



ESTABLISHING GRADUATE CERTIFICATES
ARIZONA STATE UNIVERSITY
GRADUATE EDUCATION

This form should be used by programs seeking to establish a new graduate certificate. All sections should be completed.

The graduate certificate is a programmatic or linked series of courses in a single field or in one that crosses disciplinary boundaries. The graduate certificate facilitates professional growth for people who already hold the baccalaureate degree, and it may be freestanding or linked to a degree program. The graduate certificate enables the university to respond to societal needs while promoting university cooperation with corporate, industrial, and professional communities.

Submit the completed and signed (chairs, unit deans) proposal to the **Office of Graduate Academic Programs**

in Graduate Education. Mail code: 1003 and electronic copies to eric.wertheimer@asu.edu or amanda.morales-calderon@asu.edu.

Please type.

Contact Name(s): Sara Brownell	Contact Phone(s): 480-727-9093 480-965-2349 480-727-1811
College: College of Liberal Arts and Sciences (CLAS)	
Department/School: School of Life Sciences (SOLS)	
Name of proposed Certificate: Scientific Teaching in Higher Education (Per recommendation from <i>Maria T. Allison and Frederick C. Corey we have changed the original title of the certificate (Graduate Certificate in Science Teaching)</i>)	
Requested Effective Term and Year: Spring 2016	
Do Not Fill in this information: <u>Office Use Only</u> CIP Code:	

1. OVERVIEW. Below, please provide a brief overview of the certificate, including the rationale and need for the program, potential size and nature of the target audience, information on comparable programs (at ASU and/or peer institutions), how this program would relate to existing programs at ASU, and any additional appropriate information.

The graduate certificate in scientific teaching in higher education is designed to provide graduate students with a more sophisticated understanding of teaching and education research in the context of college-level science classrooms, which hopefully will empower them to become agents of change as we strive towards undergraduate science education reform.

Meanwhile, despite the many educational programs Mary Lou Fulton Teachers College has to offer, they do not currently offer a program supporting science teaching in higher education. Hence this is a unique opportunity for the two schools to pool their resources and expertise to promote high quality teaching for the next generation science educators in higher education.

The certificate prepares graduate students pursuing degrees with the skills and knowledge needed to implement and evaluate evidence-based teaching at the college level. The program consists of three major components: (a) teaching experience, including use of evidence-based teaching, (b) coursework in teaching and education, and (c) a culminating experience related to significant teaching, curriculum development, or discipline-based education research focused on undergraduate science education under the guidance of a faculty member. Graduate students currently enrolled in a program at ASU will be eligible to apply to this certificate program.

For example, about 50% of SOLS students graduating over the last 10 years are currently employed in academia and are involved in teaching in one way or the other. Hence, it is important to provide as many graduate students as possible with a deeper understanding of evidence-based teaching.

Finally, this certificate will help to make students more successful in today's competitive job market, e.g. writing a concise teaching philosophy statement or demonstrate their commitment to provide excellent teaching.

2. ADMINISTRATION AND RESOURCES

- A. How will the proposed certificate be administered (including recommendations for admissions, student advisement, retention etc.)?** *Describe the administering body in detail, especially if the proposed certificate is part of a larger interdisciplinary agenda. How will the graduate support staffing needs for this proposed certificate program be met?*

The program will be administered through the Graduate Office in the School of Life Sciences which currently has 2 ½ staff positions and is overseeing 15 graduate programs. Dr. Sara Brownell (School of Life Sciences) and Dr. Bryan Henderson (Mary Lou Fulton Teachers College) will be the faculty leaders for the program and will work with students to ensure that they are meeting the certificate admissions requirements in addition to the graduate certificate program requirements.

- B. What are the resource implications for the proposed certificate, including projected budget needs?** *Will new books, library holdings, equipment, laboratory space and/or personnel be required now or in the future? If multiple units/programs will collaborate in offering this certificate, please discuss the resource contribution of each participating program. Letters of support must be included from all academic units that will commit resources to this certificate program.*

The required courses are taught by current faculty in SOLS. These include BIO 530 Scientific Teaching and BIO 531 Advanced Scientific Teaching, both taught by Dr. Amy Pate, Miles Orchinik, and Sara Brownell and BIO 532 Recent Papers in Discipline-based Education Research, taught by Dr. Sara Brownell. The elective courses are currently offered through the School of Life Sciences or Mary Lou Fulton Teacher's College.

No new resources, personnel, or space will be required.

3. ADMISSIONS PROCEDURES AND CRITERIA

- A. Admission criteria** – *Applicants must meet the admissions criteria for Graduate Education. Please also include any other additional admission requirements, e.g. type of undergraduate degree, minimum GPA, tests and/or entry-level skills that are required for this certificate program.*
(http://graduate.asu.edu/sites/default/files/GraduatePolicies_1.pdf)

Degree(s): Students currently enrolled in a graduate degree program at ASU will be eligible to apply to this certificate program." A bachelor's degree or equivalent is required.

GPA: Minimum of a 3.00 cumulative GPA (scale is 4.0=A) in the last 60 hours of a student's bachelor's degree program or in good standing in a Ph.D. program at ASU.

English Proficiency Requirement for International Applicants: (See Graduate Education policies and procedures) (http://graduate.asu.edu/admissions/international/english_proficiency):

Same as Graduate Education policy.

Required Admission Examinations: GRE GMAT Millers Analogies None required

B. Application Review Terms

Indicate all terms for which applications for admissions are accepted and the corresponding application deadline dates, if any:

Students may begin the certificate in either the fall or the spring term.

Fall Deadline (month/year): May 2016

Spring Deadline (month/year): Dec 2015

C. Projected annual admission/enrollment

How many students will be admitted immediately following final approval of the certificate? What are enrollment projections for the next three years?

We anticipate that about 30 students currently interested in the Scientific Teaching certificate program will enroll immediately in this program and followed by 20 students enrolling every year over the next 3 years.

Year 1	Year 2	Year 3
30	50	50

4. ACADEMIC REQUIREMENTS

A. Minimum credit hours required for certificate: 17

B. Please describe the primary course delivery mode, (e.g., online, face-to-face, off-site etc.).

Please note: If this proposed initiative will be offered completely online, clearly state that in this section.

Courses will be offered primarily face-to-face, but some courses may have online components and off-site experiences (e.g. internships).

C. As applicable, please describe culminating experience required (e.g., internship, project, research paper, capstone course, etc.)

Each student will undertake a significant experience related to scientific teaching in higher education in one of three categories (BIO 593 Applied Project): teaching, curriculum development, or discipline-based education research. Students must take this course after they have fulfilled all other requirements.

- For teaching, students will engage in a significant teaching experience, either co-teaching or solely teaching an undergraduate course at ASU in one semester in an evidence-based way by frequently assessing students, by the program directors and using peer evaluations. In coordination with, and under the supervision of, the program chairs, students can also teach

at another university or college (BIO 584 Internship). Making arrangements to teach at other universities or colleges will be an exception that will be decided on a case by case basis by the program directors.

- For curriculum development, students will either create or co-create with a faculty member either a revised curriculum for an existing course or a new curriculum for a newly developed course. This curriculum should be aligned with the goals for evidence based scientific teaching outlined in Vision and Change of Undergraduate Teaching in Biology as detailed by AAAS (American Association for the Advancement of Science) and NSF (documented at <http://visionandchange.org/files/2013/11/aaas-VISchange-web1113.pdf>) and taught in BIO 530 Scientific Teaching, BIO 531 Advanced Scientific Teaching). Additionally students need to provide learning goals and proposed assessments that test these learning goals.
- For discipline-based education research, students will work closely with a discipline-based education researcher over two semesters to conduct a research project that examines the effectiveness of particular teaching strategies, classroom innovations, or other interventions that aim to improve higher education in science.

All students will be required to enroll in BIO 590 Applied Project for each of these three categories. They will work closely with a faculty advisor on their culminating experience and will present the results of it as a poster in an annual spring symposium focused on Scientific Teaching in Higher Education open to the whole ASU community. The content of the poster will be described in an accompanying description which will be part of the evaluation of the poster. In addition to student poster presentations, we will have a set of faculty talks about innovations and research in scientific teaching. This symposium will be sponsored through the School of Life Sciences. Not only will this be an opportunity to students to showcase their work, but it will also be an opportunity for faculty and staff within the sciences to talk more deeply about the quality of their teaching.

D. What knowledge, competencies, and skills (learning outcomes) should graduates have when they complete this proposed certificate program? *Examples of program learning outcomes can be found at (<https://uoeee.asu.edu/program-outcomes>).*

Outcome 1. Graduates of this Certificate in Scientific Teaching in Higher Education will be aware of and able to successfully implement evidence-based scientific teaching approaches. This includes being aware of best practices, using methods of student-centered instruction that have been documented to be effective, developing assessments aligned with learning goals, and iteratively modifying their teaching based on assessment of student understanding and experience.

Outcome 2. Graduates will be able to critically evaluate discipline-based education literature. This includes being aware of journals that publish discipline-based education research, staying current on the literature, and being analytical in their evaluation of the effectiveness of a particular teaching strategy or classroom intervention.

Outcome 3. Graduates will be able to develop a complete curriculum for an Undergraduate level Science class.

E. How will students be assessed and evaluated in achieving the knowledge, competencies, and skills outlined in 4.D. above? *Examples of assessment methods can be found at (<http://www.asu.edu/oue/assessment.html>).*

Outcome 1. Graduates of this Certificate in Scientific Teaching in Higher Education will be aware of and able to successfully implement evidence-based scientific teaching approaches in their own teaching.

Measure 1. Student teaching will be observed by a trained professional (faculty member or academic professional) and evaluated based on the inclusion on evidence-based teaching. The trained professional will use a validated rubric (see Appendix III) to conduct the observation and will give the students a total score of 1-3 (3 being the highest).

Performance Criterion 1. 80% of students must demonstrate the incorporation of some type of evidence-based teaching through the observation by getting at least an average

score of 2. If not, they will be asked to teach another class or schedule another observation to complete this requirement.

Measure 2. Students will submit a written example of an instructors outline (See sample outline in Appendix IV) for one of the classes they have taught.

Performance Criterion 2. The instructors outline needs to be evaluated as satisfactory by the supervising faculty or academic professional.

Outcome 2. Graduates will be able to critically evaluate discipline-based education literature.

Measure 1. (BIO 531 Advanced Scientific Teaching) Students will present a recent paper in discipline-based education research and be evaluated on the quality of their interpretation and critique of the paper using a rubric that gives them a total score of 1-5 (5 being the highest).

Performance Criterion 1. 80 % of students must demonstrate the ability of critically evaluating a paper in discipline-based education research by getting either a 4 or a 5 using the rubric below.

5- Greatly exceed expectations: Student presents the background for the paper (e.g. who the authors are, what their previous work is, and what has been done on the topic before). Student critically evaluates all aspects of the paper, including study design, results, interpretations, and limitations. Student critically evaluates how generalizable results are and the relative impact of the paper.

4 - Exceeds expectations: Student presents the background for the paper (e.g. who the authors are, what their previous work is, and what has been done on the topic before). Student critically evaluates most aspects of the paper, but misses some important elements. However, their evaluation is thoughtful and accurate.

3. Meets Expectations (but may need minor revisions/clarifications): Student presents the background for the paper, but it may be incomplete (e.g. who the authors are, what their previous work is, and what has been done on the topic before). Student critically evaluates most aspects of the paper, but may have inaccuracies in their thinking. May have missed important elements.

2- Below expectations: Student tries to critically evaluate paper, but is not able to evaluate most of the paper. Did not present any background for the paper.

1- Greatly below expectations: Student has not read the paper, presents inaccurate findings about the paper, or does not critically evaluate any component of the paper. Did not present any background for the paper.

Measure 2. (BIO 532 Recent Papers in Discipline-based Education Research).Every student has to present and write a critically review one paper in Papers in Discipline-based Education Research

Performance Criterion 2. 90% or more of student papers will be evaluated at a level 3 or higher using the rubric under measure 1.

Outcome 3. Graduates will be able to develop a complete course curriculum for an Undergraduate Science Class.

Measure 1. 80% of Students will submit a curriculum for a course they taught or an undergraduate course of their choice.

Performance Criterion 1. The curriculum will earn a rating of "Meets Expectations" or better as determined by the supervising faculty (completeness, clarity, etc.).

Measure 2. Exit survey of BIO 593 Applied Project

Performance Criterion 2. 80% of exit survey respondents will report that BIO 593 contributed “Quite a Bit” or “Very Much” to the development of their ability to create a comprehensive curriculum for an undergraduate science class.

F. Please state the satisfactory student academic progress standards and guidelines (including any time limits for completion).

Students will be evaluated based on the measures listed above. They will have to finish successfully complete all course work within 6 years. All other CLAS and Graduate Education policies apply.

G. Will this proposed certificate program allow sharing of credit hours from another ASU degree program to be used as part of this certificate program? (Please note that a maximum of 12 graduate-level credit hours taken as a non-degree student at ASU, including as a part of a certificate program, may be used towards a future graduate degree at ASU).

Yes

H. Below, please list all required and elective courses in the appropriate boxes (you may attach additional pages if necessary).

Please ensure that all new core course proposals have been submitted to the Provost’s office through the Curriculum ChangeMaker online course proposal submission system before this initiative is put on the University Graduate Council and CAPC agendas. Please note: a minimum of 2/3 of the courses required for a graduate certificate must be at the 500-level or above.

Required Courses			Credit Hours
<i>(Prefix & Number)</i>	<i>(Course Title)</i>	<i>(New Course ?) Yes or No?</i>	6
BIO 530	Scientific Teaching	No	2
BIO 531	Advanced Scientific Teaching (Prerequisite = BIO 530)	No	3
BIO 532	Recent Papers in Discipline-based Education Research	Yes	1
Electives <i>Students choose two courses from the list below for a total of six credit hours. Other electives may be selected with approval of the academic advisor.</i> <i>A minimum of two-thirds of the courses taken to complete the certificate must be at the 500-level or above.</i>			Credit Hours 6
<i>(Prefix & Number)</i>	<i>(Course Title)</i>	<i>(New Course ?) Yes or No?</i>	
BIO 598	Topic: Biology Education Research	No	3
EDP 502	Introduction to Data Analysis	No	3
EDP 503	Introduction to Qualitative Research	No	3
EDP 523	Educational Assessment	No	3
EDP 540	Theoretical Views of Learning	No	3
EDP 541	Motivating Students to Learn	No	3

BIO 480	Methods of Teaching Biology	No	3
<u>Culminating Experience</u>			Credit Hours 3
BIO 593 Applied Project			3
<u>Other Requirements</u> <i>Students have to take one of these courses for at least 2 credit hours before they can graduate</i>			Credit Hours 2
BIO 482	Advanced Methods of Teaching Biology	No	1-3
BIO 584	Internship: Scientific Teaching in Higher Education	No	1-6
BIO 598	Topic: Advanced Study Practicum: Teaching Assistance	No	1-3
Total required credit hours			17

5. PRIMARY FACULTY PARTICIPANTS - Please list all primary faculty participants for the proposed certificate, including home unit and title. You may attach additional pages if necessary.

Name	Home Unit	Title
Sara Brownell	SOLS	Assistant Professor
Ying-Chih Chen	Mary Lou Fulton Teachers College	Assistant Professor
Bryan Henderson	Mary Lou Fulton Teachers College	Assistant Professor
Juergen Gadau	SOLS	Professor
Miles Orchinik	SOLS	Professor
Valerie Stout	SOLS	Associate Professor
David Pearson	SOLS	Adjunct Professor
Sarah Dalrymple	SOLS	Academic Professional
Christian Wright	SOLS	Academic Professional
Amy Pate	SOLS	Instructor/ Technical Coordinator (IT)
Shelley Haydel	SOLS	Associate Professor
Mike Angiletta	SOLS	Associate Professor

6. REQUIRED SUPPORTING DOCUMENTS

(Please label accordingly, i.e., Appendix or Attachment A, B, etc.)

Please include the following with your proposal:

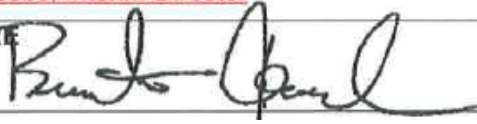
- A. Sample plans of study for students in the proposed program – See Appendix II
- B. Statements of support from all deans and heads of impacted academic units - See Appendix V

7. APPROVALS - If the proposal submission involves multiple units, please include letters of support from those units.

DEPARTMENT CHAIR or SCHOOL DIRECTOR (PRINT/TYPER)

Bertram Jacobs, Interim Director

SIGNATURE



DATE

8/25/14

DEAN (PRINT/TYPER)

Paul LePore, Associate Dean of Student and Academic Programs

SIGNATURE



DATE

3-23-15

The following section will be completed by Graduate Education following the recommendations of faculty governance bodies.

VICE PROVOST FOR GRADUATE EDUCATION

SIGNATURE

DATE

Please note: Proposals for new certificates also require the review and recommendation of approval from the University Graduate Council, Curriculum and Academic Programs Committee (CAPC), the Academic Senate, and the Office of the Provost before they can be put into operation.

The final approval notification will come from the Office of the Provost.

GF1112G-89

**APPENDIX I
OPERATIONAL INFORMATION FOR GRADUATE CERTIFICATES**

(This information is used to populate the [Graduate Programs Search](#) website.)

1. Provide a brief (catalog type - no more than 150 words) program description.

The graduate certificate in scientific teaching in higher education prepares graduate students with the skills and knowledge needed to implement and evaluate evidence-based teaching at the college level. The program consists of three major components: (a) significant teaching experience, including use of evidence-based teaching, (b) coursework in teaching and education, and (c) a culminating experience related to significant teaching, curriculum development, or discipline-based education research focused on undergraduate science education under the guidance of a faculty member.

Breakdown of requirements for the academic catalog:

- Core (6)
 - BIO 530 Scientific Teaching (2)
 - BIO 531 Advanced Scientific Teaching (3)
 - BIO 532 Recent Papers in Discipline-based Education Research (1)
- Electives (6)
- Other Requirement (2)*
- Culminating Experience (3) credit hours of BIO 593 Applied Project

* Students have to select a teaching internship course from a restricted list.

2. Contact and Support Information:

Office Location (Building & Room): LSC 226	Campus mail code: 4501
Campus Telephone Number: 480-965-7490	Program Director (Name): Bryan Henderson; Sara Brownell; Juergen Gadau
Program email address: sols.grad@asu.edu	Program Support Staff (Name): Wendi Simonson
Program Website: https://sols.asu.edu	Admissions Contact (Name): Wendi Simonson

3. Application and iPOS Recommendations: *List the Faculty and Staff that will input admission/iPOS recommendations to Gportal **and** indicate their approval for Admissions and/or POS:*

Name	ADMSN	POS
Wendi Simonson	X	X

4. Campus(es) where program will be offered: *
- | | | | |
|--------------------------|---------------|-------------------------------------|-------|
| <input type="checkbox"/> | Downtown | <input checked="" type="checkbox"/> | Tempe |
| <input type="checkbox"/> | Online (only) | <input type="checkbox"/> | West |
| <input type="checkbox"/> | Polytechnic | | |

5. **Keywords:** (List all keywords that could be used to search for this program. Keywords should be specific to the proposed program.)

Scientific Teaching, Higher Education, Discipline-based Education Research, Curriculum Development, Science Teaching

6. **Area(s) of Interest:**

- A. *Select one (1) primary area of interest from the list below that applies to this program.*

- [Architecture & Construction](#)
- [Arts](#)
- [Business](#)
- [Communications & Media](#)
- [Education & Teaching](#)
- [Engineering & Technology](#)
- [Entrepreneurship](#)
- [Health & Wellness](#)
- [Humanities](#)
- [Interdisciplinary Studies](#)
- [Law & Justice](#)
- [Mathematics](#)
- [Psychology](#)
- [STEM](#)
- [Science](#)
- [Social and Behavioral Sciences](#)
- [Sustainability](#)

- B. *Select one (1) secondary area of interest from the list below that applies to this program.*

- [Architecture & Construction](#)
- [Arts](#)
- [Business](#)
- [Communications & Media](#)
- [Education & Teaching](#)
- [Engineering & Technology](#)
- [Entrepreneurship](#)
- [Health & Wellness](#)
- [Humanities](#)
- [Interdisciplinary Studies](#)
- [Law & Justice](#)
- [Mathematics](#)
- [Psychology](#)
- [STEM](#)
- [Science](#)
- [Social and Behavioral Sciences](#)
- [Sustainability](#)

APPENDIX II
SAMPLE PLAN OF STUDY

Plan of Study (one course per semester)

Fall 2015: BIO 530 Scientific Teaching
Spring 2016: BIO 531 Advanced Scientific Teaching
Fall 2016: BIO 532 Recent papers in Discipline-based education research
Spring 2017: BIO 598 Biology Education Research
Fall 2017: BIO 480 Methods of Teaching Biology
Spring 2018: BIO 584 Internship + BIO 593 Applied Project

Accelerated Plan of Study

Fall 2015: BIO 530 Scientific Teaching + BIO 584 Internship + BIO 598 Biology Education Research
Spring 2016: BIO 531 Advanced Scientific Teaching + BIO 480 Methods of Teaching Biology
Fall 2016: BIO 532 Recent papers in Discipline-based education research + BIO 593 Applied Project

APPENDIX III

Rubric for Evidence based teaching evaluation (for Outcome 1: Measure 1)

Professional Knowledge The student demonstrates an understanding of the curriculum, subject content, and the developmental needs of students by providing relevant learning experiences.	1	2	3
	Does not demonstrate an understanding of the intellectual, social, emotional, and physical development of the age group.	Somewhat demonstrates an understanding of the intellectual, social, emotional, and physical development of the age group.	Clearly demonstrates an understanding of the intellectual, social, emotional, and physical development of the age group.
Instructional Planning The student uses effective, evidence based methods to meet the needs of all students.	1	2	3
	Does not incorporate evidence based methods in his planning.	Does plan to use only one evidence based methods.	Clearly plans multiple interconnected and effective evidence based methods.
Instructional Delivery The student effectively engages students in learning by using a variety of evidence based instructional strategies in order to meet individual learning needs.	1	2	3
	Does not deliver evidence based methods in his teaching.	Delivers only 1-2 not interconnected and effective evidence based method in his teaching.	Clearly delivers multiple interconnected and effective evidence based methods.
Learning Environment The student uses resources, routines, and procedures to provide a respectful, positive, safe, student-centered environment that is conducive to evidence based learning.	1	2	3
	Does not arrange the classroom to maximize learning while providing a safe environment.	Somewhat arranges the classroom to maximize learning while providing a safe environment.	Clearly arranges the classroom to maximize learning while providing a safe environment.

APPENDIX VI
Instructor's Outline Example

Class for Bio 100 - What is Nature for?

Phase	Module
Learning Objectives	<ol style="list-style-type: none"> 1. Define sustainability and describe how it can coexist with business interests. 2. Discuss how individual patterns of consumption can impact distant biomes. 3. Explain how business interests can study nature's models and use these designs and processes to solve human problems. 4. Examine how many natural chemicals in plants and animals can be used as medicines for humans.
<p>Engage</p> <p>Ask a question, define a problem, and/or show a discrepant event that produces cognitive disequilibrium</p>	<p>Time Estimate: 10 min</p> <ol style="list-style-type: none"> 1. Poll students: How do you view Nature? <ol style="list-style-type: none"> a. Resources to be used? b. A blueprint to model. c. A partner. d. An adversary e. Place for relaxation and recreation f. ? 2. What does the word "sustainable" mean? 3. Think-Pair-Share the following prompts: <ol style="list-style-type: none"> a. What is your view of nature? What does it entail?
<p>Explore</p> <p>Concrete, hands-on, minds-on activity that moves learners from disequilibrium to accommodation</p>	<p>Time Estimate: 10 min</p> <ol style="list-style-type: none"> 1. Buzz Group the following prompts: <ol style="list-style-type: none"> a. Look at each of these images of Nature and brainstorm how it best might be used by humans (Have each table use one image). Use whiteboard to briefly outline insights). <ol style="list-style-type: none"> i. School of fish <div data-bbox="571 1188 1019 1535" data-label="Image"> </div> ii. Humpback Whale <div data-bbox="571 1587 1019 1892" data-label="Image"> </div>

iii. Mountain



iv. Leaf with water drops




v. Soaring vulture



vi. Ants forming a bridge



vii. Forest fire

	
<p>Explain</p> <p>Reconcile student conceptions with scientific explanations using data from the Engage and Explore phases.</p>	<p>Time Estimate: 10 min</p> <ol style="list-style-type: none"> 1. Ask students to work in pairs, and then by table, to develop a brief outline of how they would explain to their parents, family or friends how they value nature and why. 2. Ask tables to write their outline on the whiteboard.
<p>Elaborate</p> <p>Use new situation(s) or problem(s) that require application of learners' understanding to extend learners' conceptual understanding</p>	<ol style="list-style-type: none"> 1. Present Biomimicry Challenge on an index card to each table of six students. 2. Working in groups of six, simplify the challenge to a question of what the appropriate solution/design should do. 3. Determine how Nature would do it. 4. Brainstorm using computer, text, lectures, and other sources to find key words, habitats, or creatures in nature that deal with this challenge. 5. Determine how you would develop and eventually commercialize this product
	<p>Bio 100 ALC 14 index card content and format for each student group</p> <p>[INDEX CARD FORMAT]</p> <p>Bio 100 ALC 14, Biomimicry Challenges</p> <p>Challenge #1: We need clothing that helps keep a soccer player cool. Function: What does the design need to do? Biologize: "How would Nature...?" Key words: What words, habitats, creatures might launch our investigation?</p> <p>Challenge #2: I need to keep bugs out of my house but don't want to use chemicals from the store.</p> <p>Challenge #3: I need to sterilize the hospital room before the next patient arrives.</p> <p>Challenge #4: I want to design a more efficient saw blade.</p> <p>Challenge #5: I want a lightweight alternative to plastic bottles to hold my drinking water on long hikes.</p> <p>Challenge #6: I'd like children's clothing that fits kids for several years.</p> <p>Challenge #7: The filters in our water filter keep getting clogged and are expensive to replace.</p> <p>Challenge #8: I'm designing a house in California and want to meet their earthquake codes in an innovative way.</p> <p>Challenge #9: I can't sell my fabric in the US because the dyes contain heavy metals.</p> <p>Challenge #10: How can I install floor tiles using much less chemical adhesive?</p>

	<p>Challenge #11: How can we build a better bicycle helmet?</p> <p>Challenge #12: How can I make a light bulb that does not produce heat?</p> <p>Challenge #13: A Fortune 500 company needs cost effective and flexible-use containers to ship bulk</p> <p>Challenge #14: A company needs a new super abrasion resistant coating that when applied becomes a clear, high gloss, scratch resistant automotive paint.</p>
<p>Evaluate</p> <p>Assess understandings and abilities</p>	<p>Time Estimate: 0 min</p> <ol style="list-style-type: none"> 1. Turn in written outline of each group's solution to its Biomimicry challenge.

APPENDIX V

SUPPORT STATEMENTS

College of Liberal Arts and Sciences – Official Submission

From: Paul LePore [<mailto:Paul.Lepore@asu.edu>]
Sent: Monday, March 23, 2015 3:40 PM
To: curriculumplanning@asu.edu
Cc: Jenny Smith; P.F. Lengel; Paul LePore
Subject: Proposal to establish a Certificate in Scientific Teaching in Higher Education

Please accept the attached proposal to establish a graduate certificate in Scientific Teaching in Higher Education. The proposal was approved last spring by the CLAS Curriculum Committee and Senate.

Thank you.

PL

PAUL C. LEPORE, Ph.D.

Associate Dean

College of Liberal Arts and Sciences

Foundation Building, Suite 110

Arizona State University | P.O. Box 876605 | Tempe, Arizona 85287-6605
480.965.6506 | Fax: 480.965.2110 | e-mail: paul.lepore@asu.edu

ASU College of Liberal Arts and Sciences — *Transforming learning, discovery and lives*

School for Engineering of Matter, Transport and Energy
Faculty Member Support

----- Forwarded message -----

From: Stephen Krause <skrause@asu.edu>

Date: Fri, Apr 25, 2014 at 11:40 AM

Subject: RE: Graduate Certificate Program in Scientific Teaching in Higher Education

To: Sara Brownell <sbrownel@asu.edu>

Hi Sara,

I think that is a wonderful idea and would be happy to be listed as a faculty member who is highly supportive of the program.

Thanks

Steve

From: Sara Brownell [mailto:sbrownel@asu.edu]

Sent: Friday, April 25, 2014 11:34 AM

To: Stephen Krause

Subject: Graduate Certificate Program in Scientific Teaching in Higher Education

Hi Stephen-

I hope all is going well as the semester comes to a close! I can't believe how quickly it went by! We (the School of Life Sciences) are putting together a proposal for a Graduate Certificate in Scientific Teaching in Higher Education. This would be something that would be available to any Ph.D. student in any scientific discipline who would want to do a concentration in teaching/education. As part of the program, students would need to teach, take a few education classes (including the Scientific Teaching courses that we have been offering), and have a capstone experience in either teaching, curriculum development, or education research.

We are in need of contacts outside of SOLS who would be supportive of this program. Would you be willing to be listed as a supporter? (note: we are not asking you to do any additional work)

Thanks,

Sara

**Ira A. Fulton Schools of Engineering
Support Statement**

From: Jeremy Helm
Sent: Monday, March 23, 2015 11:39 AM
To: Juergen Gadau
Cc: James Collofello; Kacie Cannon
Subject: RE: Letter of support for Certificate

Dear Juergen,

The Ira A. Fulton Schools of Engineering has reviewed the SOLS proposed Certificate in Scientific Teaching in Higher Education. The Fulton Schools of Engineering has no objections - we support the creation and implementation of the Certificate in Scientific Teaching in Higher Education.

Jeremy Helm

Director, Academic Administration & Student Success
Ira A. Fulton Schools of Engineering
Arizona State University
Tempe, AZ 85287-8109
(480) 965-8931 voice
(480) 965-8095 fax

From: Juergen Gadau
Sent: Friday, March 20, 2015 4:14 PM
To: Jeremy Helm
Cc: Kacie Cannon
Subject: Letter of support for Certificate

Dear Jeremy

I just left a message on your answering machine. Graduate Education told me today that I need an additional support letter/e-mail from Engineering for our application to establish a Certificate in Scientific Teaching in Higher Education. The application is attached to this e-mail.

The certificate is aimed at educating our Graduate Students in teaching and gives them a leg up when they apply for teaching jobs in academia.

The catch is that the letter/e-mail is due Monday 5 pm. I am sorry for the late notice but I just learned about this today. Otherwise the application will be held up till the fall semester! The e-mail can be brief, essentially one sentence! Please send them to me and Kacie Cannon (cc'ed).

Let me know if you have any question.

Ciao, Juergen

Jürgen Gadau

Professor

Associate Director of Graduate Studies SOLS

Barrett Honors Faculty

Arizona State University

Jgadau@asu.edu

480-965-2349

Web-page: <http://gadau.lab.asu.edu/>

**Mary Lou Fulton Teachers College
Support Statement**

From: Mari Koerner
Sent: Saturday, March 21, 2015 7:50 AM
To: Juergen Gadau; Kacie Cannon; Sherman Dorn
Subject: RE: Certificate in Scientific Teaching in Higher Education -

I support the Memo of Dr. Sherman Dorn.

Dean Mari Koerner

Mari Koerner, Ph.D.
Dean

Arizona State University | [Mary Lou Fulton Teachers College](#)
PH: 480.965.3463 | Email: Mari.Koerner@asu.edu



From: Juergen Gadau [<mailto:Juergen.Gadau@asu.edu>]
Sent: Friday, March 20, 2015 4:04 PM
To: Kacie Cannon; Sherman Dorn; mkoerner@asu.edu
Subject: Certificate in Scientific Teaching in Higher Education -
Importance: High

Dear Sherman and Marie

Graduate Education told me that the memo from Sherman is not enough and they need the approval from the dean of Mary-Lou-Fulton. The approval can be just a simple e-mail to Kacie Cannon and me that you support the Memo of Sherman or an even more general e-mail saying that you support the establishing of the *Certificate in Scientific Teaching in Higher Education*.

Sorry for the late notice but I just found out and the letter is due Monday at 5PM to make it into the University Curriculum Committee.

Thanks

Ciao, Juergen

Jürgen Gadau
Professor
Associate Director of Graduate Studies SOLS
Barrett Honors Faculty
Arizona State University
Jgadau@asu.edu
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**Division of Educational Leadership and Innovation
Support Statement**

Date: October 28, 2014

To: Juergen Gadau, Associate Director for Graduate Studies, School of Life Sciences

From: Sherman Dorn, Director, Division of Educational Leadership and Innovation

Re: Proposed Teaching in Higher Education graduate certificate

I am happy to provide this letter in support of the proposed Teaching in Higher Education certificate to be offered by the School of Life Sciences. Such a sequence will enhance the ability of ASU graduate students to be effective instructors at ASU and in faculty jobs after their graduation.

The proposed certificate will include at least one course in MLFTC, the inclusion of which will enhance the mission of the Mary Lou Fulton Teachers College in advancing teaching and learning.

I wish you every success with the certificate.

(NEW GRADUATE INITIATIVES)

PROPOSAL PROCEDURES CHECKLIST

Academic units should adhere to the following procedures when requesting new curricular initiatives (degrees, concentrations or certificates).

Obtain the required approval from the Office of the Provost to move the initiative forward for internal ASU governance reviews/approvals.

- Establishment of new curricular initiative requests; degrees, concentrations, or certificates
- Rename requests; existing degrees, concentrations or certificates
- Disestablishment requests; existing degrees, concentrations or certificates

Submit any new courses that will be required for the new curricular program to the Curriculum ChangeMaker online course approval system for review and approval.

- Additional information can be found at the Provost's Office Curriculum Development website: [Courses link](#)
- For questions regarding proposing new courses, send an email to: courses@asu.edu

Prepare the applicable proposal template and operational appendix for the proposed initiative.

- New degree, concentration and certificate templates (contain proposal template and operational appendix) can be found at the Provost's Office Curriculum Development website: [Academic Programs link](#)

Obtain letters or memos of support or collaboration. (if applicable)

- When resources (faculty or courses) from another academic unit will be utilized
- When other academic units may be impacted by the proposed program request

Obtain the internal reviews/approvals of the academic unit.

- Internal faculty governance review committee(s)
- Academic unit head (e.g. Department Chair or School Director)
- Academic unit Dean (will submit approved proposal to the curriculumplanning@asu.edu email account for further ASU internal governance reviews (as applicable, University Graduate Council, CAPC and Senate)

Additional Recommendations - All new graduate programs require specific processes and procedures to maintain a successful degree program. Below are items that Graduate Education strongly recommends that academic units establish after the program is approved for implementation.

Set-up a Graduate Faculty Roster for new PhD Programs – This roster will include the faculty eligible to mentor, co-chair or chair dissertations. For more information, please go to http://graduate.asu.edu/graduate_faculty_initiative.

Establish Satisfactory Academic Progress Policies, Processes and Guidelines – Check within the proposing academic unit and/or college to see if there are existing academic progress policies and processes in place. If none have been established, please go to http://graduate.asu.edu/faculty_staff/policies and scroll down to the **academic progress review and remediation processes** (for faculty and staff) section to locate the reference tool and samples for establishing these procedures.

Establish a Graduate Student Handbook for the New Degree Program – Students need to know the specific requirements and milestones they must meet throughout their degree program. A Graduate Student Handbook provided to students when they are admitted to the degree program and published on the website for the new degree gives students this information. Include in the handbook the unit/college satisfactory academic progress policies, current degree program requirements (outlined in the approved proposal) and provide a link to the Graduate Policies and Procedures website. Please go to http://graduate.asu.edu/faculty_staff/policies to access Graduate Policies and Procedures.