Summer 2018

Science Methods for Teachers

Donna Governor
University of North Georgia, donna.governor@ung.edu

David Osmond
University of North Georgia, david.osmond@ung.edu

Grants Collection
University of North Georgia

UNIVERSITY SYSTEM OF GEORGIA

Donna Governor, David Osmond, Sanghee Choi, and April Nelms

Science Methods for Teachers

Affordable Learning Georgia

Georgia's Virtual Library GALILEO
An Initiative of the University System of Georgia

Grants Collection

Affordable Learning Georgia Grants Collections are intended to provide faculty with the frameworks to quickly implement or revise the same materials as a Textbook Transformation Grants team, along with the aims and lessons learned from project teams during the implementation process.

Each collection contains the following materials:

- Linked Syllabus
  - The syllabus should provide the framework for both direct implementation of the grant team's selected and created materials and the adaptation/transformation of these materials.
- Initial Proposal
  - The initial proposal describes the grant project's aims in detail.
- Final Report
  - The final report describes the outcomes of the project and any lessons learned.

Initial Proposal

Application Form

Personal

Details

***Submitter First Name:**	Donna
***Submitter Last Name:**	Governor
***Submitter Title:**	Assistant Professor of Science Education
***Submitter Email Address:**	donna.governor@ung.edu
***Submitter Phone Number:**	678-936-6931
***Submitter Campus Role:**	Proposal Investigator (Primary or additional)
***Applicant First Name:**	Donna
***Applicant Last Name:**	Governor
***Applicant Email Address:**	donna.governor@ung.edu
***Applicant Phone Number:**	678-936-6931
***Primary Appointment Title:**	Assistant Professor, Teacher Education
***Institution Name(s):**	University of North Georgia

Co-Applicant Name

***Co-Applicant Name:**	David Osmond, Ph.D., Assistant Professor, Teacher Education, University of North Georgia

Application Details

Application ID:	#001747
***Proposal Title:**	317
***Final Semester of Instruction:**	Spring 2018

***Team Members (Name, Title, Department, Institutions if different, and email address for each):**

--

***Sponsor, (Name, Title, Department, Institution):**

--

***Course Names, Course Numbers and Semesters Offered:**

--

***Average Number of Students per Course Section:**	30
***Number of Course Sections Affected by Implementation in Academic Year:**	7
***Total Number of Students Affected by Implementation in Academic Year:**	210
***List the original course materials for students (including title, whether optional or required, & cost for each item):**	--
***Proposal Categories:**	No-Cost-to-Students Learning Materials
***Requested Amount of Funding:**	$12,800
***Original per Student Cost:**	$60 - $160
***Post-Proposal Projected Student Cost:**	Free
***Projected Per Student Savings:**	$60 - $160
***Projected Total Annual Student Savings:**	$12,600 - $33,600

***Creation and Hosting Platforms Used ("n/a" if none):**

--

***Project Goals:**

--

***Statement of Transformation:**

--

***Transformation Action Plan:**

--

***Quantitative & Qualitative Measures:** --

***Timeline:**

--

***Budget:**

--

***Sustainability Plan:**

--

Add Other Email Addresses for Notifications

Enter recipient(s) email address(es): --

A. References & Attachments

Bransford, J. D., Brown, A. L., & Cocking, R. R. (1999). *How people learn: Brain, mind, experience, and school*. National Academy Press.

Duschl, R. A., Schweingruber, H. A., & Shouse, A. W. (Eds.). (2007). *Taking science to school: Learning and teaching science in grades K-8*. National Academies Press.

Quinn, H., Schweingruber, H., & Keller, T. (Eds.). (2012). *A framework for K-12 science education: Practices, crosscutting concepts, and core ideas*. National Academies Press.

Riggs, I. M., & Enochs, L. G. (1990). Toward the development of an elementary teacher's science teaching efficacy belief instrument. *Science Education*, *74*(6), 625-637.

Snow, C.E. & Dibner K.A. (Eds.). (2016). *Science Literacy: Concepts, Contexts, and Consequences*. National Academies Press.

Thomas, J. A., Pedersen, J. E., & Finson K. (2001). Validating the Draw-A-Science-Teacher-Test Checklist (DASTT-C): Exploring Mental Models and Teaching Beliefs. *Faculty Publications: Department of Teaching, Learning, and Teacher Education.* Paper 94.

HTTPS://WWW.NAP.EDU/CONTENT/ABOUT-PDFS

HTTPS://WWW.NAP.EDU/CONTENT/ABOUT-THE-NATIONAL-ACADEMIES-PRESS

HTTP://WWW.NATIONALACADEMIES.ORG/LEGAL/

HTTPS://NOTES.NAP.EDU/2015/09/18/THE-NEW-OPENBOOK-READ-ANY-ACADEMIES-REPORT-ONLINE-FOR-FREE/

UNG UNIVERSITY of NORTH GEORGIA™

March 28, 2017

Mr. Jeff Gallant
Program Manager
Affordable Learning Georgia
Board of Regents Academic Affairs
Athens, GA 30606

Re: Affordable Learning Georgia Textbook Transportation Grant Proposal
Proposal Title: Authoritative Science Publications for Education Majors (ASPEM)
Applicant Name: Donna Governor, Ph.D., Assistant Professor, Department of Teacher Education
Co-Applicant: David Ormond, Ph.D., Assistant Professor, Department of Teacher Education

Dear Mr. Gallant:

Please accept this letter as a letter of support from the College of Education (sponsoring area) for the above referenced project. It is a pleasure to pledge my strong support for this innovative textbook transformation project, which will develop no-cost-to-students learning materials while enhancing the preparation of pre-service elementary teachers in applying best practices in science education in their classrooms.

The project will provide significant financial savings to students and strengthen the curriculum for the Science Methods for Elementary School Teachers course (SIED 4184). This course is provided for future teachers primarily from expert, free, online publications of the National Academies of Sciences (NAS) through the National Academies Press (NAP). This vision will be attained by achieving three strategic goals: **1)** Create an extensive list of hyperlinked source texts that includes readings from the most current research on effective science teaching from free, expert resources, with an emphasis on reports from the NAP; **2)** Align the course readings to the Next Generation Science Standards (NGSS), Georgia Standards of Excellence (GSE) and National Science Teachers Association's (NSTA) Position Statement on Science Teacher Preparation, and **3)** Expose pre-service teachers to NAP documents early in their careers to enable effective teaching by current, research-based literature.

I am especially pleased that the project will be led by an outstanding team composed of Dr. Donna Governor, Dr. David Osmond, Dr. Sanghee Choi and Dr. April Nelms. These faculty members have significant experience teaching the course targeted in the proposal. They have the experience, expertise, passion and resources needed to achieve the project goals. You are cordially invited to visit our institution to examine the capabilities and strong commitment that we will provide to help this ALG project attain its goals. Please contact me at (706) 864-1998 or susan.ayres@ung.edu if you desire further information.

Sincerely,

Susan Brandenburg- Ayres, Ed.D. Dean
College of Education

UNG | UNIVERSITY of NORTH GEORGIA™

April 28, 2017

Mr. Jeff Gallant
Program Manager
Affordable Learning Georgia
Board of Regents Academic Affairs
2500 Daniells Bridge Road, Building 300
Athens, GA 30606

Re: Affordable Learning Georgia Textbook Transportation Grant Proposal
Proposal Title: Authoritative Science Publications for Education Majors (ASPEM)
Principal Investigator (PI): Donna Governor, Ph.D., Assistant Professor, Department of Teacher Education

Dear Mr. Gallant:

Please consider this to be an official letter of commitment for the above referenced project. If awarded, the University of North Georgia (UNG) will be supportive of Dr. Governor's efforts to achieve the goals of this project and UNG agrees to provide the services defined in Dr. Governor's scope of work on a reasonable best effort basis. The estimated budget is $12,800 for the one-year project period.

Agreements required in conjunction with this project should reflect The Board of Regents of the University System of Georgia by and on behalf of the University of North Georgia as the contracting party. The award and any administrative correspondence should be sent to the address below:

Ms. Lourdes Bastas
Associate Director for Post-Award Services, Grants and Contracts Administration
University of North Georgia
82 College Circle
Dahlonega, GA 30597-0001
Phone: (706) 867-3280 Email: lourdes.bastas@ung.edu

If additional information is needed, please contact me at the UNG Grants and Contracts Administration Office at (706) 867-2139 or charles.wood@ung.edu. Thank you for your assistance.

Sincerely,

Charles P. Wood, Associate Director
Grants and Contracts Administration

Affordable Learning Georgia Textbook Transformation Grants

Round Nine

For Implementations beginning Summer Semester 2017

Running Through Spring Semester 2018

Proposal Form and Narrative

- *The proposal form and narrative .docx file is for offline drafting and review. Submitters must use the InfoReady Review online form for proposal submission.*
- ***Note: The only way to submit the proposal is through the online form in Georgia Tech's InfoReady Review at:***

  https://gatech.infoready4.com/#competitionDetail/1757803
- *If you are copying and pasting into InfoReady Review from this form, first convert the file to **plain text** and copy/paste from the plain text file.*
  - *In Word, go to File > Save As… > and change the file format to "Plain Text (.txt)."*
  - *Copy and paste from the .txt file.*
  - *Be sure to save both copies in case you are asked to resubmit.*
- *Microsoft Word Document formatting pasted into InfoReady Review will render the reviewer copy unreadable. **If you paste Word-formatted tables into InfoReady Review, you may be asked to resubmit your application if time permits.***
- *Italicized text is provided for your assistance; please do not keep the italicized text in your submitted proposal. Proposals that do not follow the instructions may be returned.*

Submitter Name	Donna Governor, Ph.D.
Submitter Title	Assistant Professor of Science Education, University of North Georgia
Submitter Email	donna.governor@ung.edu

Submitter Phone Number	678-936-6931
Submitter Campus Role	*Select: Proposal Investigator (Primary or Additional)*
Applicant Name	Donna Governor, Ph.D.
Applicant Email	donna.governor@ung.edu
Applicant Phone Number	678-936-6931
Primary Appointment Title	Assistant Professor, Department of Teacher Education
Institution Name(s)	University of North Georgia
Team Members	Donna Governor, PhD., Assistant Professor Teacher Education, University of North Georgia (UNG); David Osmond, Ph.D., Assistant Professor, Teacher Education, UNG, david.osmond@ung.edu; Sanghee Choi, Ph.D., Associate Professor, Teacher Education, UNG, sanghee.choi@ung.edu; April Nelms, Ph.D., Associate Professor and Department Head, Teacher Education, UNG, april.nelms@ung.edu
Sponsor, Title, Department, Institution	Susan Ayres, Ed.D., Dean, College of Education, University of North Georgia
Proposal Title	Authoritative Science Publications for Education Majors (ASPEM)

Course Names, Course Numbers and Semesters Offered	Science Methods for Elementary School Teachers SIED 4184, Fall semester Science Methods for Teachers (6-12) SIED 4500, Fall semester				
Final Semester of Instruction	Fall 2017				
Average Number of Students Per Course Section	30	**Number of Course Sections Affected by Implementation in Academic Year**	**7**	**Total Number of Students Affected by Implementation in Academic Year**	210
Award Category (pick one)	☒ No-or-Low-Cost-to-Students Learning Materials ☐ OpenStax Textbooks ☐ Interactive Course-Authoring Tools and Software ☐ Specific Top 100 Undergraduate Courses				
List the original course materials for students (including title, whether optional or required, & cost for each item)	Required Text: Settlage, J., & Southerland, S. A. (2012). *Teaching science to every child: Using culture as a starting point*. Second edition. Taylor & Francis. ISBN-13: 978-0415892582 Cost: $60.00 paperback; $160.00 hardback				
Requested Amount of Funding	$12,800				
Original Per Student Cost	$60 - $160				

Post-Proposal Projected Per Student Cost	Free
Projected Per Student Savings	$60 - $160
Projected Total Annual Student Savings	$12,600 - $33,600
Creation and Hosting Platforms Used	Original faculty content contributions will be the creation of reflective and guided reading questions. Source reading materials will not be created under the grant, but rather compiled and made accessible through an interactive, link-based online resource (such as the University's online platform) and through a digital commons repository. Other instructional materials such as guided discussion questions to be used in conjunction with the online readings will be compiled into documents and added to both the repository and online learning platform.

NARRATIVE

1.1 PROJECT GOALS

List the goals you are trying to achieve with the transformation, including goals for student savings, student success, materials creation, and pedagogical transformation.

The Authoritative Science Publications for Education Majors (ASPEM) project is a textbook transformation program for elementary and secondary science education majors at the University of North Georgia (UNG). The primary goal is to build a curriculum for the science methods course for future teachers primarily from expert, free, online publications of the National Academies of Sciences through the National Academies Press (NAP) to completely replace the current textbook.

The National Academies Press (NAP) is the government publisher of reports from the National Academies of Sciences (NAS). The education-related documents published here are considered the primary sources from which educational policy is developed. These documents are published in several formats, including traditional print and digital formats. The primary texts accessed for this project are NAP documents that can be freely accessed through NAP's Digital Content website https://www.nap.edu . The entire text may be freely read on the website, but may only be downloaded by registered users or signed in guests. After creating a free account, the majority of the materials for this course can be downloaded in their entirety from the open and downloadable section of the NAP website after creating a free account.

The NAP publications selected for ASPEM provide a summary of current research that utilizes leading experts in the fields of science, math, engineering and education documents such as "Taking Science to School" (Dusch et.al., 2007), "A Framework for K-12 Science Education" (Quinn, et.al., 2012) and "How People Learn" (Bransford, et.al., 1999) that have been the driving force in science education reforms in the current century. New documents are being released annually such as the 2016 report entitled "Science Literacy: Concepts, Contexts, and Consequences" (Snow & Dibner, 2016) which builds a case for improved science instruction in K-12 education. The documents produced by the National Academies of Science are foundation reports that every prospective and practicing teacher should be familiar with as these documents shape current and new educational policies.

Our current textbook for both elementary and middle/secondary science education majors (Settlage & Southerland, 2007) is a well written text that includes a variety of topics that future elementary teachers need to explore in order to be effective teachers. However, this textbook, with a cost of up to $160, is not current with recent research-based practices in teaching science.

All of the contemporary textbooks used for science methods courses that we have examined fail to provide a comprehensive framework for future educators. The variety of textbooks generally do not align to new research in science education, as proposed by the national science education standards, Next Generation Science Standards (NGSS), and the state standards, Georgia Standards for Excellence (GSE). Content included in contemporary textbooks cover instructional ideals like "Science Process Skills" and "Habits of Mind," which, under newly accepted national and state standards, have been

replaced with a focus on “Science & Engineering Practices” and “Cross Cutting Concepts.” Additionally, the currently accepted practical applications of classroom instruction have shifted from teaching “science” to a STEM (Science, Technology, Engineering, and Mathematics)-based instructional approach. Science Methods textbooks have been unable to keep up with the research-based practices presented in NAP reports. These NAP reports, which are at the forefront of instructional innovation, are a free resource to students. However, the variety of NAP reports are extensively broad and detailed on the variety of instructional topics, which prepare and improve knowledge and skills for high quality science teaching. Accepting just one resource as a textbook would result in substantial gaps in knowledge for the pre-service teacher and not allow us to keep pace with ever evolving research-based reports from multiple resources. Therefore, a textbook transformation, which makes use of the most current and relevant research in science education, is needed for preparing pre-service teachers of science.

Three specific goals are proposed to develop Authoritative Science Publications for Education Majors (ASPEM) that we believe to be the most effective content-rich science teaching curriculum for pre-service teachers available at no-cost:

- **Goal One**: Create an extensive list of hyperlinked source texts that includes readings from the most current research on effective science teaching from free, expert resources with an emphasis on reports from the National Academies Press (NAP);
- **Goal Two**: Align the course readings to the NGSS, GSE, and NSTA’s Position Statement on Science Teacher Preparation, and
- **Goal Three**: Expose pre-service teachers to NAP documents early in their careers to enable effective teaching by current, research-based literature.

1.2 STATEMENT OF TRANSFORMATION

- *Describe the transformation.*
- *Identify stakeholders affected by the transformation.*
- *Describe the impact of this transformation on stakeholders and course success.*
- *Describe the transformative impact on the course, program, department, institutions, access institution, and/or multiple courses.*

The ASPEM textbook transformation process will begin with identifying the methods and pedagogical content knowledge that pre-service teachers need for effective research-based teaching of science at the elementary and secondary levels. To ensure buy-in, all experienced faculty from the science education workgroup at UNG that share the duties of teaching these methods courses will fully participate in this ALG-supported project. The transformation will begin with the process of brainstorming, compiling and then finalizing the list of concepts to be covered during instruction. Course concepts will be matched with relevant readings from NAP reports, major education resources (such as the Carnegie Foundation where applicable), and key documents (such as the Georgia Standards for Excellence) to ensure that we are adhering to the most recent, research-based practices to guide course learning.

Stakeholders include university instructors who are charged with preparing pre-service teachers in science methods courses for the challenges of applying best-practices in science education in their classroom, the future teachers enrolled in the program, their mentor teachers, and the hundreds of young students that will eventually pass through their classrooms. University instructors will be aided by having a comprehensive, up-to-date, research-based curriculum that will transform their instructional practices. Pre-service teachers enrolled in the program will be better prepared as well as they may transfer research-based teaching practices to their mentor teachers. These mentor teachers were trained under the guiding principles of the 1996 National Science Standards (NSS) paradigm, or possibly even older instructional practices. Our young students will benefit by a better educated teacher, with updated content knowledge and best pedagogical skills based on 21st century research.

Below, we describe the ASPEM transformation in more detail, within the context of our three goals:

1. **<u>Goal One</u>: Create a composite reference list that includes readings from the most current research on effective science teaching from open, expert resources with emphasis on reports from the National Academies Press.** Reading assignments will be selected based on relevance, research, and best-practices from the most current publications. These publications will then be assimilated into a cohesive hyperlinked reading list with guided question using a modular structure. One to two readings will be selected from various chapters, articles and resources for each topic. Because the readings will not rely on a single source, future research-based publications will easily be integrated into the course to replace outdated selections. This approach will allow ASPEM to remain

a current, research-based text.

2. **<u>Goal Two</u>: Align the course readings to the NGSS, GSE, and NSTA's Position Statement on Science Teacher Preparation.** The topics used for the ASPEM transformation project will be selected using the research-based documents that are driving the current shift in science educational practices. The 2014 NGSS and 2016 GSE are based on research which will be reflected in the preparation of future teachers. The core documents and their supporting resources will illuminate the content that pre-service teachers need in an effective methods course. The process of creating the list of core documents will start with a research-based approach. Through a collaborative process, course professors will prioritize the topics and targeted readings required for STEM teaching.
3. **<u>Goal Three</u>: Familiarize pre-service teachers with NAP documents early in their careers to enable effective teaching by current, research-based literature.** The documents published by the NAP are at the forefront of innovation and research in science and technology education. Each year new reports are published on matters related to STEM fields and effective teaching. Teachers who are familiar with the NAP will be better able to align their teaching practices with current trends and issues in science education. Further, teachers exposed to these documents early in their career will be better prepared to keep abreast of future shifts in educational practices as new reports are published.

Secondary transformation will occur by providing potential discussion questions and related resources for each ASPEM reading to provide a richer, more meaningful learning experience. As pre-service teachers develop research-based high quality teaching and learning practices through the self-paced ASPEM reading, they will model this self-directed learning to their future students.

The current textbooks, which can cost up to $160 per student, place an economic strain on students who are frequently required to spend additional monies on certification exams, licensure insurance, instructional supplies, and travel expenses for student teaching. The impact of this ASPEM transformation will be a widespread improvement in students understanding of methods for teaching elementary and middle/secondary science and a reduction in the total cost required for students to earn an education degree.

1.3 TRANSFORMATION ACTION PLAN

Action plans must address:

- *The identification, review, selection, and adoption/adaptation/creation of the new course materials.*
- *The course and syllabus instructional design/redesign necessary for the transformation.*
- *The activities expected from each team member and their role(s): subject matter experts, instructional designer, librarian, instructor of record, et al.*
- *The plan for providing open access to the new materials.*

The action plan will be to review course objectives and identify the most pertinent readings and current research available, primarily through NAP documents. Secondary resources will include publications from other research-based organizations (i.e., Carnegie Foundation, NSTA, AAAS where appropriate).

Our ASPEM team, which includes all those in the science education workgroup that has had responsibility for teaching the elementary and secondary science methods courses at UNG, will collaboratively share in the work for this grant (see timeline). While Dr. Osmond and Dr. Governor will lead the project, other key personnel will take important roles in the project. The timeline provides additional information related to specific tasks assigned to each member of the team.

The first step will to be identify course objectives and compile a list of topics necessary to develop a curriculum map for this course. The subsequent step will be to select a variety of content-rich readings from NAP and other research-based organizational resources and to obtain permissions for text use. Guided reading questions will be created (see timeline) to assist pre-service teachers in the formation of an in-depth knowledge of teaching methods and effective pedagogical skills. ASPEM reading selections will be shared with departmental faculty to discuss merits and limitations, before developing the course materials. The syllabus, activities and key assessments will be restructured to align with a scope and sequence that reflects the revised ASPEM readings. All course materials will be made available to University of North Georgia students via a digital commons repository and the University's online instructional platform. Additionally, course materials will be made available to other USG institutions that wish to adapt all or part of the ASPEM approach that utilize NAP documents as instructional materials for science methods courses.

1.4 QUANTITATIVE AND QUALITATIVE MEASURES

- *The quantitative and qualitative measures of impact on student success and experience. The quantitative and qualitative data collected will be utilized in your final report as well as within ALG program communications.*
- *It is important to identify how the data is to be analyzed for each data source. In specific, the action plan must address the project's quantitative impact on student success (items such as Learning Objective success, Drop, Fail, Withdraw (DFW) delta rate, and any other critical factors) to measure impact on student experience.*
- *Qualitative measures can include student feedback through surveys, interviews, focus groups, or other means.*

Measuring development of student concepts in science education is structured around two quantitative and qualitative measures, the first being the Science Teaching Efficacy Belief Instrument, “STEBI-B” (Riggs & Enoch, 1990), which is a 25-item instrument that is designed to measure science teaching self-efficacy in preservice teachers. This instrument will be administered in a pre- and post-test design to measure changes in students’ perceptions of their ability to teach science in the elementary and middle/secondary classroom.

The second quantitative measure is the Draw-A-Science –Teacher Test (DASTT) (Thomas, Pedersen 2001). This instrument will be used to identify students’ teaching style and any supporting details of their ideas of teaching and learning science. Both of the assessments are currently utilized as part of an IRB-approved research program looking at UNG’s professional school models and will provide data to inform the grant.

Student-teaching performance will be evaluated using the Georgia Intern Keys assessment currently used in UNG field evaluation. The Intern Keys assessment contains 10 teaching performance standards and rubrics sourced from the Teacher Candidate Assessment on Performance Standards (TAPS) as a component of the official teacher candidate evaluation system in Georgia. These rubrics will assess students’ ability to plan and implement high quality science lessons as suggested by current research-based practices. Rubric domains are currently structured to assess students’ abilities to apply research-based teaching and learning practices, align lessons to the Science and Engineering Practices, Cross Cutting Concepts, and GSE science standards.

Qualitative analyses of students’ research-based methods in science teaching will additionally occur through students constructing and presenting two lessons during the semester and submitting reflections on those lessons that integrate a discussion of research-based methods. Analysis and comparison to previous year’s student reflections will highlight qualitative changes.

In addition, select students will participate in focus group interviews that will allow faculty to have in-depth conversations with students to unpack students’ experiences with using ASPEM in a digital commons repository and the University’s online

instructional platform environment. Additional impacts of transformed materials will be examined through student responses to reading assignments and discussion prompts to gain valuable insights for developing effective science curriculum for college students.

1.5 TIMELINE

This is a timeline of milestone dates for your transformation project through the end of the first semester the transformed course(s) is/are offered to students. Your interim reports will utilize this timeline to indicate if the project is on schedule.

When submitting this timeline in InfoReady Review, do not copy and paste tables, as this will render the proposal unreadable.

Table 1. Project Timeline

*NOTE: All tasks indicated “led by” are collaborative; however, each task has an assigned leader to facilitate and guide participation.

When	What	Who
May, 2017	(1) Review course objectives and relevant NAP and other documents with faculty work group. (2) Develop a list of topics, including scope and sequence, to be covered during each course.	(1) Led by Dr. Sanghee Choi (2) Led by Dr. Donna Governor
June, 2017	(1) Develop list of suggested readings from relevant NAP reports and similar documents to address those topics listed in scope and sequence. (2) Present those selections to the workgroup and select those that are most closely aligned to the stated objectives to be included in course readings. (3) Seek publisher permissions for approved content.	(1) & (2) Shared responsibility, led by Dr. April Nelms. Topics will be assigned to different workgroup members to identify resources based on areas of interest. (3) Dr. David Osmond will lead the permissions process.
July, 2017	(1) Revise list and establish big idea questions to guide reading and discussion questions. Brainstorm and create a list of potential guiding questions for use with reading materials. (2) Make changes to reading	(1) Led by Dr. David Osmond, with all workgroup members contributing input. (2) Led by Dr. April Nelms

	resources and a list of finalized course materials for each course. (3) Revise rubrics for use with lesson plans and reflections to align with current research and reading materials.	
August, 2017	(1) Review course objectives and relevant NGSS standards with faculty. (2) Have course reading materials uploaded to digital commons repository. (3) Submit ALG status report by August 30, 2017 (4) Have rubrics for lesson plans and reflections submitted for uploading to LiveText. (5) Administer STEBI pre-evaluation to preservice teachers at beginning of semester.	(1) Led by Dr. Sanghee Choi (2) Led by Dr. David Osmond (3) Task assigned to Dr. Donna Governor (4) Task assigned to Dr. Sanghee Choi (5) Shared by all methods instructors
September – November 2017	(1) Monitor course implementation and make necessary adjustments to discussion questions. (2) Monitor course discussion and reading responses to NAP and related readings. (3) Assemble focus groups to discuss students' experiences with using NAP readings in the D2L learning environment.	(1) & (2) Shared by all methods instructors (3) Shared responsibility of Dr. Donna Governor (UNG Dahlonega Campus), Dr. David Osmond (UNG Gainesville Campus) and Dr. Sanghee Choi (UNG (Cumming Campus)
December 2017	1. Administer STEBI post-evaluation 2. At the completion of the fall semester, transformed course and	(1) Shared by all methods instructors (2) Shared responsibility, led by Dr. Donna Governor

	materials will be assessed for qualitative and quantitative successes.	and Dr. David Osmond
January - March 2018	1. Faculty will meet to reflect on the use of NAP and other public documents for use in teaching science methods for preservice teachers. 2. Faculty will make a list of suggested revisions for the 2018-19 year.	1. Led by Dr. April Nelms 2. Led by Dr. Sanghee Choi
April 2018	1. Final Report Submitted to ALG.	1. Task assigned to Dr. Donna Governor

1.6 BUDGET

Include Personnel & Projected Expenses as appropriate for the category.

Proposals must involve teams of at least teams of 2 or more of any of the following: faculty, faculty librarians, instructional designers, subject matter experts, editors, graphic designers, or others as needed. It is required to include the $800 for overall project expenses and travel in this section.

Two levels of funding are available based on the scale of the project proposed:

Standard-Scale Transformation: Textbook transformation projects within one or more courses or sections with under 500 students enrolled on average per academic year total.

$10,800 maximum award
$5,000 maximum per team member
$800 for travel and expenses

Large-Scale Transformation: Textbook transformation projects within one or more courses or sections or department-wide adoptions with 500 or more students enrolled on average per academic year total.

$30,000 maximum award
$5,000 maximum per team member
$800 for travel and expenses

Funding is not a direct stipend to the team members, but rather goes to the institution to cover the team member's time (salary/release time/overload/replacement coverage), project expenses including related department needs, and travel expenses (up to $800 is specifically designated for at least two team members to attend the required in-person kickoff meeting). The proposing team must coordinate as necessary with their departments and institutional sponsors to determine how to handle the distribution, including amounts, release time/overload/salary/replacement as well as semester(s). This provides the maximum flexibility to the institution and the team in terms of how many people and what types of skills are needed, amount of compensation vs. replacement of teaching load, and timing in terms of semesters of preparatory work vs. semesters of adoption.

When submitting the budget in InfoReady Review, do not copy and paste tables, as this will render the proposal unreadable.

The budget is proposed as follows: $12,000 for four (4) faculty members release or overload time (4 @ $3,000/each = $12,000) and $800 for travel for faculty to attend the ALG kick-off meeting on June 5 and for additional related expenses. The majority of the work will be conducted during the spring semester; however, because of departmental

course load requirements, the salary will not be requested until the summer semester. The allocation of budget is shown in Table 2.

Table 2. Budget Details

Timeline	Budget details
June 2017	$800 for travel expenses
Summer – Fall, 2017	$12,000 - $3,000 each for release time/overload/salary/replacement for Dr. Sanghee Choi, Dr. Donna Governor, Dr. David Osmond, and Dr. April Nelms to manage course transformation
Total	$12,800

1.7 SUSTAINABILITY PLAN

What is plan for offering the course in the future, including maintenance of course materials?

The workgroup will set up bi-monthly meetings for collaborative and cooperative effort to develop the ASPEM materials. Science education faculty will be trained in the use of ASPEM materials and be given curriculum support, ensuring a campus-wide adoption and long-term education culture changes. As a workgroup, we will continuously assess data, make changes and update course materials. Once the initial transformation takes place, NAP publications will be monitored and ASPEM materials will be updated due to the modular course design. We are dedicated to ensure our combined efforts meet the development and maintenance of no-cost and most effective course materials for our students. We believe that the steady stream of research-based documents from the National Academy of Sciences (NAS) as released in NAP documents will contain more recent and relevant resources than textbooks which often take years to incorporate the suggested innovations presented in these publications.

1.8 REFERENCES & ATTACHMENTS

This could include any citations, references, your administrative letter(s) of support, etc. Letters of support must be provided from the sponsoring area (unit, office, department, school, library, campus office of the Vice President for Academic Affairs, etc.) that will be responsible for receipt and distribution of funding. Letters must reference sustainability. In the case of multi-institutional affiliations, all participants' institutions/departments must provide a letter of support.

1.9 REFERENCES & ATTACHMENTS

Bransford, J. D., Brown, A. L., & Cocking, R. R. (1999). *How people learn: Brain, mind, experience, and school*. National Academy Press.

Duschl, R. A., Schweingruber, H. A., & Shouse, A. W. (Eds.). (2007). *Taking science to school: Learning and teaching science in grades K-8*. National Academies Press.

Quinn, H., Schweingruber, H., & Keller, T. (Eds.). (2012). *A framework for K-12 science education: Practices, crosscutting concepts, and core ideas*. National Academies Press.

Riggs, I. M., & Enochs, L. G. (1990). Toward the development of an elementary teacher's science teaching efficacy belief instrument. *Science Education*, *74*(6), 625-637.

Snow, C.E. & Dibner K.A. (Eds.). (2016). *Science Literacy: Concepts, Contexts, and Consequences*. National Academies Press.

Thomas, J. A., Pedersen, J. E., & Finson K. (2001). Validating the Draw-A-Science-Teacher-Test Checklist (DASTT-C): Exploring Mental Models and Teaching Beliefs. *Faculty Publications: Department of Teaching, Learning, and Teacher Education.* Paper 94.

HTTPS://WWW.NAP.EDU/CONTENT/ABOUT-PDFS

HTTPS://WWW.NAP.EDU/CONTENT/ABOUT-THE-NATIONAL-ACADEMIES-PRESS

HTTP://WWW.NATIONALACADEMIES.ORG/LEGAL/

HTTPS://NOTES.NAP.EDU/2015/09/18/THE-NEW-OPENBOOK-READ-ANY-ACADEMIES-REPORT-ONLINE-FOR-FREE/

Syllabus

UNIVERSITY OF NORTH GEORGIA
College of Education

SIED4184 ELEMENTARY SCIENCE TEACHING METHODS
FALL 2017

View Supplemental Syllabus at http://ung.edu/academic-affairs/policies-and-guidelines/supplemental-syllabus.php

CAMPUS CARRY - Georgia House Bill 280, commonly referred to as the "campus carry" legislation, takes effect as of July 1, 2017. For more information on this new law (which amends O.C.G.A. § 16-11-127.1) and how it will be implemented on University System of Georgia campuses, please read Chancellor Wrigley's guidance to the USG community, dated May 24, 2017.

GENERAL INFORMATION

Instructor: Donna Governor, PhD
Office: Dunlap 106B
Email: donna.governor@ung.edu
Office Hours: Tuesday 2:00 – 5:00, Wednesday 10:00 – Noon, & 3:00 – 4:00

TEXT, TECHNOLOGY AND OTHER MATERIALS

Text: You will be reading free, open resource documents throughout this course in place of a traditional textbook. Most of the readings will come from reports from the National Academy of Science and published by the National Academies Press. You will need to create an account at: https://www.nap.edu/ to download readings. Weekly readings are listed in the class schedule (below).

Supplemental Readings: TBD
LiveText, Inc.: All students in Teacher Education programs must have a subscription LiveText.

LiveText is an online management system for all materials and documents, a way to collaborate online with fellow students and faculty, and a way to submit assignments for feedback. LiveText provides online help. You may also contact Kathy Moody at kmoody@ung.edu for assistance. If you do not purchase and activate/register LiveText by the end of drop/add, you may be 'withdrawn without penalty' (W) from class.

For those without LiveText, go to your bookstore or purchase online at www.livetext.com. Purchase and register for the 'Field Experience Edition', being sure to add your student employee number correctly. Use your @ung.edu email address and register with the 'University of North Georgia'.

For those with LiveText through another institution, contact LiveText at support@livetext.com (866-548-3839) and ask them to 'add the University of North Georgia domain to username [your LT username]'. Do not ever repurchase LiveText! If your subscription has expired, you are able to add subscription years to your current account at minimal expense.

If you have LiveText but not the 'Field Experience module', you will need to have the $15 'add-on program' added to your current account. Do not repurchase LiveText! Log into your LiveText account. Click on 'My Accounts' (in upper right corner) and purchase the 'FEM add-on' for $15. This will allow us to place you in your field experiences.

Online Resource: Desire to Learn (D2L):

University System of Georgia's **Desire2Learn Help Center** provides assistance through their 'knowledge base' **http://d2lhelp.view.usg.edu/** & 855.772.0423. The USG D2L Help Center is available 24 hours a day, 7 days a week. The Online Support Center site includes a 'knowledge base'. There are sections for students & instructors. You can also call for technical support . Please encourage students to check the 'knowledge base' before calling tech support. Also reference CTLE's D2L website.

D2L will be the primary repository of all course documents, discussions, grades and weekly quizzes. You are expected to check D2L regularly, with a minimum of once per week.

COURSE DESCRIPTION

This course is designed to prepare K-5 pre-service teachers to deliver hands-on, content rich science instruction and to help students understand core ideas and practices in science. This course provides opportunities for teacher candidates to learn and understand how to teach the cross cutting concepts and core ideas, and scientific practices of earth, physical, and life sciences that are aligned to the Georgia Standards for Excellence (GSE) and the Next Generation Science Standards (NGSS). The course will also examine psychological underpinnings of science learning, elementary science curricula and standards, classroom layout and safety, assessment, and science in popular literature. Guided field experience is required.

COURSE OBJECTIVES (EXPECTED OUTCOMES) *Revised August 2016*

Objective 1	The student will be able to understand the nature of scientific evidence.
INTASC	4, 5, & 7
NSTA	NSTA Standard 1: Content Knowledge Effective teachers of science understand and articulate the knowledge and practices of contemporary science. They interrelate and interpret important concepts, ideas, and applications in their fields of licensure.
COE CONCEPTUAL FRAMEWORK	1a. The teacher candidate is intellectually engaged through critical thinking and creative problem-solving in theory and practice 2a. The teacher candidate utilizes research based teaching and learning through content literacy. 1c. The teacher candidate is intellectually engaged through professional collaboration and communication.
ISTE-T	1b. Engage students in exploring real-world issues and solving authentic problems using digital tools and resources 1d. Model collaborative knowledge construction by engaging in learning with students, colleagues, and others in face-to-face and virtual

	environments 3a. Demonstrate fluency in technology systems and the transfer of current knowledge to new technologies and situations 4b. Address the diverse needs of all learners by using learner-centered strategies providing equitable access to appropriate digital tools and resources 4d. Develop and model cultural understanding and global awareness by engaging with colleagues and students of other cultures using digital age communication and collaboration tools.
EVALUATION METHOD	Class Discussion & Reading Quizzes
Objective 2	The student will be able to utilize the scholarly literature to find materials and information for their classroom.
INTASC	1, 3, 4,5, 7, 8, 9, 10
NSTA	Standard 6: Professional Knowledge and Skills Effective teachers of science strive continuously to improve their knowledge and understanding of the ever changing knowledge base of both content, and science pedagogy, including approaches for addressing inequities and inclusion for all students in science. They identify with and conduct themselves as part of the science education community.
COE CONCEPTUAL FRAMEWORK	1a. The teacher candidate is intellectually engaged through critical thinking and creative problem-solving in theory and practice. 1b. The teacher candidate is intellectually engaged through active engagement in reflective practice. 1c. The teacher candidate is intellectually engaged through professional collaboration and communication. 1d. The teacher candidate is intellectually engaged through commitment to on-going professional development. 2a. The teacher candidate utilizes research-based teaching and learning through maintaining content literacy. 2b. The teacher candidate utilizes research-based teaching and learning through data driven decision making.
ISTE-T	3d. Model and facilitate effective use of current and emerging digital tools to locate, analyze, evaluate, and use information resources to support research and learning. 4a. Advocate, model, and teach safe, legal, and ethical use of digital information and technology, including respect for copyright, intellectual property, and the appropriate documentation of sources. 5d. Contribute to the effectiveness, vitality, and self- renewal of the teaching profession and of their school and community.
EVALUATION METHOD	Research Position Paper NSTA Learning Center Library Project
Objective 3	The student will be able to use assessments to inform teaching practice.
INTASC	1, 4, 5, & 7
NSTA	NSTA Standard 5: Impact on Student Learning Effective teachers of science provide evidence to show that P-12 students' understanding of major science concepts, principles, theories, and laws have changed as a result of instruction by the candidate and that student knowledge is at a level of understanding beyond memorization. Candidates provide evidence for the diversity of students they teach.
COE CONCEPTUAL FRAMEWORK	2a. The teacher candidate utilizes research-based teaching and learning through maintaining content literacy. 2c. The teacher candidate utilizes research-based teaching and learning through student centered practices. 2d. The teacher candidate utilizes research-based teaching and learning through technological literacy.
ISTE-T	1c. Promote student reflection using collaborative tools to reveal and clarify students' conceptual understanding and thinking, planning, and creative processes 3a. Demonstrate fluency in technology systems and the transfer of current knowledge to new technologies and situations 3b. Collaborate with students, peers, parents, and community members using digital tools and resources to support student success and innovation 5c. Evaluate and reflect on current research and professional practice on a regular basis to make effective use of existing and emerging digital tools and resources in support of student learning
EVALUATION METHOD	Lesson Plans and Teaching Demonstrations
Objective 4	The student will be able to identify student conceptions and misconceptions and use to guide instruction.
INTASC	1, 4, 5, 7, 8,
NSTA	NSTA Standard 2: Content Pedagogy Effective teachers of science understand how students learn and develop scientific knowledge. Preservice teachers use scientific inquiry to develop this knowledge for all students.
COE CONCEPTUAL FRAMEWORK	1b. The teacher candidate is intellectually engaged through active engagement in reflective practice. 2c. The teacher candidate utilizes research-based teaching and learning through student centered practices.
ISTE-T	3c. Communicate relevant information and ideas effectively to students, parents, and peers using a variety of digital age media and formats. 5a. Participate in local and global learning communities to explore creative applications of technology to improve student learning 5b. Exhibit leadership by demonstrating a vision of technology infusion, participating in shared decision making and community building, and developing the leadership and technology skills of others.
EVALUATION METHOD	Lesson Plans, Reflections, and Video Analysis
Objective 5	The student will be able to assemble and deliver content rich, hands-on, inquiry based activities.
INTASC	1, 2, 3, 4, 5, 6, 7, 8, 9
NSTA	NSTA Standard 3: Learning Environments Effective teachers of science are able to plan for engaging all students in science learning by setting appropriate goals that are consistent with knowledge of how students learn science and are aligned with state and national standards. The plans reflect the nature and social context of

	science, inquiry, and appropriate safety considerations. Candidates design and select learning activities, instructional settings, and resources--including science-specific technology, to achieve those goals; and they plan fair and equitable assessment strategies to evaluate if the learning goals are met.
COE CONCEPTUAL FRAMEWORK	1a. The teacher candidate is intellectually engaged through critical thinking and creative problem-solving in theory and practice. 2c. The teacher candidate utilizes research-based teaching and learning through student centered practices. 2e. The teacher candidate utilizes research-based teaching and learning through immersion in the learning community through field experience and clinical practice. 3a. The teacher candidate will provide advocacy and service by promoting social justice and education as a human right for the individual and their communities. 3b. The teacher candidate will provide advocacy and service through their leadership. 3c. The teacher candidate will provide advocacy and service through ethical practice. 3d. The teacher candidate will provide advocacy and service by practicing professional accountability.
ISTE-T	1a. Promote, support, and model creative and innovative thinking and inventiveness. 2a. Design or adapt relevant learning experiences that incorporate digital tools and resources to promote student learning and creativity. 2b. Develop technology-enriched learning environments that enable all students to pursue their individual curiosities and become active participants in setting their own educational goals, managing their own learning, and assessing their own progress. 2c. Customize and personalize learning activities to address students' diverse learning styles, working strategies, and abilities using digital tools and resources. 2d. Provide students with multiple and varied formative and summative assessments aligned with content and technology standards, and use resulting data to inform learning and teaching.
EVALUATION METHOD	Lesson Plans, Video Analysis, and GSE Analysis
Objective 6	The student will understand the safety issues related lab science activities.
INTASC	5, 7, 8
NSTA	NSTA Standard 4: Safety Effective teachers of science can, in a P-12 classroom setting, demonstrate and maintain chemical safety, safety procedures, and the ethical treatment of living organisms needed in the P-12 science classroom appropriate to their area of licensure.
COE CONCEPTUAL FRAMEWORK	2a. The teacher candidate utilizes research-based teaching and learning through maintaining content literacy. 3c. The teacher candidate will provide advocacy and service through ethical practice. 2d. The teacher candidate utilizes research-based teaching and learning through technological literacy. 2e. The teacher candidate utilizes research-based teaching and learning through immersion in the learning community through field experience and clinical practice.
ISTE-T	4c. Promote and model digital etiquette and responsible social interactions related to the use of technology and information.
EVALUATION METHOD	Lesson Plan Safety documentation and Safety Posters

METHODS OF INSTRUCTION

Face-to-face	Online Learning Environment	PDC Classrooms
Collaborative Group Learning	Professor Demonstrations/Presentation	Simulations

ATTENDANCE

The nature and design of this course requires your attendance for the various learning activities that take place, therefore, **attendance is required at <u>ALL</u> sessions for this course**. Should they occur, individual absences will result in a 5% deduction from your overall grade. Students missing more than four classes, *for excused or unexcused reasons*, will be withdrawn from the course and given a grade of 'WF.' <u>The only excuses for absence are personal illness, personal/family emergency, and death of someone in the immediate family and ONLY with documentation.</u>

Coming to class on time is also a critical component of this class; therefore, being tardy (coming in five minutes or more after scheduled start time) will be equal to half of an unexcused absence. In addition to grade consequences, excessive absences and tardies will be noted in the College of Education disposition reporting system.

Students should make copies of all assignments they wish to keep prior to submission for grading. The original document should be submitted for grading. Late assignments carry a penalty of ***10% per day late***.

In addition to the **5% per absence penalty, any work missed due to an unexcused absence will receive a grade of zero (0)**. Work missed with an excused absence **will be graded only after *official* documentation** substantiating the absence is turned in to the instructor. Each case, should they arise, will be judged individually.

If a student's absences exceed 14% of the scheduled class meetings for the semester or the student fails to attend 10% of any class meetings prior to the midpoint of the term, the student will be subject to being dropped from the class roll with a 'WF'.

Documentation accounting for a student's absence may be requested. Please note that habitual tardiness and/or absences to class will affect your grade and may result in your removal from the roll.

If a student chooses to withdraw from the course it is that student's responsibility to complete the withdrawal process. Students who cease attending class without formally withdrawing receive a grade of WF for the course. Students with two or more absences may receive a grade of WF.

Grades of I (Incomplete) are awarded only in cases of serious illness and other significant non-academic circumstances. The instructor reserves the right to make the final decision with regard to granting a grade of "I".

COURSE COMMUNICATION

When questions arise outside of class time, please feel free to contact me. Outside of class, I am available during office hours, through UNG email, or by phone. **UNG Email is the quickest way to reach me**, but please respectfully allow 48 hours, not including weekends and holidays, for a reply.

EVALUATION METHODS

Your grade in this course will depend on a number of factors. The percentages for each area of evaluation are listed below. *The instructor reserves the right to amend the evaluation topics and percentages with advance notice provided to the students.* **All submissions must be YOUR ORIGINAL work. Plagiarism will result in a grade of ZERO. Every submission will be checked for originality through the Turnitin.com system.**

Categories	Items	Weight	Due Date
Midterm Position Paper 15%	KEY ASSESSMENT: Position Paper	15%	October 13
Unit Lesson Plan 50%	KEY ASSESSMENT: Lesson Plan 1 To be taught between Oct. 23 & Nov. 3	15%	October 20
	KEY ASSESSMENT: Lesson Plan 2 To be taught between Nov. 6 & Nov. 17KEY	15%	November 3
	KEY ASSESSMENT: Reflection 1	10%	November 17
	KEY ASSESSMENT: Reflection 2	10%	December 1
Weekly Reading Assignments 25%	Reading Quizzes and/or Online Discussion Participation	25%	Weekly
Class Projects 10%	NSTA Learning Center Library & Other In Class Activities	10%	Various
	FINAL GRADE	**100%**	

COURSE GRADING

1. Midterm Position Paper (15%)***Key Assessment*****

You will write a position paper on the teaching of science that includes your views on the teaching of science – as a paper for this course. This is one of key assessments for this course and will be submitted **via LiveText**. (see Guideline & rubric). You will be writing this paper in sections throughout the first half of the course. By October 13 you will compile those sections into a midterm paper and submit to Livetext for your midterm paper.

2. Lesson Plans (30%) *****Key Assessment***

You will Develop two lessons of curriculum from your interests in K-5 science: The lessons will need to be approved by your mentor teacher and written in a detailed lesson plan format. This format is specifically designed for science based lessons.

- Your lesson plan includes copies of activities used, including rubrics and/or assessments.
- The lesson plans should be **investigations** that include all aspects of 3 dimensional learning.
- You address assessment appropriately, including formative assessments to examine whether the objectives are met in all sections of the lesson.
- **LESSONS WILL NEED TO BE TAUGHT AND VIDEO RECORDED FOR ANALYSIS AND REFLECTION. PLAN EARLY TO COORDINATE WITH YOUR MENTOR TEACHER.**
- **Document and submit the following:** Lesson plan (use template), student handouts & artifacts, any assessments (i.e., worksheets or rubrics).
- **Lesson plans will be rejected (for a grade of zero) if they do not meet minimum criteria, including:**
    - Missing safety requirements
    - Lack of investigation component
    - NOTE: If your lesson has no materials other than a book, video or handout, it is not likely to be an investigation and likely to be rejected

3. Reflection Videos & Papers (20%)***Key Assessment*****

Two reflection papers will be written:

- Upload a 2-minute video segment from you lesson.
- Write a 1-page (minimum) reflection paper based on feedback from your presentation and teaching experience at your practicum classroom. This will be concentrated on the video segment you upload.
- **This is not the same as the questions at the end of the EdTPA lesson plan template. You will be required to go above and beyond the basic questions provided.**

4. Weekly Reading Quizzes (25%)

There will be a set of questions related to each week's reading assignments that will be answered for each week's reading. This will be completed each week as a "quiz" in D2L and is due on the Saturday BEFORE the class we will be discussing the readings in. Each and every class we will discuss our assigned reading topics in class and you are expected to fully participate. Each week's online "quiz" will include a place for a reflection on the previous week's discussion.

5. Class Projects (10%)

We will be doing several projects, by group or individually, throughout this semester. Details about each project will be provided prior to each activity.

WRITTEN ASSIGNMENTS

All must be typed in 12-point standard-sized font. All double-spaced assignments should contain your name, course number (SIED4184), and page numbers where appropriate.

IN-CLASS ACITIVITIES

This course includes some science laboratory and/or other science-learning activities. All students in your group are responsible for contributing equally to the activity and its write-up. At the end of each activity, make sure you clean your table. All materials should be cleaned and left to dry or put back in the appropriate place.

MAKE-UP POLICY

You are responsible for any material/information missed during an absence excused or unexcused). Late assignments are ONLY accepted for an excused absence and MUST be submitted with documentation at the next class meeting. Online assignments will have a 10% reduction in the grade occur each day they are late. Otherwise, late assignments will not be accepted and be given a grade of zero.

ACADEMIC INTEGRITY POLICY

Any violations of the Academic Integrity Policy will result in an automatic zero for the assignment and a referral to the office of the Dean of Students under the Student Code of Conduct.

Plagiarism and Turnitin.com: Students agree that by taking this course all required papers may be subject to submission for textual similarity review to Turnitin.com for the detection of plagiarism. All submitted papers will be included as source documents in the Turnitin.com reference database solely for the purpose of detecting plagiarism of such papers. Use of the Turnitin.com service is subject to the Terms and Conditions of Use posted on the Turnitin.com site.

Copyright: Both Federal and State laws forbid the unlawful duplication of copyrighted computer software or other reproductions of copyrighted material. In accordance with these policies, University of North Georgia expressly forbids the copying of such materials supplied by or used in the College. Unlawful duplication of copyrighted materials by a user may result in disciplinary action by the College under the Student Code of Conduct (Non-Academic Infractions--Prohibitions, Theft), and/or possible criminal action by the owner of the copyright.)

DISRUPTIVE BEHAVIOR POLICY

Students who exhibit behaviors that are considered to obstruct or disrupt the class or its learning activities are subject to sanctions under the Board of Regents Policy on Disruptive Behavior. Behaviors which may be considered to be inappropriate in this classroom includes, but is not limited to, sleeping, coming in late, talking out of turn, inappropriate use of laptops or mobile devices, verbal behavior that is disrespectful of other students or the faculty member, or other behaviors that may be disruptive. Students who exhibit such behavior may be temporarily dismissed from the class by the instructor and will be subject to disciplinary procedures outlined in the Student Handbook.

COURSE CALENDAR

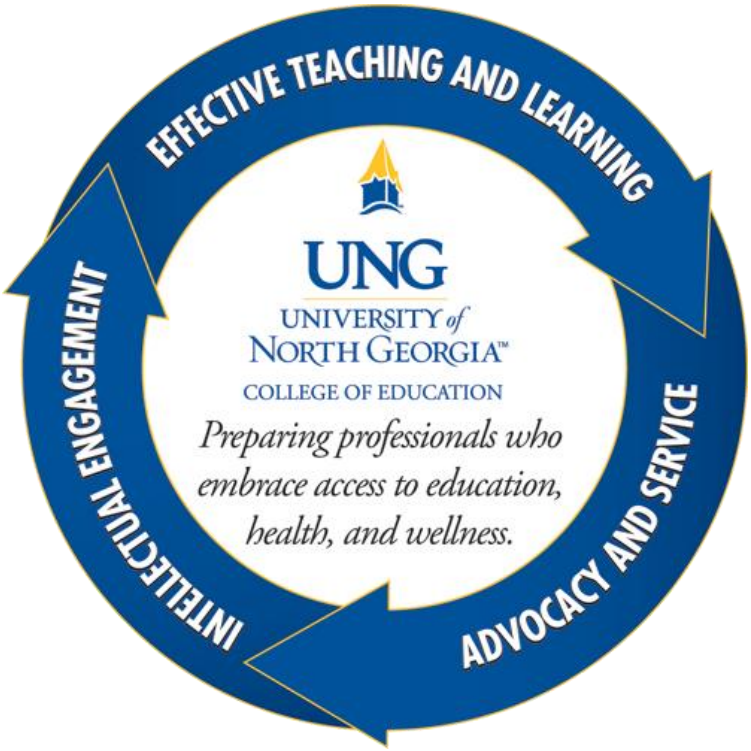
- First Day of Class: August 28
- Drop/Add period ends: August 25
- Withdrawal Deadline: October 13
- Online Learning Day(s): September 11
- Holiday: September 4
- Classes end: December 8

SIED4184 Course Weekly Schedule

Date(s)	Topic(s)	Activities & Assignments
Week 1: Aug 28	Course Overview Syllabus, Introductions, Safety, NSTA Learning Center	In Class: 1. STEBI pre-assessment 2. Safety Readings: • Science & Safety, It's Elementary • Safety in the Elementary Classroom 3. Create NSTA LC Account After Class: 1. Building your LC Library **DUE 9/11**
Reading Assignment:	**Read & Complete Quiz by 9/9:** *Taking Science to School*, Chapter 2: Goals for Science Education AND Chapter 6: Understanding How Scientific Knowledge is Created	
Sept 4	**Labor Day (No Class)**	
Week 2: Sept 11 *Online Class Meeting*	Nature of Science	In Class: Video: How Simple Ideas Lead to Scientific Discoveries Activity: Understanding Science (online) Note: Participate in online discussion After Class: Write a 1-page essay about why teaching science is important. Include citations from assigned & other references. APA format.
Reading Assignment:	**Read & Complete Quiz by 9/16:** *How People Learn*, Chapter 1: Learning – from Speculation to Science *Ready Set Science*, Chapter 3: Foundational Knowledge and Conceptual Change	
Week 3: Sept 18	Learning Theories & Conceptual Change	In Class: Videos: Lessons from Thin Air (segment), Conceptual Change Activity: Conceptual Cartoons After Class: Write 1-page essay about your position on how students learn science. Include citations from assigned AND additional references. APA format.
Reading Assignment:	**Read & Complete Quiz by 9/23:** (1) *Seeing Students Learn Science,* (2017) Chapter 1: What's Really Different? pages 1-18 only (2) *Science Teachers' Learning: Enhancing Opportunities, Creating Supportive Contexts, (2015)* Chapter 2: A New Vision of Science Teaching & Learning, pages 27-46	

Week 4: **Sept 25**	3D Learning, Including: ● Science & Engineering Practices ● Cross Cutting Concepts	In Class: Video: Doing Science Activity: Comparing Standards After Class: Write 1-page essay about your position on how science should be taught. Include citations from assigned AND additional references. Include readings due 10/2 in your references. APA format.
Reading Assignment:	**Read & Complete Quiz by 9/30:** *Ready Set Science*, Chapter 7: Learning from Science Investigations *Inquiry and the National Science Education Standards*, Chapter 6: Making the Case	
Week 5: **Oct 2**	Investigations & Inquiry	In Class: Video: 3 Rules to Spark Learning Activity: Levels of Inquiry Experience After Class: Write 1-page essay about your position on how science should be assessed. Include citations from assigned AND additional references. Include readings due 10/9 in your references. APA format.
Reading Assignment:	**Read & Complete Quiz by 10/7:** *Developing Assessments for the Next Generation Science Standards* Chapter 4: Classroom Assessment	
Week 6: **Oct 9**	Assessment	In Class: Video: Making a Rubric Activity: Who is Most Talented? After Class: **MIDTERM POSITION PAPER DUE 10/13 to *Livetext*:** Compile and condense essays into single paper, maximum of 3 pages
Reading Assignment:	**Read & Complete Quiz by 10/14:** *The BSCS 5E Instructional Model: Origins & Effectiveness*	
Week 7: **Oct 16**	Strategies: 5E Model	In Class: Video: Teaching with the 5E Learning Cycle Activity: 5E Experience After Class: **LESSON 1 DUE 10/20 to *Livetext***
Reading Assignment:	**Read & Complete Quiz by 10/21:** *Taking Science to School*, Chapter 9: Teaching science as practice *Effective Instruction, What Does Research Tell Us?*	

Week 8: Oct 23	Planning	In Class: Video: Using Phenomena Activity: Developing Phenomena After Class: Teach Lesson 1
Reading Assignment:	**Read & Complete Quiz by 10/28:** *Literacy for Science*, Chapter 4: Weaving Science & Literacy Together Across the Grades *STEM Integration in K-12 Education*, Chapter 2: A Descriptive Framework for Integrated STEM Education, p.31-50	
Week 9: Oct 30	Integration	In Class: Video: Common Sense Activity: Collaborating on Integrated Unit Plans After Class: **LESSON 2 DUE 11/3 to *Livetext***
Reading Assignment:	**Read & Complete Quiz by 11/4:** *Engineering in K-12 Education*, Chapter 5: Teaching and Learning Core Engineering Concepts and Skills in Grades K–12	
Week 10: Nov 6	Engineering	In Class: Video: Engineering Crash Course Activity: Experience Engineering After Class: Teach Lesson 2
Reading Assignment:	**Read & Complete Quiz by 11/11:** *Frameworks for K-12 Science Education*, Chapter 11: Equity & Diversity in Science & Engineering Education	
Week 11: Nov 13	Differentiation Equity & Diversity	In Class: Video: Closing the Gender Gap Activity: Examining Bias (Project Implicit) After Class: **REFLECTION 1 DUE 11/17 to *Livetext***
Reading Assignment:	**Read & Complete Quiz by 11/25:** *Surrounded by Science*, Chapter 1: Informal Environments for Learning Science	
Nov 20	**UNG Fall Break**	
Week 12: Nov 27	Learning Beyond the Classroom	In Class: Video: Economic Value of Informal Science Education Activity: STEBI Post-assessment After Class: **REFLECTION 2 DUE 12/1 to *Livetext***



UNIVERSITY OF NORTH GEORGIA
College of Education

SIED4500
Fall, 2017

View Supplemental Syllabus at http://ung.edu/academic-affairs/policies-and-guidelines/supplemental-syllabus.php

CAMPUS CARRY - Georgia House Bill 280, commonly referred to as the "campus carry" legislation, takes effect as of July 1, 2017. For more information on this new law (which amends O.C.G.A. § 16-11-127.1) and how it will be implemented on University System of Georgia campuses, please read Chancellor Wrigley's guidance to the USG community, dated May 24, 2017.

GENERAL INFORMATION

Instructor: Donna Governor, PhD
Office: Dunlap 106B
Email: donna.governor@ung.edu
Office Hours: Tuesday 2:00 – 5:00, Wednesday 10:00 – Noon, & 3:00 – 4:00

TEXT, TECHNOLOGY AND OTHER MATERIALS

- **Text:** You will be reading free, open resource documents throughout this course in place of a traditional textbook. Most of the readings will come from reports from the National Academy of Science and published by the National Academies Press. You will need to create an account at: https://www.nap.edu/ to download readings. Weekly readings are listed in the class schedule (below).
- **Supplemental Readings:** TBD

- **LiveText, Inc.: All** students in Teacher Education programs must have a subscription LiveText. LiveText is an online management system for all materials and documents, a way to collaborate

online with fellow students and faculty, and a way to submit assignments for feedback. LiveText provides online help. You may also contact Kathy Moody at kmoody@ung.edu for assistance. If you do not purchase and activate/register LiveText by the end of drop/add, you may be 'withdrawn without penalty' (W) from class.

For those without LiveText, go to your bookstore or purchase online at www.livetext.com. Purchase and **register** for the 'Field Experience Edition', being sure to add your student employee number correctly. Use your @ung.edu email address and **register with the 'University of North Georgia'**.

For those with LiveText through another institution, contact LiveText at support@livetext.com (866-548-3839) and ask them to 'add the University of North Georgia domain to username [your LT username]'. **Do not ever repurchase LiveText!** If your subscription has expired, you are able to add subscription years to your current account at minimal expense.

If you have LiveText but not the 'Field Experience module', you will need to have the $15 'add-on program' added to your current account. **Do not repurchase LiveText!** Log into your LiveText account. Click on 'My Accounts' (in upper right corner) and purchase the 'FEM add-on' for $15. This will allow us to place you in your field experiences.

Desire to Learn (D2L):

University System of Georgia's **Desire2Learn Help Center** provides assistance through their 'knowledge base' **http://d2lhelp.view.usg.edu/** & 855.772.0423. The USG D2L Help Center is available 24 hours a day, 7 days a week. The Online Support Center site includes a 'knowledge base'. There are sections for students & instructors. You can also call for technical support . Please encourage students to check the 'knowledge base' before calling tech support. Also reference CTLE's D2L website.

COURSE DESCRIPTION

SIED4500 is a course designed to prepare middle grades and secondary science teachers to deliver hands-on, content rich science instruction and to engage students in the process of science. Georgia Standards of Excellence for Science will be used as the basis for implementation of instruction. The course will also examine psychological underpinnings of science learning, science curricula and standards, classroom logistics and safety, teaching strategies, and assessment. Prerequisite: Admission to Teacher Education.

COURSE OBJECTIVES (EXPECTED OUTCOMES)

Objective	INTASC Standard	ACEI Standard	COE Conceptual Framework	Evaluation Method
1. The student will be able to understand the nature of scientific evidence.	4, 5, & 7	2.2a, 2.2g	1a, 2a, 1c	Projects, Quizzes
2. The student will be able to utilize the scholarly literature to find materials and information for their classroom.	1, 3, 4,5, 7, 8, 9, 10	2.2b	1a, 1b, 1c, 1d, 2a, 2b	Projects, Quizzes
3. The student will be able to use metric measurements.	1, 4, 5, & 7	2.2b	2a, 2c, 2d	Projects, Quizzes
4. The student will be able to identify student conceptions and misconceptions and use to guide instruction.	1, 4, 5, 7, 8,	2.2g	1b, 2c,	Projects, Quizzes
5. The student will be able to assemble and deliver content rich, hands-on, inquiry based activities.	1, 2, 3, 4, 5, 6, 7, 8, 9	2.2d	1a, 2c, 2e, 3a, 3b, 3c, 3d	Projects, Quizzes
6. The student will understand the safety issues related lab science activities.	5, 7, 8,	2.2b	2a, 3c, 2d, 2e	Safety Certification

METHODS OF INSTRUCTION

Face-to-face, Online Learning Environment, Collaborative Group Learning, Microteaching, Demonstrations/Presentation

EVALUATION METHODS

The percentages for each area of evaluation are listed below. *The instructor reserves the right to amend the evaluation topics and percentages with advance notice provided to the students.* **All submissions must be an ORIGINAL product. Every submission will be checked for originality. Plaigarism will result in a grade of ZERO.**

Category	Item(s)	Due Date	Weight
NSTA Learning Center	Create and build an NSTA Learning Center library	August 30	10%
Science Safety Certification	Complete either the middle or high school science safety course through Flinn Scientific online	September 16	15%
Position Paper	**KEY ASSESSMENT** Position Paper	October 11	25%
Assessment Evaluation	Assessment evaluation with reteaching activity	November 3	10%
Final Project	Unit Plan	December 6	15%
Weekly Reading Assignments/Quizzes	Reading Quizzes and/or Online Discussion Participation	Weekly	25%

COURSE GRADING

- Weekly Reading Quizzes – 25% - There will be a set of questions related to each week's reading assignments that will be answered for each week's reading. This will be completed each week as a "quiz" in D2L and is due on the Monday BEFORE the class we will be discussing the readings in. Each and every class we will discuss our assigned reading topics in class. Each week's online "quiz" will include a place for a reflection on the previous week's discussion and you expected to fully participate for full credit. **Due Weekly.**
- NSTA Learning Center Library – 10% - You will create a free account at the NSTA Learning Center and upload a minimum of 10 resources. You will create a library of resources (minimum 10) that you can use to teach science concepts in your own class. **Due 8/30.**
- Science Safety Certification – 15% - You will complete the Flinn Science Safety Course for either high school or middle school (https://labsafety.flinnsci.com/Home.aspx). You will have to create a free account for certification. Certificate of safety course completion. **Due 9/16.**
- Position Paper – 25% – **KEY ASSESSMENT** - You will write a position paper on the teaching of science that includes your views on the teaching of science – as a paper for this course. This is one of key assessments for this course and will be submitted **via LiveText**. (see Guideline & rubric). You will be writing this paper in sections throughout the first half of the course. You will compile those sections into a midterm paper and submit to Livetext for this key assessment. **Due 10/13.**
- Assessment Evaluation – 20% - You will conduct a data analysis of one assessment used in your classroom and identify areas of strengths and weakness. You will design a reteaching activity for one area for which students need reteaching. **Due 11/3**
- Final Project – 15% - You will prepare a unit of instruction for one or more standards, that includes the following components.
    - Standards overview
    - Unit map, including daily schedule
    - Description of introductory phenomena
    - 2 Specific, 3-dimensional learning activities in 5E format
    - 1 Project based activity, with rubric
    - Evidence of differentiation
    - Assessment

  This unit will be shared during the final 2 class meeting. **Due 12/6**

ATTENDANCE

The nature and design of this course requires your attendance for the various learning activities that take place, therefore, **attendance is required at ALL sessions for this course**. Should they occur, individual absences will result in a 5% deduction from your overall grade. Students missing more than four classes, *for excused or unexcused reasons*, will be withdrawn from the course and given a grade of 'WF.' The only excuses for absence are personal illness, personal/family emergency, and death of someone in the immediate family and ONLY with documentation.

Coming to class on time is also a critical component of this class; therefore, being tardy (coming in five minutes or more after scheduled start time) will be equal to half of an unexcused absence. In addition to grade consequences, excessive absences and tardies will be noted in the College of Education disposition reporting system.

Students should make copies of all assignments they wish to keep prior to submission for grading. The original document should be submitted for grading. Late assignments carry a penalty of ***10% per day late***.

In addition to the **5% per absence penalty, any work missed due to an unexcused absence will receive a grade of zero (0)**. Work missed with an excused absence **will be graded only after *official* documentation**

substantiating the absence is turned in to the instructor. Each case, should they arise, will be judged individually.

If a student's absences exceed 14% of the scheduled class meetings for the semester or the student fails to attend 10% of any class meetings prior to the midpoint of the term, the student will be subject to being dropped from the class roll with a 'WF'.

Documentation accounting for a student's absence may be requested. Please note that habitual tardiness and/or absences to class will affect your grade and may result in your removal from the roll.

If a student chooses to withdraw from the course it is that student's responsibility to complete the withdrawal process. Students who cease attending class without formally withdrawing receive a grade of WF for the course. Students with two or more absences may receive a grade of WF.

Grades of I (Incomplete) are awarded only in cases of serious illness and other significant non-academic circumstances. The instructor reserves the right to make the final decision with regard to granting a grade of "I".

COURSE COMMUNICATION

When questions arise outside of class time, please feel free to contact me. Outside of class, I am available during office hours, through UNG email, or by phone. **UNG Email is the quickest way to reach me**, but please respectfully allow 48 hours, not including weekends and holidays, for a reply.

ASSIGNMENTS AND ASSESSMENTS

Your grade in this course will depend on a number of factors. The percentages for each area of evaluation are listed below. *The instructor reserves the right to amend the evaluation topics and percentages with advance notice provided to the students.* **All submissions must be YOUR ORIGINAL work. Plagiarism will result in a grade of ZERO. Every submission will be checked for originality through the Turnitin.com system.**

COURSE CALENDAR

- First Day of Class: August 21
- Drop/Add period ends: August 25
- Online Learning Day(s): September 13
- Withdrawal Deadline: October 13
- Holiday: September 4
- Classes end: December 8

SIED4500 Course Weekly Schedule

Note: Reading Assignments are Tenatative and Subject to Change

Date(s)	Topic(s)	Activities & Assignments
Week 1: Aug. 23	Course Overview Syllabus, Introductions, NSTA Learning Center	STEBI pre-assessment Create NSTA LC Account - LC Library **DUE 8 /30** Start on Science Safety Certification **DUE 9/16**
Reading Assignment:	**Read & Complete Quiz by 8/28:** *Taking Science to School*, Chapter 2: Goals for Science Education AND Chapter 6: Understanding How Scientific Knowledge is Created	

Week 2: Aug. 30	Nature of Science	Video: How Simple Ideas Lead to Scientific Discoveries Follow Up: Write a 1-page essay about why teaching science is important. Include citations from assigned & other references. APA format.
Reading Assignment:	**Read & Complete Quiz by 9/4:** *How People Learn,* Chapter 1: Learning – from Speculation to Science *Learning and Understanding* Chapter 6: Learning with Understanding, 7 Principles	
Week 3: Sept. 6	Learning Theories & Conceptual Change	Videos: Lessons from Thin Air (segment), Conceptual Change Follow Up: Write 1-page essay about your position on how students learn science. Include citations from assigned AND additional references. APA format.
Reading Assignment:	**Read & Complete Quiz by 9/11:** *America's Lab Report*, Chapter 6: Facilities, Equipment and Safety	
Week 4: Sept. 13	Safety	Online Learning Week: Complete either the middle or high school level Flinn Science Safety Course by 9/16.
Reading Assignment:	**Read & Complete Quiz by 9/18:** (1) *Seeing Students Learn Science,* (2017) Chapter 1: What's Really Different? pages 1-18 (2) *Science Teachers' Learning: Enhancing Opportunities, Creating Supportive Contexts, (2015)* Chapter 2: A New Vision of Science Teaching & Learning, pages 27-46	
Week 5: Sept. 20	3D Learning, Including: ● Science & Engineering Practices ● Cross Cutting Concepts	Video: Doing Science
Reading Assignment:	**Read & Complete Quiz by 9/25:** *BSCS Why Does Inquiry Matter?* *Inquiry and the National Science Education Standards*, Chapter 6: Making the Case for Inquiry	
Week 6: Sept. 27	Investigations & Inquiry	Video: 3 Rules to Spark Learning Follow Up: Write 1-page essay about your position on how science should be taught. Include citations from assigned AND additional references. Include readings due 9/20 and 9/27 in your references. APA format.
Reading Assignment:	**Read & Complete Quiz by 10/2:** *Developing Assessments for the Next Generation Science Standards* Chapter 4: Classroom Assessment	

Week 7: Oct. 4	Assessment	Video: Making a Rubric Follow Up: Write 1-page essay about your position on how science should be assessed. Include citations from assigned AND additional references. Include readings due 10/4 in your references. APA format. **Assessment Activity due 11/3**
Reading Assignment:	**Read & Complete Quiz by 10/9:** *The BSCS 5E Instructional Model: Origins & Effectiveness*	
Week 8: Oct. 11	5E Model	Video: Teaching with the 5E Learning Cycle **Position paper due 10/11 to *Livetext***
Reading Assignment:	**Read & Complete Quiz by 10/16:** *Science Teaching Reconsidered*, Chapter 2: How Teachers Teach, Specific Methods	
Week 9: Oct. 18	Teaching Strategies	Video: Asking Effective Questions
Reading Assignment:	**Read & Complete Quiz by 10/23:** *America's Lab Report* Chapter 3: Laboratory Experiences and Student Learning	
Week 10: Oct. 25	Laboratory Science	Video: Create your Own Science Lab
Reading Assignment:	**Read & Complete Quiz by 10/30:** *Effective Instruction, What Does Research Tell Us?*	
Week 11: Nov. 1	Planning & Unit Instruction	Video: Using Phenomena **Assignment: Unit Plan due 12/6**
Reading Assignment:	**Read & Complete Quiz by 11/6:** *STEM Integration in K-12 Education: Status, Prospects and and Agenda for Research,* Chapter 2: A Descriptive Framework for Integrated STEM Education	
Week 12: Nov. 8	STEM Education & Engineering Design	Video: Engineering Crash Course
Reading Assignment:	**Read & Complete Quiz by 11/13:** *Frameworks for K-12 Science Education,* Chapter 11: Equity & Diversity in Science & Engineering Education	
Week 13: Nov. 15	Differentiation Equity & Diversity	Video: Closing the Gender Gap
Reading Assignment:	**Read & Complete Quiz by 11/27:** *Surrounded by Science,* Chapter 1: Informal Environments for Learning Science	

Week 14: Nov. 29	Learning Beyond the Classroom	Video: Economic Value of Informal Science Education
Reading Assignment:	**Read & Complete Quiz by 12/4:** *Science Teachers Learning:* Chapter 6, Enhancing Opportunities, Creating Supportive Contexts	
Week 15: Dec. 6	Professional Development	Video: Hey Science Teachers, Make it Fun

Final Report

Affordable Learning Georgia Textbook Transformation Grants
Final Report

To submit your Final Report, go to the Final Report submission page on the ALG website: http://affordablelearninggeorgia.org/site/final_report_submission
Final report submission requires four files:

- *This completed narrative document*
- *Syllabus or syllabi*
  - *(if multiple files, compress into one .zip folder)*
- *Qualitative/Quantitative Measures data files*
  - *(if multiple files, compress into one .zip folder)*
- *Photo of your team or a class of your students w/ at least one team member, minimum resolution 800x600px*
  - *(nearly all smartphones take photos larger than this size by default)*

Follow the instructions on the webpage for uploading your documents. Based on receipt of this report, ALG will process the final payment for your grant. ALG will follow up in the future with post-project grantee surveys and may also request your participation in a publication, presentation, or other event.

General Information

Date: April 27, 2018

Grant Round: 9

Grant Number: 317

Institution Name(s): University of North Georgia

Project Lead: Donna Governor

Team Members (Name, Title, Department, Institutions if different, and email address for each):

- Donna Governor, Asst. Professor, Teacher Education, donna.governor@ung.edu
- David Osmond, Asst. Professor, Teacher Education, david.osmond@ung.edu
- Max Vazquez Dominguez, Asst. Professor, Teacher Education, Max.VazquezDominguez@ung.edu
- Sanghee Choi, Associate Professor, Teacher Education, sanghee.choi@ung.edu
- April Nelms, Department Head, Teacher Education, april.nelms@ung.edu

Course Name(s) and Course Numbers:

- SIED4184
- SIED4500

Semester Project Began: Fall 2018

Final Semester of Implementation: Spring 2018

Total Number of Students Affected During Project: 103

1. Narrative

A. The textbook transformation process for this grant was a valuable project, not just for our students, but for our workgroup. We had a short lead time however, came back together to meet just prior to the start of the semester. We compiled a list of NAP documents and other online, credible, free resources (i.e. BSCS) and identified specific documents and chapters that would correlate with the topics typically covered in our methods courses. In some cases, there were multiple documents to cover each topic, but for other topics, we found only one or two. We then divided that list and each identified the most helpful reading assignments for our students and developed reading/discussion questions to use with each selection. A final list was compiled, with a broader range of readings and topics than we were able to cover in the past, which allowed each instructor to customize his or her instruction. We also have spent this year revising our key assessments and lesson plan templates to align with our revised syllabus and the reading materials we've implemented for our textbook transformation.

The work that we did collaboratively helped us better align our courses to make sure that all our students are getting a quality class experience, and helped to facilitate some great discussions on what should be included in the methods course and to share both pedagogy and resources. The biggest challenge we had was the tight timeline between the award and the start of the fall semester. Collaborating over the summer was difficult so we had to rely on Google docs and emails, rather than face-to-face interaction until just prior to the start of the semester. There is an abundance of NAP documents for science education, so another major challenge was in organizing the materials for students. In the end, we did start the semester with our syllabi ready with adequate resources, and continued to build them over the term. Additionally, we as faculty, could add any additional readings from their database if necessary (according to students' needs and the schools and varying school districts' responsibilities).

We feel that this project was transformative in a number of ways. As instructors, selection of learning materials is key to the teaching and learning processes in the classroom. The readings have to align with the goals of the course and also to the goals of your student-teachers. Reading materials are in many cases long. With all the administrative requirements and students' responsibilities, we have to be very efficient in how we choose these materials and how we select the activities in the classroom. We have started rethinking all of the materials that are incorporated into our classes so that we can make better use of the available materials. It was good for us to go through the course and reorganize with these readings. That experience provided insight to have a better organization for the class and facilitated good discussions each week based on online readings. We are now actively reviewing new resources and incorporating them into our courses when relevant. As the NAP releases new materials, they will be reviewed and included into each relevant section.

For our students, we felt that they had a better learning experience. Our students felt that the variety of voices made assigned readings more interesting. Others felt that the readings were more appropriate and useful for teaching. One student commented, “I feel that using the readings that we did was extraordinarily useful. They seemed to provide a better fit than traditional textbooks. Instead of fitting the instruction around the text, the instruction guided the text.” Another summarized their experience, “I feel that it gave me more specific information that directly pertained to what we were learning in class. Our teacher could directly choose readings based of what we were covering instead of continually reading through one book. Also, this gave use experience reading credible sources online and learning how to incorporate multiple articles within a lesson was interesting.” Another student commented on how appropriate the materials were for their internship placements, “"I like the reading due to they are practical based so I can apply my reading into my own teaching in the internship classroom."

B. Overall, we feel the program was a success. Probably the one thing we would have liked to do differently is to have had more time between the grant and the start of the semester to improve the quality of the questions and to allow for more discussion within the workgroup. We ended up collaborating mostly online, but we lost some of the richness that face-to-face discussion can bring.

2. Quotes

- *I like my reading due to it is easy to understand. I am doing my teaching internship and I can see lots of components from reading in the real classroom setting.*
- *I have really enjoyed using NAP and public domain documents as our 'textbook' for this course. I like how it has allowed us to use many books throughout the semester. Instead of only receiving one author's perspective, we have been able to read from a variety of sources. Also, this has allowed us to read more current articles that include research which is presently shaping the field of education. This ensures that the readings are useful and have direct applications in the classroom. The readings have been very helpful with the new GSE that have been adopted, and have taught me how to properly teach these standards in the classroom. I also liked how we were able to download the entire book if we were interested in reading more on the topic. Overall, I really enjoyed using the public domain documents as our textbook for the class.*
- *Personally, I think that the textbook alternative was the most useful course reading I have ever had in the education program at UNG. Not only were the assigned readings free to use, they were easy to navigate, download, and reference when completing assignments. The readings have been extremely beneficial. They are resources that I know that I will continue to use throughout the education program, and even after graduation. I like that this alternative to traditional textbooks allows us to be exposed to a variety of authors, and a broader range of information. By being assigned specific chapters that are the most meaningful and beneficial, I believe that more students will be inclined to actually read the assigned reading, and will be better prepared in the long run. I am fully in favor of continuing to use the textbook alternative rather than using a traditional textbook.*

3. Quantitative and Qualitative Measures

3a. Uniform Measurements Questions

Student Opinion of Materials

Was the overall student opinion about the materials used in the course positive, neutral, or negative?

Total number of students affected in this project: ____103_____

- Positive: ___78____ % of __103_____ number of respondents
- Neutral: ___19____ % of ___103_____ number of respondents
- Negative: ___3____ % of ___103_____ number of respondents

Student Learning Outcomes and Grades

Was the overall comparative impact on student performance in terms of learning outcomes and grades in the semester(s) of implementation over previous semesters positive, neutral, or negative?
Our records show that the overall impact on grades and course success was neutral. Students did not perform worse or better in terms of grades or class performance. However, we felt that the students benefited by not only have a free resource of relevant and current materials, but that we could select those that could be aligned to the goals of the course, rather than trying to align the course to the textbook.

Choose One:

- ___ Positive: Higher performance outcomes measured over previous semester(s)
- _X__ Neutral: Same performance outcomes over previous semester(s)
- ___ Negative: Lower performance outcomes over previous semester(s)

Student Drop/Fail/Withdraw (DFW) Rates

Was the overall comparative impact on Drop/Fail/Withdraw (DFW) rates in the semester(s) of implementation over previous semesters positive, neutral, or negative?
The Pass/Fail/Withdrawal rate was neutral over previous semesters.

Drop/Fail/Withdraw Rate:
Depending on what you and your institution can measure, this may also be known as a drop/failure rate or a withdraw/failure rate.
_____0__% of students, out of a total ___103____ students affected, dropped/failed/withdrew from the course in the final semester of implementation.
Choose One:

- ___ Positive: This is a lower percentage of students with D/F/W than previous semester(s)
- _X__ Neutral: This is the same percentage of students with D/F/W than previous semester(s)
- ___ Negative: This is a higher percentage of students with D/F/W than previous semester(s)

3b. Measures Narrative

GENERAL DATA:
The average GPA for this course is a 3.7.
There were no drop, fails or withdrawals, either this semester or in the previous year.

QUANTITATIVE DATA:

Our main source of quantitative data was the STEBI B, a measure of science teaching efficacy for pre-service teachers. This was administered to students at the beginning and end of the semester. Not all students provided data, however a majority of the students in our six courses did complete the pretest, while data for only a third of the students is available for the end of the semester. Because we had unequal groups, we used a two sample, unpaired t-Test for data analysis with an alpha of 0.05. Results for the total instrument and each item are shown below.

STEBI B Pre/Post Test Scores for Sample Class in ASPEM Grant

1 = Strongly Agree
2 = Agree
3 = Uncertain
4 = Disagree
5 = Strongly Disagree

Pretest Number = 73
Posttest Number =66

2 Sample, unpaired t-Test, alpha = 0.05

Items with a negative direction on the pre/post test scores correlate with items worded negatively. Therefore, a negative increase in the mean score indicates a positive improvement on the statement.

Item	Pre	SD	Post	SD	Direction	p-Value	Sig
1. When a student does better than usual in science, it is often because the teacher exerted a little extra effort.	2.17	0.99	2.11	0.82	+	0.7	No
2. I will continually find better ways to teach science.	1.40	0.60	1.33	0.45	+	0.17	No
3. Even if I try very hard, I will not teach science as well as I will most subjects.	4.05	0.89	3.91	0.77	+	.32	No
4. When the science grades of students improve, it is often due to their teacher having found a more effective teaching approach.	1.86	0.57	2.05	0.59	-	0.056	No
5. I know the steps necessary to teach science concepts effectively.	3.26	0.78	1.97	0.70	+	<0.001**	YES
6. I will not be very effective in monitoring science experiments.	3.98	0.86	4.30	0.74	-	0.0198*	YES
7. If students are underachieving in science, it is most likely due to ineffective science teaching.	2.77	1.04	2.67	0.94	+	0.55	No
8. I will generally teach science ineffectively.	4.26	0.75	4.36	0.59	-	0.38	No

9. The inadequacy of a student's science background can be overcome by good teaching.	1.95	0.61	1.92	0.64	+	0.78	No
10. The low science achievement of some students cannot generally be blamed on their teachers.	3.18	0.92	3.33	0.84	-	0.32	No
11. When a low-achieving child progresses in science, it is usually due to extra attention given by the teacher	2.35	0.79	2.29	0.72	+	0.64	No
12. I understand science concepts well enough to be effective in teaching elementary science.	2.67	1.01	1.82	0.67	+	<0.001**	YES
13. Increased effort in science teaching produces little change in some students' science achievement.	3.98	0.78	3.92	0.86	+	0.67	No
14. The teacher is generally responsible for the achievement of students in science.	2.58	0.81	2.50	0.76	+	0.55	No
15. Students' achievement in science is directly related to their teacher's effectiveness in science teaching.	2.51	0.89	2.50	0.72	+	0.94	No
16. If parents comment that their child is showing more interest in science at school, it is probably due to the performance of the child's teacher.	2.53	0.77	2.38	0.75	+	0.25	No
17. I will find it difficult to explain to students why science experiments work.	3.79	0.84	3.98	0.83	-	0.28	No
18. I will typically be able to answer students' science questions.	2.31	0.75	2.02	0.64	+	0.0152*	YES
19. I wonder if I will have the necessary skills to teach science.	2.79	1.03	3.56	0.96	-	<0.001**	YES
20. Given a choice, I will not invite the principal to evaluate my science teaching.	3.79	0.75	3.92	0.86	-	0.35	No
21. When a student has difficulty understanding a science concept, I will usually be at a loss as to how to help the student understand it better.	3.81	0.67	4.12	0.59	-	0.0043*	YES

22. When teaching science, I will usually welcome student questions.	1.55	0.62	1.45	0.58	+	0.33	No
23. I do not know what to do to turn students on to science.	3.48	0.95	4.02	0.73	-	<0.001**	YES
Overall	**2.91**	**0.84**	**2.89**	**0.73**	**+**	**0.88**	**No**

Note: Statistically significant *p<.05, **p<.001

Items students made significant gains on:

Teaching Efficacy:
5. I know the steps necessary to teach science concepts effectively.
6. I will (not) be very effective in monitoring science experiments.

Teaching Effectiveness:
12. I understand science concepts well enough to be effective in teaching elementary science.
18. I will typically be able to answer students' science questions.
19. (I wonder if) I will have the necessary skills to teach science.
21. When a student has difficulty understanding a science concept, I will usually (be at a loss as to how to) help the student understand it better.
23. I do (not) know what to do to turn students on to science.

Summary of gains:

Students feel that they have learned how to teach science and will be effective. They feel that they will be able to explain concepts to students and answer their questions. They are confident that they are able to teach science.

QUALITATIVE DATA:

A sampling of data is provided for students based on survey feedback at the end of the semester. Not all students provided input. Below are the responses we received:

- *I really enjoyed the use of NAP and public domain documents. In my opinion, it was a wonderful investment the school made. I normally do not read textbooks, even if I buy them, so having online readings helped me. I also enjoyed that it was chunked in chapters because it made it less overwhelming. Some of the readings, however, were better than others, but I was still able to glean something from each of the readings.*
- *I really enjoyed using the NAP documents as an alternative text. The documents had an ease of readability and accessibility that was very convenient, and they served as great sources to delve into more current research of effective instructional practices for teaching science. All of the readings this semester were fairly current, and provide good insight into the future of science teaching and were useful in clarifying key characteristics of recommended science instruction, such as the characteristics of inquiry and multidisciplinary instruction.*
- *Using the readings from NAP and other public domain documents has been a breath of fresh air as a student. I really enjoyed the accessibility of the readings as I am always on the move. Not just their accessibility but their content was always recent, letting me know as a student*

that I was reading the most recent, accurate information on the topics we were reading about. The quality was always top-notch, and really related well with our discussions in class. It was easy to relate the readings to our field experience too. I would sometimes catch myself using information that I read from our readings and applying them while I was teaching my students.

- *I like the reading due to they are practical based so I can apply my reading into my own teaching in the internship classroom.*
- *I like my reading due to it is easy to understand. I am doing my teaching internship and I can see lots of components from reading in the real classroom setting.*
- *I can use some reading topics for my teaching.*
- *It was easy to access to those readings each week due to I can use my cell phone or tablet.*
- *I really liked having the vast array of articles to read throughout this semester. The articles and readings covered many different topics addressing science education and the best possible outcomes to incorporate STEM in the classroom. The quality of the readings were really good, but some of the articles were too long. The readings were useful for getting creative in your lessons and learning how to incorporate phenomena to engage your students' interests. I felt like the readings were appropriate for this class because the material connected with the objectives in the SIED 4500. Also the readings were appropriate to use within your placement to make connections of public school education and STEM procedures. Overall, the articles/readings were engaging and relevant for science placement opportunities when incorporating the material into the lessons.*
- *I have really enjoyed using NAP and public domain documents as our 'textbook' for this course. I like how it has allowed us to use many books throughout the semester. Instead of only receiving one author's perspective, we have been able to read from a variety of sources. Also, this has allowed us to read more current articles that include research which is presently shaping the field of education. This ensures that the readings are useful and have direct applications in the classroom. The readings have been very helpful with the new GSE that have been adopted, and have taught me how to properly teach these standards in the classroom. I also liked how we were able to download the entire book if we were interested in reading more on the topic. Overall, I really enjoyed using the public domain documents as our textbook for the class.*
- *I really enjoyed the National Academies Press readings, but I may be biased as I enjoy doing research and learning about studies done in areas I could apply to my classroom. I found them all to be very useful, so much so that I downloaded and saved them all to my computer. The readings were appropriate for the most part, with the exception of a few things that may have been geared toward younger/older students. These items could still be adapted for middle grades, though. Using this as a textbook alternative was amazing for cost purposes. The literature was extremely informational, but not too dense. The material was easy to understand and apply to one's own classroom. I really enjoyed using this as a textbook option and would recommend its use in future college classes.*
- *Personally, I think that the textbook alternative was the most useful course reading I have ever had in the education program at UNG. Not only were the assigned readings free to use, they were easy to navigate, download, and reference when completing assignments. The readings have been extremely beneficial. They are resources that I know that I will continue to use throughout the education program, and even after graduation. I like that this alternative to traditional textbooks allows us to be exposed to a variety of authors, and a broader range of information. By being assigned specific chapters that are the most meaningful and*

beneficial, I believe that more students will be inclined to actually read the assigned reading, and will be better prepared in the long run. I am fully in favor of continuing to use the textbook alternative rather than using a traditional textbook.

- *I actually thoroughly enjoyed using the online books with our class because I feel that it gave me more specific information that directly pertained to what we were learning in class. Our teacher could directly choose readings based of what we were covering instead of continually reading through one book. Also, this gave use experience reading credible sources online and learning how to incorporate multiple articles within a lesson was interesting. I also liked that I didn't have to pay for it because I needed that money I saved from not buying a book in this class. I would definitely take classes that used this method in the future if I had a choice.*
- *All of the articles that were made available to us through our professor and NAP were extremely helpful when it came to my understanding of the course material. I enjoyed reading the articles week to week as it gave me insight into the professional world of science education. The articles included research-based strategies, and i was able to apply several to my lessons in student teaching. Topics covered in the articles included but were not limited to diversity, equity, 5E instruction, nature of science, inquiry-based practices, and discovering phenomena. Because the articles were free to read, there was a greater chance of me reading the course material. Textbooks cost anywhere from $20-$300, and most students are not willing to buy such if they aren't going to use it throughout the semester. I am sure though, if we were to have had a textbook, it would have been used throughout the semester because of how much curriculum we had to cover in such a short period of time.*
- *I really enjoyed the free readings. I loved the fact that it was easier on us as the poor college students. The material was good quality and an easy read. It was very appropriate for this course and provided detailed information about teaching science. College students should not have to pay for a big textbook they look at once and never look at again. So, this is a wonderful option*
- *I thought that the quality of the readings was very good and I enjoyed learning from them. I personally would like to see more pedagogy taught and more examples from real life teaching practices incorporated into the readings. Many of the readings were very generalized and while I understood the methods and the pedagogy that they were instructing us on, many times I was left wanting a good way to use the practice in my future classroom. I just like to see real-world examples, etc. in order to better understand how to implement it.*
- *I feel that using the readings that we did was extraordinarily useful. They seemed to provide a better fit than traditional textbooks. Instead of fitting the instruction around the text, the instruction guided the text. Being a science major, I was more comfortable with this format. In our discipline, it makes sense for us to gain additional experience with these types of text from various documents. In the real world, scientific endeavors rarely draw from one source. Additionally, I was relieved to find out that there were no books to purchase for this course. The trade-off was very weighted. Instead of paying for an overpriced book that loosely fit the course, we read hand-selected material that directly related to our studies and did so for free while being exposed to an archive of peer-reviewed resources that will benefit us throughout our careers. This was awesome on so many levels. Thank you!*
- *I have enjoyed the (FREE!!!!!) readings this semester. I actually downloaded them all into a folder on my computer so that I can revisit them when need be. Being able to have these online textbooks readily accessible made it easy. It also prevented us as a class from buying multiple books to learn what was needed to learn. The readings were appropriate in my opinion, and very helpful in keeping us up to date in the "science world."*

Qualitative Summary:

Probably the most common theme we saw was that students really appreciated the fact that these resources are free. As senior interns, they do not have the financial resources to support purchasing a large number of textbooks. They also feel that these resources are much more valuable than a text, as they are research based, relevant, current and appropriate. Another theme that emerged is that they liked the variety of resources. Because they were from different sources, some were more engaging than others, but they brought variety and novelty to the assigned readings. They valued the different perspectives they were exposed to. Several students mentioned that they felt the readings were more relevant than a traditional text, and they were able to integrated their readings into their placement easier than a text would facilitate. More than one student appreciated the fact that as instructors we were able to tailor the readings to the course, rather than have to make our course fit a text. There were a few students, one or two in each section, who felt that the readings were difficult and hard to read. However, there were also a number of students who felt that the readings were not only appropriate, but easy. A final trend that was fairly common was that students appreciated the accessibility of the readings. They could always access the reading materials on their devices, where ever they went.

4. Sustainability Plan

Our sustainability plan involves a regular review of the syllabus and scope and sequence of the methods course. We plan to continue using these resources for our students. The National Academy of Sciences is always publishing new materials through the National Academies Press (NAP). Research into all aspects of science education is continuously ongoing, with publications driving new trends. The 2012 publication, "The Frameworks for K12 Science Education" was the spark that lit the move to the Next Generation Science Standards and 3-Dimensional learning. Just as these NAP documents have sparked new conceptual frameworks in the past, future publications will drive the trends of tomorrow. Therefore, it is important that keep current and continuously modify our readings list based on new publications. We believe that the use of NAP documents in our methods course is a living, breathing text, that will evolve, topic by topic, as new materials become available. We are actively reviewing new resources and incorporating them into our courses when relevant. As the NAP releases new materials, they are being reviewed and included into each relevant section. Older materials will be cycled out as new publications provide more updated information. These decisions will be made at monthly workgroup meetings, with a special focus on syllabus revision in the fall of each year.

5. Future Plans

Transforming our student readings from a traditional text to using current, professional documents has helped us think differently about our courses. It's helped us look for other, nontraditional resources for our courses. For example, we have also moved away from a traditional text for our ISCI courses, and begun using the NSTA Learning Center's SciPack modules for content. We are applying this practice to our other courses as we are looking for free, online web-based text and video links for different courses' reading homework.

We believe that the NSTA *Journal of College Science Teaching* is the appropriate journal for publishing a paper about our experience. We feel that the use of NAP resources exposed our students to high

quality, professional resources that could become the standard for science methods courses. During our upcoming retreat, we will discuss a plan to move forward to the manuscript. We also plan to continue collecting data, as well as identify data sets from past iterations, that might be useful in developing a research paper.

6. Description of Photograph

Our grant team shown in the photo includes our Science Methods Instructors who worked on and implemented the grant in their methods courses:

- Donna Governor, Grant Lead and Instructor SIED4184 & SIED4500
- David Osmond, Grant Co-Lead and Instructor SIED4184
- Sanghee Choi, Workgroup Lead and Instructor SIED4184

Not shown is our department head, April Nelms and Max Vazquez Dominguez, Instructor SIED4184