady progress toward degree completion. Students who do not meet the SAP requirements may lose their financial aid eligibility.  All students that were enrolled during the current school year and those who have submitted a FAFSA for the upcoming year will be evaluated for SAP at the end of each term including summer. See your Student Handbook for specific details and/or discuss with your advisor.  **Communication Requirement**  Students are expected to activate and regularly use the university provided email domain (studentname@stu.campbellsville.edu) for all email communication for this class. |

**Resources**

**Websites:**

**Enduring Skills for Science:**

http://education.ky.gov/teachers/PGES/TPGES/Documents/Enduring Skills Initial List for Science

**KDE Science Curriculum Materials:** <http://education.ky.gov/curriculum/conpro/science/Pages/Curriculum-Documents-for-Science.aspx>

**KDE Science Newsletter:** <http://education.ky.gov/comm/Documents/Science%20Newsletter%20May%202013.pdf>

**KDE Science Web Links**: <http://education.ky.gov/curriculum/conpro/science/Pages/Science-Web-Links.aspx>

**Kentucky Environmental Literacy Plan:** <http://education.ky.gov/curriculum/conpro/science/Pages/Kentucky-Environmental-Literacy-Plan.aspx>

**Kentucky Science and Engineering Fair:** <http://education.ky.gov/curriculum/conpro/science/Pages/Kentucky-Science-and-Engineering-Fair-%28KY-SEF%29.aspx>

**Math and Science Partnership:** <http://education.ky.gov/curriculum/conpro/science/Pages/Mathematics-and-Science-Partnership-Program-%28MSP%29.aspx>

**Next Generation Science Standards:** The NGSS, several supporting documents and a guide for how to read the NGSS may be downloaded from [www.nextgenscience.org](http://www.nextgenscience.org)

**Literacy Design Collaborative** (Mini Tasks & Modules): <https://ldc.org/>

**Sample Science Lessons:** <https://coretools.ldc.org/curriculumLibrary?discipline_ids=1&order=created_at-desc&object_types=Minitask>

**PIMSER:** The P-12 Math & Science Outreach unit of the Partnership Institute for Math and Science Education Reform

**Professional Organizations and Kentucky Resources:** <http://education.ky.gov/curriculum/conpro/science/Pages/Professional-Organizations-and-Kentucky-Resources.aspx>

**Science Assessment:** <http://education.ky.gov/curriculum/conpro/science/Pages/Science-Assessment.aspx>

**Science Leadership Networks:** <http://education.ky.gov/curriculum/conpro/science/Pages/Science-Leadership-Networks.aspx>

**Teens Engaging Science through Journalism:** <http://www.scijourner.org/> & <http://teach4scijourn.org/>

**The Science Connection: A KDE Collaborative Resource for Teachers:** <http://education.ky.gov/comm/Documents/Science%20Connection%20Oct%202014.pdf>

**Science Websites**

[National Science Teachers Association - Official Site](http://ccs.webcrawler.com/ClickHandler.ashx?ld=20160303&app=1&c=info.wbcrwl.307.043&s=webcrawler302&rc=info.wbcrwl.307.043&dc=&euip=68.52.128.219&pvaid=9030939498764675bf9195ca4a5cb670&dt=Desktop&fct.uid=8158a56197dc40b5934dc9048d2df8e4&en=3YDphat8DJ5Li%2bTgRLOh5RHKtX3D%2fdXv7tUpRYQIBH7hfw%2fjFSrgVeBFiLEFYOCFNssXEoKmBgQ%3d&du=www.nsta.org&ru=http%3a%2f%2fwww.nsta.org%2f&ap=1&coi=1494&cop=main-title&npp=1&p=0&pp=0&ep=1&mid=9&hash=BBAA727F5EB3BFB93B64861BDED25181)

[www.nsta.org](http://www.nsta.org) National Science Teachers Association, headquartered in Arlington.

[Science Education | National Institutes of Health (NIH)](http://ccs.webcrawler.com/ClickHandler.ashx?ld=20160303&app=1&c=info.wbcrwl.307.043&s=webcrawler302&rc=info.wbcrwl.307.043&dc=&euip=68.52.128.219&pvaid=9030939498764675bf9195ca4a5cb670&dt=Desktop&fct.uid=8158a56197dc40b5934dc9048d2df8e4&en=3YDphat8DJ5Li%2bTgRLOh5RHKtX3D%2fdXv7tUpRYQIBH7hfw%2fjFSrgVeBFiLEFYOCFNssXEoKmBgQ%3d&du=www.nih.gov%2fresearch-training%2fscience-education&ru=http%3a%2f%2fwww.nih.gov%2fresearch-training%2fscience-education&ap=2&coi=1494&cop=main-title&npp=2&p=0&pp=0&ep=2&mid=9&hash=D3D10D3B422E911A788FAB996120B86B)

[www.nih.gov/research-training/science-education](http://www.nih.gov/research-training/science-education)

Office of Science Education. Free resources for science teachers. NIH’s Office of Science Education coordinates science education activities at NIH.

[Science Education Resources - khake.com](http://ccs.webcrawler.com/ClickHandler.ashx?ld=20160303&app=1&c=info.wbcrwl.307.043&s=webcrawler302&rc=info.wbcrwl.307.043&dc=&euip=68.52.128.219&pvaid=9030939498764675bf9195ca4a5cb670&dt=Desktop&fct.uid=8158a56197dc40b5934dc9048d2df8e4&en=3YDphat8DJ5Li%2bTgRLOh5RHKtX3D%2fdXv7tUpRYQIBH7hfw%2fjFSrgVeBFiLEFYOCFNssXEoKmBgQ%3d&du=www.khake.com%2fpage86.html&ru=http%3a%2f%2fwww.khake.com%2fpage86.html&ap=3&coi=1494&cop=main-title&npp=3&p=0&pp=0&ep=3&mid=9&hash=2D61AB6EA2FEB69083074E2AE64E7FAC)

[www.khake.com/page86.html](http://www.khake.com/page86.html)

Science Education Resources This page provides links to specific science resources including: science directories, science fair projects, astronomy and space science ...

[DMOZ - Science: Educational Resources](http://ccs.webcrawler.com/ClickHandler.ashx?ld=20160303&app=1&c=info.wbcrwl.307.043&s=webcrawler302&rc=info.wbcrwl.307.043&dc=&euip=68.52.128.219&pvaid=9030939498764675bf9195ca4a5cb670&dt=Desktop&fct.uid=8158a56197dc40b5934dc9048d2df8e4&en=3YDphat8DJ5Li%2bTgRLOh5RHKtX3D%2fdXv7tUpRYQIBH7hfw%2fjFSrgVeBFiLEFYOCFNssXEoKmBgQ%3d&du=www.dmoz.org%2fScience%2fEducational_Resources&ru=http%3a%2f%2fwww.dmoz.org%2fScience%2fEducational_Resources%2f&ap=4&coi=1494&cop=main-title&npp=4&p=0&pp=0&ep=4&mid=9&hash=E17AD5762A6C93735B6F3C4472DC093A)

[www.dmoz.org/Science/Educational\_Resources](http://www.dmoz.org/Science/Educational_Resources)

ANOVA Science Education - Services public and private school districts and schools on the continental USA and in Hawaii through teacher and administrator seminars and ..

**Supplementary Materials:**

Committee on the Conceptual Framework for the New K-12 Science Standards, et al. (2012). A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas, National Academies Press.

Committee on Highly Successful Schools or Program in K-12 STEM Education, (2012). K-12 Successful K-12 STEM Education: Identifying Effective Strategies in Science, Technology, Engineering and Math.

Hazen. R. L. and Trefil, J. (2009). Science Matters: Achieving Scientific Literacy. Anchor.

Saul, W., Kohnen, A., Newman, A.. Front Page Science: Engaging Teens in Science Literacy, NSTA Press: <http://www.nsta.org/store/product_detail.aspx?id=10.2505/9781936137145>