



Outcomes from *Chancellor's Awards for Excellence in STEM Education*: Quantitative and Qualitative Findings

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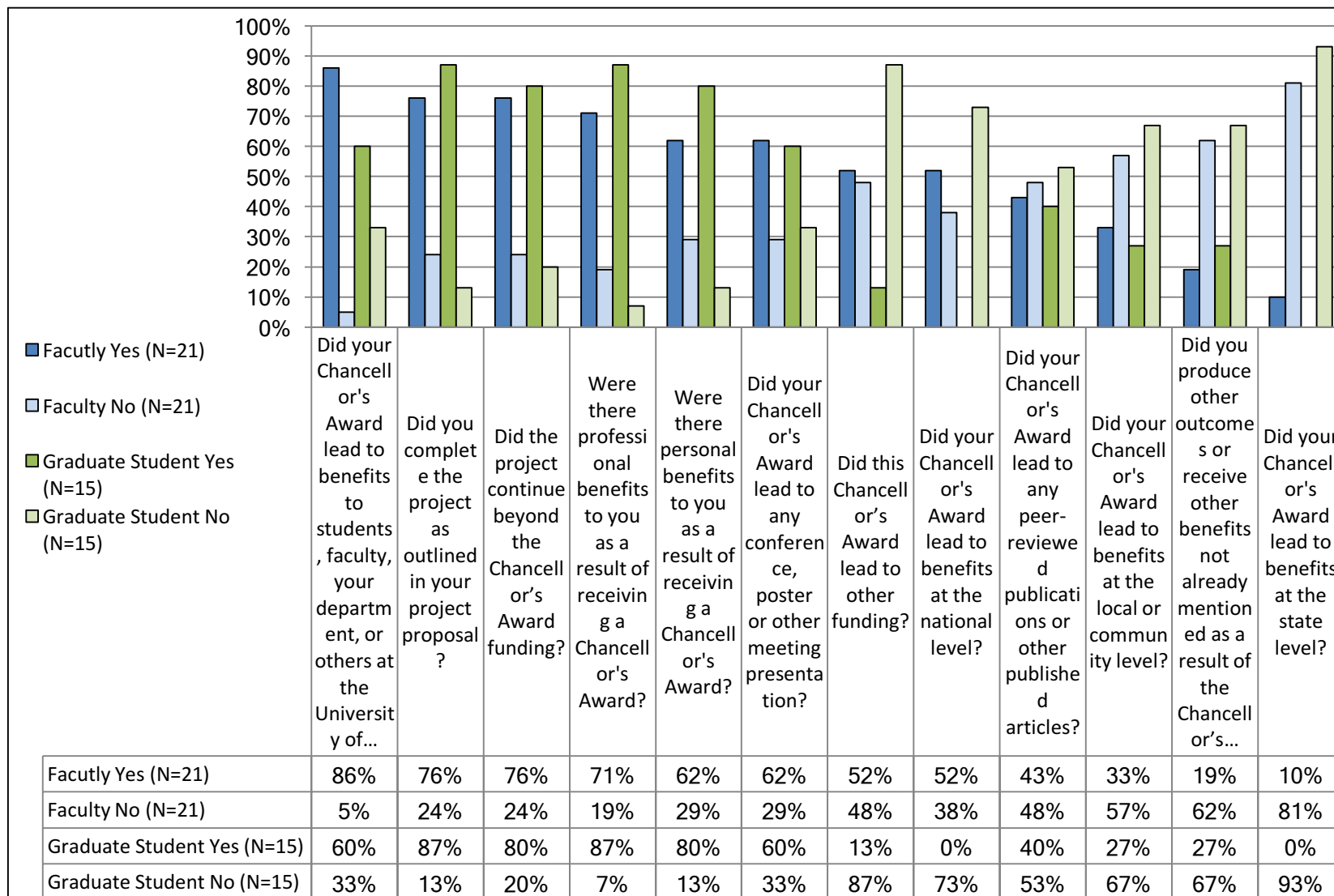
The Chancellor's Awards for Excellence in STEM Education (CAs) is a competitive grant program offered through the Center for STEM Learning at CU Boulder. The goal of the CA program is to support faculty and graduate student engagement in innovative research on student learning and implementation of research-based STEM education program initiatives. To determine the extent to which the CAs that have been granted fulfil this goal and to discover what types of projects are being undertaken and their outcomes, Dr. Valerie Otero, Co-director of CSL, asked CSL Program Manager Anne-Barrie Hunter to conduct an analysis of CA proposals and final reports. In addition to reviewing CA documents, Hunter also developed and administered a survey to CA faculty member and graduate student recipients to gather information not available from CA proposals and final reports. This report presents findings from analyses of the quantitative survey data and qualitative content analysis of CA proposals and final reports submitted by faculty members and graduate students.

The Chancellor's Awards for Excellence in STEM Education represent CSL's main programmatic initiative. Between 2009 and 2016, CSL has funded a total of 76 CAs: 38 to a total of 58 faculty members (there are multiple investigators on several proposals; three faculty members and SASC received funding twice) and 38 graduate student awards to a total of 39 students (just one proposal with multiple investigators; four graduate students received funding twice).

Results

Survey Data

A survey to discover outcomes from faculty and graduate student Chancellor's Awards for Excellence in STEM Education (CA) was sent to 79 faculty and graduate students on three separate occasions: 42 responded. The survey contained 27 questions soliciting self-report data on project outcomes in a number of benefits' dimensions: personal, professional, student, institutional, local, state and national. The final survey data set is comprised of 21 faculty members' and 15 graduate students' responses, for an overall response rate of 46%. Main survey findings are presented here; full survey results along with respondents' open-ended comments are presented in Appendix A:



- Nearly all faculty members (86%) and over half of graduate students (60%) reported benefits to undergraduates in terms of courses transformed, curricula changed or created, labs overhauled and resources for student learning developed.
- Just over half of faculty (52%) and two graduate students reported receiving additional funding from a national funding agency, such as the NSF, to continue the project. A conservative ~\$6,000,000 is listed in faculty members' open-ended comments to this question.
- Just over 40% of faculty and graduate student projects resulted in peer-reviewed publications and ~60% of all respondents had presented findings at a professional conference—some internationally.
- About 50% of faculty also reported benefits at the national level, and about a third reported gains at the local level.

Survey data results show that CAs produced multiple benefits to CU faculty, graduate students, and undergraduates, and results from research funded by the CAs contributed to science education research at multiple levels: local, state and national.

Content Analysis of Qualitative Data

CA proposals and final reports (N=90; n=45 faculty documents; n=45 graduate student documents) were coded to capture project information: type of project, area of research, aimed at lower- or upper-division courses, K-12 or education outreach, etc. A content analysis of the faculty and graduate student CA proposals and final reports was conducted. In conducting a content analysis, the analyst reads through the text data searching for relevant information. Text segments referencing distinct ideas are tagged by a code and the codes are collected in a codebook. When the analyst reads a passage that relates an idea previously encountered, the same code is reused to mark the text. Thus codes and their associated text passages are linked, amassing a data set of codes and their frequency of use across the data set. Once all of the text data is coded in this manner, codes similar in nature are grouped together forming categories, showing both the range and relative weighting of items across the data set.

Funded projects often focus on curriculum development and course and laboratory transformation. Chancellor Award projects largely targeted lower-division courses, though a good number of CAs aimed at graduate-level courses or labs, as well as at K-12 teaching and learning. While faculty members' and graduate students' research explored a range of science education topics, most commonly projects focused on developing and testing resources and tools for improving student learning. Several projects studied student misconceptions in a particular subject area or explored outcomes or implementation of student-centered, active-learning pedagogies—commonly using technology of some sort (i.e., clickers, simulations, computer software and gaming, iPads, etc.). Finally, a number of projects studied impacts from professional development, primarily aimed at graduate students and K-12 teacher preparation. See descriptive tables below.

Results from the qualitative content analysis show that the CAs funded faculty members and graduate students to undertake a variety of projects investigating a range of science

education research, and spanning the STEM disciplines and colleges, and the School of Education, at CU Boulder.

Type of Project	Faculty member	Graduate student
Curriculum development, improvement, transformation, including labs	16	4
Informal science education, education outreach	3	7
K-12 project	2	9
Embedded research, CURES, departmental UR program	2	0
Graduate level	1	1
Undergraduate level		
Lower-division STEM course	16	13
Upper-division STEM course	10	3

Research Focus	Faculty member	Graduate student
Resource or instrument development for classes	13	7
To promote active learning pedagogies, inquiry-based learning, applied learning	12	5
Investigating aspect of student learning	9	11
Understanding the gender gap, Women in STEM, identity and belonging	7	5
Investigating student understanding, misconceptions	5	11
Impact on student motivation, attitudes about science, STEM	5	4
For at-risk students, URMs	5	0
Pilot work for grant application, i.e., to NSF CCLI	5	0
Development of teaching observation protocol, survey, videos for dept, inst. use,	4	2
Retention and persistence	3	4
Teaching for social responsibility, culturally responsive teaching and learning	3	4
On pedagogy, effective teaching, peer instruction, small group learning, etc.	3	0
Innovative pedagogies, including use of technology	0	2
Simulations, screencasts, video tutorials	3	2
Flipped classroom	3	0
CS, gaming, programming software	2	4
Place-based learning	1	1
Developing student buy-in to innovation	1	0
Online learning	1	0
Tablets and iPADs, digital learning	0	4
Clickers or other auto feedback devices	0	3
Experiential learning	0	3
Peer-instruction and contextualized teaching and learning	0	1
Curriculum evaluation of grad-level course on teaching STEM	2	2

On broader Impacts ed and ed outreach program elements	2	1
Science communication skills development	2	1
Assessment	2	0
Impacts on undergraduates involved in Informal Ed Outreach	1	0
Impacts of LA program on student learning	0	3
Including bilingual resources, Spanish, Maori, Visually-impaired	0	3
K-12 teacher understanding of NG SX	0	1
Virtual professional development for ed outreach educators	0	1

Professional Development	Faculty member	Graduate student
For graduate students	4	0
For participating faculty, learning to use active learning pedagogies, technology	1	1
For undergraduate research assistants	1	0
For K-12 teacher preparation	0	5
For Las	0	2
For ed outreach educators	0	1
For K-12 teachers	0	1

STEM Discipline	Faculty member	Graduate student
Biology EBIO	4	0
Chemical and Biological engineering	3	0
Physics	3	2
Biology MCDB	2	1
Chemistry	2	1
Computer Science	2	5
Geology, Geological sciences	2	0
Integrative Physiology	2	0
Psychology	2	0
Aerospace	1	0
Astronomy	1	2
Interdisciplinary, EBIO, Psych, neuroscience	1	0
Mechanical Engineering	1	0
Applied mathematics	0	1
Atmospheric and Oceanic Sciences ATOC	0	3
Civil Engineering	0	1
Environmental Engineering	0	1
Mathematics Calculus	0	2

Overall, results from analyses of the quantitative and qualitative data show significant outcomes from CA grants to faculty members and graduate students. Importantly, the CAs have contributed to course and laboratory development and transformation centering on student-centered and active teaching and learning pedagogies, largely at the undergraduate level. Faculty members report huge returns on investment (i.e., in the millions) as evidenced by a number of projects receiving subsequent funding from national agencies to continue the research. Additionally, nearly half of all CA projects produced published, peer-reviewed articles and dissemination of results at professional conferences nationally and abroad. Faculty members reported curricula and instruments that were being used at other institutions throughout the U.S. Finally, CAs contributed provided faculty members, and especially graduate students, a number of personal and professional benefits, not the least of which was the opportunity to explore a new field of interest, engage in science education research, and—for graduate students—financial assistance to pursue or finish a Ph.D.

In sum, the CA program has been highly successful in meeting its objective to support faculty and graduate student engagement in innovative research on student learning and implementation of research-based STEM education program initiatives.

Appendix A

Results from the Center for STEM Learning Survey on Outcomes from Chancellor's Awards for Excellence in STEM Education.

<i>Survey Question</i>	<i>Faculty Yes (N=21)</i>	<i>Faculty No (N=21)</i>	<i>Graduate Student Yes (N=15)</i>	<i>Graduate Student No (N=15)</i>
Did your Chancellor's Award lead to benefits to students, faculty, your department, or others at the University of Colorado Boulder?	86%	5%	60%	33%
Did you complete the project as outlined in your project proposal?	76%	24%	87%	13%
Did the project continue beyond the Chancellor's Award funding?	76%	24%	80%	20%
Were there professional benefits to you as a result of receiving a Chancellor's Award?	71%	19%	87%	7%
Were there personal benefits to you as a result of receiving a Chancellor's Award?	62%	29%	80%	13%
Did your Chancellor's Award lead to any conference, poster or other meeting presentation?	62%	29%	60%	33%
Did this Chancellor's Award lead to other funding?	52%	48%	13%	87%
Did your Chancellor's Award lead to benefits at the national level?	52%	38%	0%	73%
Did your Chancellor's Award lead to any peer-reviewed publications or other published articles?	43%	48%	40%	53%
Did your Chancellor's Award lead to benefits at the local or community level?	33%	57%	27%	67%
Did you produce other outcomes or receive other benefits not already mentioned as a result of the Chancellor's Award?	19%	62%	27%	67%
Did your Chancellor's Award lead to benefits at the state level?	10%	81%	0%	93%

Faculty Members' Open-Ended Responses to CA Outcomes Survey

Did you complete the project as outlined in your project proposal?

Yes: 76% (n=16)

No: 24% (n=5)

If no, please briefly describe the progress you made and what hindered completion of the project.

I was involved in two CAE projects - the first was flawless & has had lasting impact; clayton lewis reported on that one. The second involve sponsoring an Atlas student who was to determine how the learning environment in computer science could be improved; she never met with or started on this project as best as I can tell. This was escalated to her thesis advisor (which switched during the period).

we were unable to secure adequate video production expertise

We had trouble with the lead time needed for video production of course modules.

We completed the basic work outlined in the grant -- a pilot project in which we developed and implemented a classroom-based intervention. Although that work was informative, we determined that additional theoretical work was needed before scaling up to a full-scale study.

This is a year-long project that involves a research seminar both fall and spring terms. The seminar is ongoing this semester and we have it on the books for spring also, with some continuing participants and some new ones.

I should be able to answer "yes" by the end of this semester. I was hindered by unexpected duties through CSL, which extended the length of the project. The project was also more intensive than expected in the proposal, but I am in the process of completing the work as promised, it is just extending beyond the project end date.

Did the project continue beyond the Chancellor's Award funding?

Yes: 76% (n=16)

No: 24% (n=5)

If yes, please provide a brief description of how the project has been continued.

The changes made to the curriculum and the course structure continued.

NSF funding allowed Prof. Lewandowski to continue rebuilding the lab course

We developed an internal study group to determine how to train undergraduates to assist in courses and labs.

The correct answer would have been "sort of". The project was intended as pilot work for an NSF proposal, which was submitted but not funded. In the longer term the collaboration

that was supported by I3 was very successful. We secured substantial NSF funding for a GK12 project that provided 50 student years of support for doctoral students.

Initial findings from our pilot project suggested that a full-scale study would not yield large, interpretable effects in intervention classrooms. Therefore, we are currently conducting experimental studies (not classroom based) to better understand the construct informing our intervention.

The project isn't yet done, so saying 'yes' here is a statement of intent, not of current fact. We are hoping to establish this research seminar as a standard offering in the department.

I built on the work from the Chancellor's Award and received additional funding to expand the work. The grant was from the German Academic Exchange Council and they funded a similar study to the one used for the Chancellor Award with German Geology students. I submitted one paper and am working on revisions now. A second paper is in the works.

I have continued to evaluate learning outcomes in the labs relative to various styles of labs.

We are using the observation protocol developed using the funding in future classes and are continuing the work in my current class (two different sections) and in future classes.

This project launched an entire research program looking at upper-division lab courses.

Continue to make screencasts to combine with interactive simulations

Pre-post testing has been extended to two additional upper-division courses

The Chancellor's Award provided the impetus to revise the IPHY 3435 Physiology Labs from an expository (cookbook) format to a guided, inquiry-based format. After the award ended, we continued to revise and improve the labs, based on a pre/post assessment we developed and still use each semester to inform our decisions.

I have been completing the work as described in the proposal, namely writing it up for web publication, reviewing videos of instructors using activities, revising activities for posting on the web, and defining the website layout. It is well underway and I have been actively working on it, the challenge was just the time.

In my project titled 'Graduate Training in STEM Education' I created a summer workshop on STEM education for graduate students in EBIO. The goal in these workshops was to introduce graduate students to evidence based best practices in teaching and learning. The workshops were conducted over two summers and were 3 days long. All the materials from the workshop are now used in my graduate seminar EBIO 6100 Science Education that I teach each fall. This current semester, Jenny Knight and I joined forces and are now co-teaching this seminar together. The seminar has a broader reach outside of EBIO and we now have participation from MCDB, IPHY, CHEM, and ENVS graduate students. The Chancellor's Award paid for the workshops and a small amount of my summer salary to work on these activities. Without the award there is no way I could have accomplish what I did over the past several years. The award not only advanced my own teaching but provided much needed training for graduate students in evidence based teaching practices.

Funds supported collection of a large quantity of survey data. We continue to follow the students in the survey, so we continue to assess longer term outcomes. A paper is being prepared reporting their outcomes. In addition, during the funding period, additional research was developed to address initial findings. This initial research was eventually developed into a successful NSF application. That grant is nearing completion, and we have submitted yet another grant (under review) that continues that work.

Did this Chancellor's Award lead to other funding?

Yes: 52% (n=11)

No: 48% (n=10)

If yes, from what agency and for what amount?

NSF, I believe \$300K minimum, but was not the PI

WISE award through School of Education

As just explained, the award led indirectly to a successful NSF GK12 project that was funded for \$3M.

We received a CU Innovative Seed Grant to fund follow-up theoretical investigations, with the hope of improving future classroom-based interventions.

Not yet, but Dr. Stempien and I have explored other sources of funding and plan to apply for a Sloan Foundation grant in the very near future.

I received funding to expand the work internationally. The grant was from the German Academic Exchange Council and they funded a similar study to the one designed for the Chancellor Award with German Geology students. The total funding amount of 6000 Euros.

Minor funding from the PTLC.

Nsf

It has now received over \$1.3 million in NSF funding. (Four grants in total)

NSF DUE 1626280 \$274k builds (in small part) on work started in this project

I didn't receive external funding for a graduate teaching program and I have been reluctant to apply since there are issues with the long term sustainability of such a program if funded externally (~3 years). Thus I have been seeking funding internally and more specifically from A&S and my department to support these activities. A&S currently provides two GPTI positions to EBIO that are set aside for 2 graduate teaching fellows each year. Our teaching fellows are advance PhD students who develop their own courses based on evidenced based practices in teaching and learning. I coordinate this program and mentor these graduate students while they are teaching their own courses. I review their courses, meet with the fellows weekly, and they are also concurrently enrolled in the science education seminar.

NSF, \$686,530 total direct costs

Did your Chancellor's Award lead to any peer-reviewed publications or other published articles?

Yes: 43% (n=9)

No: 48% (n=10)

If yes, please provide citations:

Please contact Heather Lewandowski for a comprehensive list

Not yet, but writing up a manuscript now

We have a paper under review right now.

Debra Goldberg, Dirk Grunwald, Clayton Lewis, Jessica Feld, Kristin Donley, and Odette Edbrooke. 2013. Addressing 21st century skills by embedding computer science in K-12 classes. In Proceeding of the 44th ACM technical symposium on Computer science education (SIGCSE '13). ACM, New York, NY, USA, 637- 638. SR Gallagher, W Coon, K Donley, A Scott, DS Goldberg. A First Attempt to Bring Computational Biology into Advanced High School Biology Classrooms. PLoS Computational Biology 7(10): e1002244, doi:10.1371/journal.pcbi.1002244. 7 pages. (2011). DS Goldberg, EK White. E pluribus, plurima: The synergy of interdisciplinary class groups. Association for Computing Machinery (ACM) Special Interest Group on Computer Science Education (SIGCSE) (2014). DS Goldberg, D Grunwald, C Lewis, JA Feld, S Hug. Engaging Computer Science in Traditional Education: The ECSITE Project. Association for Computing Machinery Special Interest Group on Computer Science Education (ACM-SIGCSE) Conference on Innovation and Technology in Computer Science Education (ITiCSE). 6 pages. (2012).

not yet, but Dr. Stempien is collecting data about the effect of the seminar on the participants and our intent is to submit the results for publication if they reveal useful information.

Our first paper is in revision. I will send the citation once it is accepted.

Four peer reviewed publications.

It will, though, we are still working through the data

Too many to list here. ~20

“Upper-division student difficulties with the Dirac Delta function”, B. R. Wilcox and S.J. Pollock, Phys. Rev. ST Physics Ed. Research 11, 010108 (2015), “Observations on Student Difficulties with Mathematics in Upper-Division Electricity and Magnetism”, R. Pepper, S. V. Chasteen, S.J. Pollock, K. K. Perkins, Phys. Rev. ST Physics Ed. Research 8, 010111 (2012)

Not yet, but I will be writing a paper within the year. The initial website created to house project materials was also cited in a peer reviewed article, as this is a nascent area. I also provided feedback and frameworks to another group developing publications in this area.

S.M. Love Stowell, A.C. Churchill, A.K. Hund, K.C. Kelsey, M.D. Redmond, S.A. Seiter, and N.N. Barger. 2015. Transforming graduate training in STEM education. Bulletin of the Ecological

Society or America. (Editorial Review)

Lewis, K.L., Stout, J.G., Pollock, S.J., Finkelstein, N.D., & Ito, T.A. (2016). Fitting in or opting out: A review of key social-psychological factors influencing a sense of belonging for women in physics. *Physical Review Physics Education Research*, 12, 1-10. Stout, J.G., Grunberg, V.A., Ito, T.A. (in press). Gender roles and stereotypes about science careers help explain women's and men's science pursuits. *Sex Roles*.

Did your Chancellor's Award lead to any conference, poster or other meeting presentation?

Yes: 62% (n=13)

No: 29% (n=6)

If yes, please provide citations:

Lewandowski, Zwickl, again, contact Lewandowski

Lopez (2016). Familismo in Undergraduate Science. (Submitted to NARST in 2016)

NARST Symposium, 2010: Strand 7: Pre-service Science Teacher Education S10.8 Symposium: Exploring the Utility of Discipline-Specific Pedagogy Courses in Science Teacher Recruitment and Preparation. Presenters: Erin M Furtak, University of Colorado at Boulder Noah Finkelstein, University of Colorado at Boulder Jill Marshall, University of Texas at Austin Michael Klymkowsky, University of Colorado at Boulder David E. Kanter, Temple University Angelo Collins, Knowles Science Teaching Foundation

Hand, V., Zavala, M. & Harris, L. (2013). Constructing narratives around STEM achievement and motivation among learners from non-dominant backgrounds. Published in the Proceedings of the 35th annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education (PME). Chicago, Illinois.

DS Goldberg, SR Gallagher, R Gamboa. Engaging Teens in Computing Through Current Passions. Rocky Mountain Celebration of Women in Computing (RMCWiC) (2012).

Again, not yet, but because the experiment is in progress we didn't anticipate any presentations at this stage. We do plan to present the results at future conferences.

Yes, I presented the work multiple times: Gold, A.U., Stempien, J., Ormand, C., Pendergast, P., Budd, D., Mueller, K., Kravitz, K., Stroh, J., and Quintanilla, A., 2015-7-0: Differences in Spatial Reasoning Skills in Undergraduate 9/18 Geology Students and the Effect of Weekly Spatial Skill Trainings. . Earth Educators' Rendezvous, Boulder, CO (oral presentation) Gold, A.U., Stempien, J., Ormand, C., Pendergast, P., Budd, D., Mueller, K., Kravitz, K., and Stroh, J., (2015): Distribution of Spatial Reasoning Skills in Undergraduate Geology Students and the Effect of Weekly Spatial Skill Trainings. Geology Department Talk at Ludwig Maximilians Universitaet Munich, Munich, Germany. (Invited departmental seminar) Gold, A.U., Stempien, J., Ormand, C., Pendergast, P., Budd, D., Mueller, K., Kravitz, K., Stroh, J., Quintanilla, A., 2015-3-6: Distribution of Spatial Reasoning Skills in

Undergraduate Geology Students and the Effect of Weekly Spatial Skill Trainings . North Carolina State University, Raleigh, NC. (Invited departmental seminar) Gold, A.U., Stempien, J., Ormand, C., Pendergast, P., Budd, D., Mueller, K., Kravitz, K., Stroh, J., and Quintanilla, A. (2016): The importance of spatial reasoning skills in undergraduate geology students and the effect of weekly spatial skill trainings – with a specific focus on the gender gap. Geological Society of America (GSA) meeting, Denver, CO. (oral presentation) Gold, Anne, Pendergast, P., Stempien, J., Ormand, C. (2016): The Importance of Spatial Reasoning Skills in Undergraduate Geology Students and the Effect of Weekly Spatial Skill Trainings. European Geophysical Union General Assembly, Vienna, Austria. (oral presentation)

1 DBER, several posters in the two CU symposia. If I had the finances for presenting at conferences I would have done so.

But it will...I was scheduled to talk at DBER this semester but gave up my slot for a visiting faculty member

Too many to list here.

Talk at AICHE meeting

2012 PERC: "Upper-division student understanding of Coulomb's law: Difficulties with continuous charge distributions", B. R. Wilcox, M. D. Caballero, R. Pepper, S. J. Pollock, AIP Conf. Proc. 1513, 418 (2013), 2012 PERC Proceedings, Philadelphia PA, Aug 2012, "Our Best Juniors Still Struggle with Gauss' Law." R. E. Pepper, S. V. Chasteen, S. J. Pollock, and K. K. Perkins, PERC Proceedings 2010, AIP Press, 1289, p. 245

- Evaluation of the Effectiveness and Success of Inquiry-Based Laboratories in IPHY, Discipline-Based Educational Research Seminar Series, University of Colorado, 2013. • Casagrand J, Foleys T (2014) Is it possible to improve student performance in identifying the appropriate study design and statistical test in a physiology lab? Poster presented at the 6th Annual Symposium on STEM Education, CU Boulder. • Casagrand J and Foley T (2013) Student Perceptions and Learning Gains in a Reformed IPHY Physiology Lab Course. Poster presented at the 5th Annual Symposium on STEM Education. • Holmstead E, Foley T, Casagrand J, and Bustamante H (2012) What we learned when transitioning physiology labs from a cookbook to inquiry-based format. Poster presented at the 4th Annual Symposium on STEM Education. • Holmstead E, Foley T, Casagrand J, and Bustamante H (2012) What we learned when transitioning physiology labs from a cookbook to inquiry-based format. Poster presented at the CU Science Education Initiative (SEI) and Integrating STEM Education (iSTEM) end-of-year event.

Talk: Introducing students to active learning: "Framing" strategies, America Association of Physics Teachers, Portland, OR (2013). Poster: "Framing" strategies for promoting a productive active learning classroom, S. V. Chasteen, A. Boudreau, J. Gaffney, AAPT, Portland OR (August 2013). Workshops: Faculty Teaching Excellence Program (August 2016, September 2016), Shindig group (October 2016), TRESTLE Scholars program (November 2016). I will soon have an extensive set of webpages developed on PhysPort.org and the SEI pages.

Stout, J.G., Ito, T.A., Finkelstein, N.D., & Pollock, S.J. (2013, January). How Women's

Endorsement of Gendered Science Stereotypes Contributes to the Gender Gap in STEM Participation. Talk presented at the annual meeting of the Society for Personality and Social Psychology, New Orleans, LA. Grunberg, V.A., Stout, J.G., & Ito, T.A. (2014, February). Not All STEM is Created Equal: How Perceived Goal Affordances Impact Women's Intentions to Pursue Science-Related Fields. Poster presented at the annual meeting of the Society for Personality and Social Psychology, Austin, TX.

Did your Chancellor's Award lead to benefits to students, faculty, your department, or others at the University of Colorado Boulder?

Yes: 86% (n=10)

No: 5% (n=1)

If yes, please describe the benefits gained by students, faculty, your department or others at the University of Colorado Boulder.

The new course additions aligned the curriculum with the Common Core, more closely aligned with new teaching. Also, institutionalizing the group work lead to a better class for students and but being able to institutionalize the changes they had a lasting impact.

We have a totally revamped Advanced Physics Laboratory course. 15-20 students per term are taking it now.

leveraged Chancellor's to secure funding from UROP to employ 3 talented undergraduate researchers

It allowed Mike Klymkowsky and I to co-create a course focused on teaching and learning in the discipline of biology, which has led to similar courses in chemistry and earth systems.

I was able to employ three doctoral students to work on the project.

As explained earlier, the collaboration that was supported by the I3 award developed into a successful NSF GK12 project. which provided substantial support for grad students and faculty.

Six undergraduate-level research associates worked on this project. These students gained knowledge of data collection and project administration in classroom-based settings. We had several laboratory-wide meetings about project design and administration, and three lab members (grad students and RAs) have gone on to contribute to a distinct classroom intervention. (This is unusual within our lab, which has not previously conducted classroom-based studies.)

Undergraduate students are participating in the ongoing research seminar along with faculty and this is catalyzing undergraduate research projects. We are trying to foster an undergraduate research community, which takes time. It is early days, but initial indications are very promising that we are having success in that regard.

Students improved their spatial thinking skills. Faculty members became more aware of the importance of spatial thinking and the fact that a lack of these skills may be gatekeeper

and can be trained.

Definitely students because my award directly impacted the lab curriculum design. From discussions it impacted faculty and from the presentations.

Shared the results with my colleagues that generated discussion and strategies for improving student interactions in small groups

We have continued to transform other lab courses at CU beyond the original course. Our work in total has impacted over 100 institutions.

Simulations and the screencasts are used by undergraduates

weekly online questions are available to other faculty, have been used at CU in multiple semesters

Pre/post assessment indicate great student learning gains in critical thinking, statistical analysis, and study design. This was also an opportunity to work with faculty in IPHY to discuss a more active learning approach for the labs, and emphasis on attaining higher level student learning outcomes, rather than memorization of facts.

I have been spreading the word about effective use of strategies to promote buy-in through individual consults and several workshops, with the potential to improve faculty and student experience in using active learning.

Benefits to graduate students was described in a previous question. The specific benefit to the faculty and EBIO is that along with colleagues in EBIO, we have now created a faculty teaching program and learning community.

Post-docs, graduate students, and undergraduates students were involved in all phase of the research. Many of them have been supported by the funded grant that grew out of this project.

Did your Chancellor's Award lead to benefits at the local or community level?

Yes: 33% (n=7)

No: 57% (n=12)

If yes, please describe briefly.

Better teaching students for better prepared teachers.

The physics department community now assumes that our courses can benefit the student and teach lab skills.

The research involved a partnership with the St. Vrain Valley School District and supported the Science Discovery program as well.

The GK12 program placed CU CS graduate students in middle school and high school

classrooms in BSVD and SVSD

The instructors who participated in our study became partners in improving the intervention curricula, and expressed a great deal of interest in learning more about the research design process.

Not that I am aware of.

The materials are used by students at other universities

I have given numerous outreach talks (e.g., University of Colorado Miramontes Arts & Sciences Program; American Association of University Women and CU Women's Resource Center panel on "Factors that Continue to Discourage Girls and Women from Entering STEM careers")

Did your Chancellor's Award lead to benefits at the state level?

Yes: 10% (n=2)

No: 81% (n=17)

If yes, please describe briefly.

Useful for chemical engineering students in the state

Colorado School of Mines physics dep't has used some of our materials in their E&M courses

Did your Chancellor's Award lead to benefits at the national level?

Yes: 52% (n=11)

No: 38% (n=8)

If yes, please describe briefly.

Prof. Lewandowski is a member of the Advanced Laboratory (ALPHA) board, a national org. that concentrates on improved physics lab experiences.

Almost finished writing a manuscript based on data that was partly collected through Chancellor's award. This will contribute to the literature on Latina/o undergraduates in STEM.

Results were presented at multiple national CS education forums.

Again, no final results yet, but we are hopeful that this undergraduate research community will serve as a model for how to achieve, at an R1 school, some of the same hands-on undergraduate research experience that has been amply documented to be invaluable to STEM students who attend small liberal arts schools (such as Colorado College, Williams,

or Carleton). Nothing like this has been tried at an R1 school before, so the national implications could be significant.

The publications were national and international publications.

Changed the conversation about PER to include lab courses (I have many examples, but the 2015 PERC conference was on lab courses)

Used by chemical engineering students nationally and increased visibility of the University of Colorado.

Faculty access our (web-based) collections regularly, I am personally aware of several faculty using our "puzzler" questions

We have presented our results at a national conference, and there was a lot of interest in the project.

I am developing a national set of website materials to be accessed by STEM educators nationwide, and this is one of my primary audiences.

Our team of graduate students who wrote the paper on transformation in graduate training in STEM were invited to participate in the national 'CIRTL Reads' to discuss our published paper.

I have given talks nationally on the topic. Our work on values affirmation has been disseminated widely to researchers and educators (I have shared our materials over 20 people).

Please describe any broader impacts achieved as a result of your Chancellor's Award.

Our students are now leaving with improved laboratory skills and writing/presentation skills. They notice these when moving on to jobs and to graduate studies.

Progress in incorporating CS education into K12 education, and preparing CS grad students to participate in public discourse.

The project is ongoing, so it is too early to assess the broader impacts yet. But the notes included in answers to previous questions outline the primary impacts we hope to achieve.

The additional funding and the publications have demonstrated that the topic still requires attention and that important improvements in students preparation for their success in STEM fields can be supported with spatial skill training.

Publications in international journals.

Because I am still working on the project, we can't measure impacts yet.

Increased visibility of our department and the university

Preflights ("puzzlers") support student learning in multiple classes, and inform faculty teaching upper-division as they prepare to run and teach interactive upper-division

courses. Our website has seen over 30,000 page views of our upper-division materials since 2009.

I have developed a set of materials and guidance for faculty to improve student experience and reduce resistance to use of active learning strategies. The broader impacts of providing this material online, and in workshop formats, are to address a barrier that faculty often are concerned about (and sometimes experience) in using active learning. Reducing resistance has the potential to increase faculty use of active learning, and improving student experiences has the potential to increase student learning -- both of which can lead to improved student outcomes at the university and national level.

Were there professional benefits to you as a result of receiving a Chancellor's Award?

Yes: 71% (n=15)

No: 19% (n=4)

If yes, please describe briefly.

Great experience for teaching the new advanced lab and for generating new improvements in other courses.

Learned how to integrate qualitative techniques in my research.

Financial support for research early in my pre-tenure time at CU.

It was my first small research project at CU. It also supported my work with graduate students and the theorisation of new research. Finally, it supported our work as a department in reaching out to communities and school districts.

The follow-up GK12 project was successful, and increased by visibility as a CS education researcher.

Because I had conducted all of my previous graduate work in laboratory settings, it was extremely informative to learn about the challenges and benefits associated with data collection in classrooms. Additionally, I learned more about the challenges associated with designing effective intervention curricula.

Yes, I have been expanding my personal research area and have been developing myself as an emerging leader in spatial thinking training in the geosciences.

I cannot say exactly, but they did go on my merit evaluation.

Increased my ability to engage in scientific teaching and use information for revision of curriculum and teaching practices

Tenure, new research direction, new research group

Helped support and develop a postdoc, with publications and presentations for myself

The Chancellor's award was beneficial for reappointment and promotion, as a method of demonstrating my commitment to advancing and promoting undergraduate education. In addition, the work led to several workshop and conference presentations, which was a great opportunity for networking and meeting other educators with similar interests.

I was able to develop in-depth knowledge of several areas of the educational and professional literature, engage in a course on survey design, design a survey, and interact with colleagues nationally. These all increased my professional capacity. It also provided me recognition in the community.

I was able to take time during my summer to really focus on teaching and learning. I would have not been able to do that otherwise.

Grants, publications, ability to start new work.

Were there personal benefits to you as a result of receiving a Chancellor's Award?

Yes: 62% (n=13)

No: 29% (n=6)

If yes, please describe briefly.

Stopped worrying about the quality of the lab course

Gained a deeper understanding of the experiences of Latina/o youth in undergraduate STEM majors, especially at a Predominantly White University.

The GK12 project contributed to my personal service goals.

I gained more experience coordinating teams of students for simultaneous, fast-paced data collection, which was quite challenging!

I care deeply about undergraduate STEM education and I'm excited about the vast potential this project has to better prepare our students for graduate school and STEM careers. So the main personal benefit I received from the award was the personal satisfaction of being able to attempt this educational experiment.

I greatly enjoyed the work and am excited for advancing my research in spatial thinking.

The research was interesting and made my job more exciting.

Recognition of my investment in teaching

I really enjoy this new line of research

Presenting at poster sessions allows for personal connections, my sabbatical work this year is in part an outgrowth of this earlier preparatory work.

The award provided the impetus for me to work with faculty members who I might not otherwise have worked with. Through this process, we developed a great working relationship, and have continued to work together on projects and discuss educational improvements.

I felt valued for my work and contribution through receipt of the award.

Working with graduate students on teaching and learning has been one of the most rewarding parts of job over the past few years.

Did you produce other outcomes or receive other benefits not already mentioned as a result of the Chancellor's Award?

Yes: 19% (n=4)

No: 62% (n=13)

If yes, please describe other outcomes or benefits realized as a result of receiving a Chancellor's Award.

It supported me in learning how to lead a research effort.

The collaboration that was supported by the I3 award continues to affect the evolution of educational practices and attitudes of our faculty, in particular under the influence of I3 participant Dirk Grunwald/

Connection with colleagues - Faculty from Engineering Department have been contacting me as well as a physics faculty member who wanted advice and collaboration in a CAREER grant.

I have received several related awards since the Chancellor's, including US Professor of the Year and Sterns Award at CU, which perhaps took into account my Chancellor's award as part of my record.

If you have other comments you would like to offer about your Chancellor's Award please provide them here.

The Chancellor's Awards are an excellent way to support innovation. I strongly encourage that we continue to offer them.

When it became clear that the funded candidate was not effectively working on the proposed work, I attempted to reach their thesis adviser; this was unsuccessful and then the candidate switched to another adviser. I think that having intermittent reporting or clear responsibility for outcomes could have prevented this. I personally feel bad about this because I put 1/2 a GRA funding from our department on the line for this and got basically nothing in return for that. I'd like to figure out how to have such an inspirational program but yet still hold people accountable.

The award was invaluable, and enabled me not only to traction as a new researcher, but to establish important partnerships with organisations in CU and in the local community.

Although this award did not lead to a research publication, it helped to make me (and our lab!) much more aware of the challenges associated with developing a successful intervention. This knowledge has been invaluable as we develop new grant applications, and has informed a new research direction aimed at improving our understanding of proposed mechanisms of

action.

Nothing not already mentioned. Thanks for making these awards available. I think they accomplish the goal of catalyzing innovation.

This is a fantastic program and the seed money has gone a really long way for me. I am planning on submitting proposals to expand on the work that I did under the Chancellor's Award. Thank you!

The Chancellor's award was very helpful to me personally because it allowed me to do important research on my curricula and to publish those data.

Its a good program; however, we need to invest money in faculty development of professors who would be very unlikely to apply for this kind of funding. I would rather see investment in a productive mentoring program and have the money pay to buy the time of faculty to both offer semester long or multi-day workshops on faculty development or have early career faculty enroll in a workshop and be willing to be observed and assessed by a mentor.

I could send you a CV if you would like a list of presentations/publications/national service that have resulted because I started with the very small seed grant.

The program is important, it can be hard for faculty to find support and support mechanisms when engaging in scholarly educational research. This visible honor is a real benefit. Thanks for it, it meant a lot to me.

The Chancellor's award is a unique opportunity for faculty, especially instructors, to receive modest funding that can be used to improve undergraduate education. It would be a shame to not have this opportunity to foster and promote teaching excellence.

Again, I will have a good product soon, and am planning to notify CSL once I have completed the work as outlined.

Thank you for this award. Receiving the award from the Chancellor allowed me to allocate my time to developing a graduate teaching program in STEM education, something I would have not had the time to do otherwise. I also felt validated in allocating so much of my time to teaching, when there is such a strong message to faculty to focus primarily on their research programs.

Graduate Student Responses to the CA Outcomes Survey

Did you complete the project as outlined in your project proposal?

Yes: 87% (n=13)

No: 13% (n=2)

If no, please briefly describe the progress you made and what hindered completion of the project.

Funding for the Cell Physiology labs allowed us to begin the transformation of the Cell Physiology Labs in IPHY.

Since this class only meets once per year, the transformation has taken longer than other courses. Work continues to transform the Cell Physiology labs towards the inquiry/CURE based format of laboratory instruction. After the funding ended, we continued to transform the Physiology Laboratories for the next 3 years. We formed two faculty working groups to sustain the changes made to the labs.

I did have to modify the project, based on available resources. Instead of surveying pre-service teachers, I created a survey to be used by all research participants.

Did the project continue beyond the Chancellor's Award funding?

Yes: 80% (n=12)

No: 20% (n=3)

If yes, please provide a brief description of how the project has been continued.

The funding supported my dissertation work, which I am continuing to develop for teachers.

Currently asking similar survey questions in engineering projects courses to further examine how peer interactions influence student outcomes.

We are now using the survey for the entire project. The Chancellor's award funded the pilot test - we are now conducting a full survey.

It continued through my dissertation. It has since stopped.

It produced data for my dissertation.

Continued with interviewing the participants

The award funded a study that I expanded into my dissertation project.

The goal was to create a new classroom model for learning CS and my advisor has carried on the model we developed through his teaching.

The new topic I'm working with is now the project I'll be working on for the remaining of my thesis

Currently in the process of writing up the results for submission to a journal

Not directly - but a great deal of attention has been turned towards revamping the applied math curriculum which was the main study site for my project.

Did this Chancellor's Award lead to other funding?

Yes: 13% (n=2)

No: 87% (n=13)

If yes, from what agency?

Some support at conferences

Did your Chancellor's Award lead to any peer-reviewed publications or other published articles?

Yes: 40% (n=6)

No: 53% (n=8)

If yes, from what agency and for what amount?

[in submission] Goodman, Katherine, Jean Hertzberg, and Tim Curran. "Visual Expertise in Fluid Flows: Uncovering a Link Between Conceptual and Perceptual Expertise." [in submission] Goodman, Katherine, Jean Hertzberg, and Noah Finkelstein. "Surely You Must Be Joking, Mr. Twain! : Re-engaging Science Students through Aesthetics."

Van Dusen, B. & Otero, V. (2015, April). From Fear to Self-Expression: The Contextual Nature of Physics Students' Motivations. In P. Englehardt, A. Churukian, & D. Jones (Eds.) Proc. 2014 Physics Education Research Conference. AIP Press. Van Dusen, B. (2014, August). The roots of Physics Students' Motivations: Fear and Integrity (Doctoral dissertation). Retrieved from ProQuest Dissertations and Theses. Nicholson-Dykstra, S., Van Dusen, B., Otero, V. (2014, February). Teaching to learn: iPads as tools for transforming physics student roles. In P. Englehardt, A. Churukian, & D. Jones (Eds.) Proc. 2013 Physics Education Research Conference. AIP Press. Van Dusen, B. & Otero, V. (2013, January). Influencing students' relationships with physics through culturally relevant tools. P. Englehardt, A. Churukian, & N. S. Rebello (Eds.) Proc. 2012 Physics Education Research Conference. AIP Press.

publication has been fully accepted but not published until next cycle in 2017

Beyond the Flipped Classroom: Learning by Doing Through Challenges and Hack-a-thons, Proceedings of SIG-CSE 2015

Tsai, J. Y. (2015). Actor-Networks of Sophomore Engineering: Durability and Change in Required Mathematics Courses (Doctoral Dissertation). University of Colorado, Boulder.

Did your Chancellor's Award lead to any conference, poster or other meeting presentation?

Yes: 60% (n=9)

No: 33% (n=5)

If yes, please provide citations:

1. Casagrand J and Foley TE. Is it possible to improve student performance in identifying the appropriate study design and statistical test in a physiology lab? Annual Symposium on STEM Education, 2014.
2. Casagrand J and Foley TE. Student perceptions and learning gains in a reformed IPHY Physiology Lab course. Science Education Initiative/Center for STEM Learning End-of-Year Event, 2013.
3. Homestead E, Foley TE, Casagrand J, Bustamante H. What we learned when transitioning physiology labs from a cookbook to inquiry-based format. Science Education Initiative/Center for STEM Learning End-of-Year Event, 2012.

Grover, S.S., Ito, T.A., Park, B. The Importance of Cross-Sex Interactions for Women's Belonging in Male-Dominated STEM Fields. Talk to be presented Gender Preconference at the Society for Personality and Social Psychology Annual Meeting, San Antonio, TX., January, 2017.

In progress

Goodman, Katherine, Jean Hertzberg, and Noah Finkelstein. "Aesthetics and Expanding Perception in Fluid Physics." *Frontiers in Education (FIE) 2015 Conference Proceedings*, October 2015. Pg. 1747-1751. http://fie2015.org/sites/fie2015.fie-conference.org/files/FIE-2015_Proceedings_v11.pdf

Hertzberg, Jean, and Katherine Goodman. "Aesthetics and Emotional Engagement: Why it Matters to Our Students, Why it Matters to Our Professions." *Frontiers in Education (FIE) 2015 Conference Proceedings*, October 2015. Pg. 1269-1270. http://fie2015.org/sites/fie2015.fie-conference.org/files/FIE-2015_Proceedings_v11.pdf

Goodman, Katherine, Hunter Ewen, Jean Hertzberg, and Jeffrey Harriman. (2015, June). "Aesthetics of Design: a case study of a course." In American Society for Engineering Education. Seattle, WA. <http://www.asee.org/public/conferences/56/papers/12312/view>

Goodman, Katherine, Jean Hertzberg, Tim Curran, and Noah Finkelstein. (2015, June). "Expansion of Perception in Fluids." In American Society for Engineering Education. Seattle WA. <http://www.asee.org/public/conferences/56/papers/12169/view>

Goodman, Katherine, Jean Hertzberg, John K. Bennett. "Engineering Education as Transformative Experience: a framework for examining course success." ASEE Rocky Mountain Section Conference, Denver, CO. April 2015.

Goodman, Katherine, Jean Hertzberg, and John K. Bennett. "Visual Expertise in Fluid Physics: Expanding Perception in Engineering Students." Poster session at REASON International Spring School, Munich, Germany. (http://www.en.mcls.lmu.de/reason_spring_school) March 5, 2015.

Goodman, Katherine, Jean Hertzberg, Tim Curran, and Noah Finkelstein. "Flow Visualization: where physics and art mix." Invited. University of Cologne, Institute for Physics and Physics Education, Cologne, Germany. March 3, 2015.

Hertzberg, Jean R., Katherine Goodman, Tim Curran, and Noah Finkelstein. "Flow Vis and Beyond: The Power of Aesthetics in Engineering Education." Invited, Northern New Mexico College, December 9, 2014.

Hertzberg, Jean, Tim Curran, and Katherine Goodman. "Measuring Visual Expertise in Fluid Dynamics. E7.00002." Oral presentation presented at the APS -67th Annual Meeting of the APS Division of Fluid Dynamics, San Francisco, CA, November 23, 2014. <http://meetings.aps.org/Meeting/DFD14/Session/E7.2>.

Van Dusen, B. (2015, March). Looking at the Roots of Physics Student Motivation, Deutsche Physikalische Gesellschaft, Wuppertal, Germany. Van Dusen, B., Otero, V., Bresges, A., Huesler, S., Girdwidz, R., Moore, E., & Perkins, K. (2014, July). Using technology to enhance physics teaching: Research-based technology innovations, Physics Education Research Conference, Minneapolis, MN. Van Dusen, B. (2014, May). Blurring the Boundary Between Physics Problem Solving and Students' Peer Cultural Practices, Portland State University, Portland, OR. Van Dusen, B., Nicholson-Dykstra, S. & Cheversia, M.B. (2013, December). Tablets in the physics classroom, National Science Teachers Association Regional Conference, Denver, CO. Van Dusen, B., Nicholson-Dykstra, S. & Otero, V. (2013, September). Using boundary objects to mediate students' motivation toward physics, 5th Annual Symposium on STEM Education, Boulder, CO. Van Dusen, B. Ross, M., Suarez, E., Cannava, A., & Grimes, A. (2013, July). Talk symposium: stop calling me stupid: failure avoidance versus empowerment in physics learning, Physics Education Research Conference, Portland, OR.

Renga, I.P. (2014). The contours and possibilities of desire in sociocultural research on learning and becoming. Presented at the International Conference of the Learning Sciences (ICLS) 2014: Boulder, CO.; Renga, I.P. (2013). Teach like a researcher: The contours and implications of a teaching experiments approach to preparing secondary STEM teachers. Presented at CU-Boulder's 4th Annual Symposium on STEM Education: Boulder, CO.

SIG-CSE 2015 Presentation (corresponding with above publication)

poster at the 2014 Astronomical Society of the Pacific meeting, Susanna Kohler and Seth Hornstein, "The Effects of Science Communication Training on STEM Students"

Tsai, J. Y., Kotys-Schwartz, D. A., & Knight, D. W. (2015). Introducing Actor-Network Theory Via the Engineering Sophomore Year. In Proceedings of the 2015 American Society for Engineering Education Annual Conference and Exposition. Seattle, WA. Tsai, J. Y., Kotys-Schwartz, D., & Knight, D. W. (2015). What's fair in sophomore engineering mathematics courses? Investigating exams from an actor-network perspective. Presented at the Mid Years Engineering Experience Conference, College Station, TX.

Did your Chancellor's Award lead to benefits to students, faculty, your department, or others at the University of Colorado Boulder?

Yes: 60% (n=9)

No: 33% (n=5)

If yes, please describe the benefits gained by students, faculty, your department or others at the University of Colorado Boulder.

We have gathered survey data from students suggesting that their interest in the Cell Physiology labs improved significantly after the transformations. In addition, we have served as a model for other lab courses hoping to transform their labs. The students

continue to rave about the transformation of the Physiology labs in IPHY. This led to the transformation of a second laboratory course in IPHY (Cell Physiology), which also received Chancellor's Award funding.

Provided initial data to help get me into engineering classrooms to do further research on peer interactions in STEM work groups. Hopefully this research will benefit these courses.

We are using this in support of a current research project

I believe our study of the Engineering elective, Aesthetics of Design, led to that course being offered again.

I studied a faculty colleague's course, which led to formative discussions that helped her to improve it.

The students have loved the class model and many have taken more classes with me and my advisor on that basis.

I started a student hackathon, which has become a corner piece for my department. We received sponsorship with local companies, which helped foster partnerships between the university and the tech community. We also had an article written about us in the Daily Camera.

I worked to introduce faculty to doing Educational Research. They learned about best practices to inform their action research. They also rejected a hypothesis that allowed them to direct their efforts toward supporting underrepresented minority students in new ways.

measurable improvement in the science communications skills exhibited by undergraduate and graduate students in the astronomy classes included in the study; lesson plans made available to faculty to continue such training in future classes

On a larger level the benefits were to broaden the conversation around engineering education research conducted here at CU. Greater attention to the sophomore year and the APPM sequence for all CEAS undergraduates. A math "task force" being run by the Associate Dean for Education, Ken Anderson, to further revamp and investigate the experience of undergraduates in these influential courses. Since my project examined the APPM curriculum the students and faculty in that department benefited from an outsider's analysis of the official and unofficial course activities taking place.

Did your Chancellor's Award lead to benefits at the local or community level?

Yes: 27% (n=4)

No: 67% (n=10)

If yes, please describe briefly.

Teachers that participated in the Scalable Game Design project were given access to it.

Teachers are using the data to determine their effectiveness

The grant paid for me to be a resource to a local high school science teacher and her students.

It gave me the opportunity to start a student hackathon that reached over 100 undergraduate students in my field.

Did your Chancellor's Award lead to benefits at the state level?

Yes: 0% (n=0)

No: 93% (n=14)

If yes, please describe briefly.

[No responses.]

Did your Chancellor's Award lead to benefits at the national level?

Yes: 0% (n=0)

No: 73% (n=11)

If yes, please describe briefly.

[No responses.]

Please describe any broader impacts achieved as a result of your Chancellor's Award.

I'm planning on releasing the software that I developed as part of the funded project, which will fill a need for students learning CS. Currently my challenge is finding time to publish and make modifications to the software.

Since transforming the labs to an inquiry-based format, we have met with several other faculty across campus looking for feedback about the process. As we are finalizing the format of the Cell Physiology labs, we are planning on writing up our labs for publication to share with the greater Cell Physiology community.

I have been discussing this research with others who are looking to see if this approach will work for their project as well.

New way of developing computing learning theory through a mashup of two or more theories for interdisciplinary research

The award provided a vital opportunity for me to conduct a solo investigation and engage in a supportive community (the DBER group).

It is our hope that this project will result in a long-term increase in the ability of science

students to communicate science

In addition - my thesis ended up incorporating an historical/architectural element as I was able to apply a novel organizational theory to the math curriculum as well as our Engineering Center building. The architectural piece is being celebrated currently at the CEAS as it is the building's 50th birthday.

Were there professional benefits to you as a result of receiving a Chancellor's Award?

Yes: 87% (n=13)

No: 7% (n=1)

If yes, please describe briefly.

finished degree (PhD)

Gave me the opportunity to work on the project that I was interested in. There would have been no funding to do it otherwise.

I have been able to attend scientific conferences as a result of this project. Transforming labs to the inquiry-based format allowed me to make contacts with other faculty at CU that have done this type of work. I don't know if I would have met these faculty otherwise.

Practice writing grant-type application, presentation in interdisciplinary research group (DBER), further experience with data analysis.

It's great to show that I can obtain funding for future positions. I got involved in DBER which I wouldn't have otherwise. Finally, I engaged in a number of professional discussions as a result of this work.

Without this support, I would have had at least one semester unfunded during my PhD process. CSL also provided broader community in which to develop my work.

Professional growth and publications

The award provided a line on my CV to the scholarship of my study

It afforded an important CV item that helped me to land my current position as an assistant professor.

I was able to explore different paths and found a research area that I like and will continue to work in

Greater visibility on campus. CV line item.

allowed me to expand my CV into science communication and science education fields, which assisted me in securing my current employment

I was able to complete my PhD and defend successfully following my Chancellor's Award year.

Were there personal benefits to you as a result of receiving a Chancellor's Award?

Yes: 80% (n=12)

No: 13% (n=2)

If yes, please describe briefly.

Was able to develop my research and technical skillsets while I worked on the funded project.

Yes, I could clearly see that the students and the graduate TA's had more fun when performing inquiry based labs. It was clear that the students and the graduate TA's enjoyed the labs more after the transformation.

Allowed me to dedicate more time to research.

It affirmed the research I've been studying and conducting

It helped me afford to get my PhD

funding to continue study

The study funded by the award afforded me an invaluable opportunity to observe higher ed instruction (and gain key insights about it).

Developing deeper relationships with faculty.

increased my confidence in the fields of science communication and science education

I was able to complete my PhD with minimal financial burden and defend successfully following my Chancellor's Award year.

Did you produce other outcomes or receive other benefits not already mentioned as a result of the Chancellor's Award?

Yes: 27% (n=4)

No: 67% (n=10)

If yes, please describe other outcomes or benefits realized as a result of receiving a Chancellor's Award.

Based on the success of the Cell Physiology labs, the Department is currently looking at transforming all of the labs courses.

Personal feeling that my study was on the right track and worth continuing

Greater connection with the CSL and DBER communities here on campus. Presented at DBER and felt more active as part of the CSL.

If you have other comments you would like to offer about your Chancellor's Award please provide them here.

Yes, please keep them! They are a wonderful opportunity for Instructors with no funding (such as myself) to stay current and connected to the science education community. The Chancellor's Award are essential for Instructors looking to perform science education research. Without such funding, such work would be impossible. Furthermore, funding from the Chancellor's Awards has allowed our IPHY department to continue to improve and refine its undergraduate curriculum.

Have not written up the results of the Chancellors award for publication yet, still working on some follow-up analyses. I intend to write up the results for publication next semester (Spring 2017).

I feel this was really an excellent opportunity for me to pursue my own research in a supportive environment. Too often, our research as grad students is directed by our projects - for me, this was truly my own research. It has gained a lot of attention, and will benefit not only the project, but I suspect will be taken up by others as well. I'm very grateful for the opportunities provided.

(Please make all the boxes on the survey bigger, like this one.) My final report to CSL, emailed in July 2015, contained a much more complete version of this feedback. I am happy to email it again if needed.

The funding came at a much needed time. I would not have been able to continue without the funding.

I think the awards should have an extension option if they project goes well. There's a lot more research and work we could've done to expand the model and develop its integrity, but we had to stop as we had no other support. Also, it'd be nice if there were campus efforts to integrate the work done in these awards into other departments and classrooms, but there is really no campus buy-in to the innovations coming out of these awards.

I was personally attacked by a member of the administration, no longer at the University, because they had criticism of the project as described in the abstract. This experience was very negative for me as well as my faculty collaborators. The Award coordinators should be prepared to shield Awardees from attacks since education research can be controversial, especially when conducted by those not traditionally conducting that research.

I now work at the American Astronomical Society, which allows me to put some of my time toward continuing this research. I'm excited to use my position in a professional society to expand the impact of this work nationwide! None of this would have been possible without the Chancellor's Award — this award had an enormous impact on my time in graduate school and was one of the largest factors shaping the direction my career has taken. I'm enormously grateful for the opportunities it provided.

I enjoyed going to DBER and presenting at CSL Symposia to the assembled group of interested STEM education researchers. Being a Chancellor's Award recipient was hugely beneficial to me both professionally and personally, as it filled in my last gap to enable me to focus on writing the thesis and finishing the degree (the alternative would have required teaching another course or splitting my time on other research projects). Being a Chancellor's Awardee also made me feel more included as a member of the STEM Education community and through the CSL - faces became more and more familiar throughout the semesters.