

**Collaborative work within Optical Engineering: Ethnography and curricular development in the proposed undergraduate concentration in optical engineering in MEES at UNC Charlotte**

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2011-2012 SOTL Grants

October 28, 2011

## Abstract

The purpose of this project is to conduct ethnographic research that will:

1. inform the creation and continuing development of the proposed undergraduate concentration in Optical Engineering in The Department of Mechanical Engineering and Engineering Sciences (MEES) at UNC Charlotte. And
2. Stimulate efforts to improve the efficacy of cross-cultural and cross-disciplinary Optical Engineering graduate study and research in Optical Science and Engineering

This project addresses the need to examine and describe academic and professional work practices in Optical Engineering. Its attention to the professional and curricular needs of UNCC undergraduates addresses University Strategic Goal #8, “to graduate *students* with the breadth and depth of knowledge and the intellectual and professional skills that prepare them for a productive life in an ever-changing world.” The proposed research will be conducted by an interdisciplinary team, and concerns itself with the nature of interdisciplinary research in Optical Engineering, and the instructional and research preparation required of scholars in that field, and so addresses Academic Affairs’ strategic goal #2: “To advance programs of research and scholarship that expand the frontiers of knowledge...[that]... solve problems at the interface of disciplines and leverage discovery for the public benefit. Conducting the research and discussing and distributing the results addresses University Strategic Goal # 2, “to increase both faculty and student *research* that will address fundamental and regional problems.”



Ethnography and curricular development in Optical Engineering at UNC Charlotte, SOTL proposal

925000	Travel - Domestic	\$5000.00
926000	Travel - Foreign	
928000	Communication and/or Printing	
930000	Supplies	
942000	Computing Equipment	\$ 230.00
944000	Educational Equipment	
951000	Other Current Services	
<b>GRAND TOTAL</b>		<b>\$8830.00</b>

**Attachments:**

1. Attach/provide a narrative that explains how the funds requested will be used. (see below)
2. Has funding for the project been requested from other sources? No.

## **Budget Narrative:**

### **Graduate Student Pay:**

- \$12/hr, 20hrs/week, for 15 weeks (Spring Semester 2012): **\$3600.00**

The graduate student will be paid to do ethnographic observations, conduct, transcribe and code interviews, under the supervision of Dr. Lanclos

### **Equipment Costs:**

- 1 digital voice recorder, Olympus WS-400 S Digital Recorder: **\$130.00**

Voice recorder will be used to record formal and informal interviews with optics researchers and students.

- 1 digital camera, Nikon Coolpix L22 12.0MP Digital Camera with 3.6x Optical Zoom and 3.0-Inch LCD : **\$100.00**

Digital camera will be used to take photos of workspaces, video collaborative interactions as they happen in the optics lab, and/or video short interviews with optics researchers and students

### **Travel Costs:**

- conference registration, plane tickets to conference, plus hotel and rental car to Optical Fabrication and Testing conference (Monterey, CA), the 2012 Optical Fabrication and Testing Conference (June 2012), the Optics Education and Outreach II (August 2012), ETOP 2012- Education and Training in Optics & Photonics; and at the 2012 Educause SE Regional Conference): \$2500/each, 2 participants: **\$5000.00 travel funds altogether.**

At least two of the three grant recipients will travel to a conference to present research results and preliminary recommendations based on the results. Conference registration and travel will be paid for within the 2011-2012 FY.

**Total Budget Request: \$8830.00**

***All budget will be spent according to the Special Requirements, ie, before June 15, 2012. In addition, we realize that restrictions on travel or equipment funding could affect the award that the CTL is able to give this project.***



UNC CHARLOTTE

J. Murrey Atkins Library

**Library Administration**

9201 University City Boulevard, Charlotte, NC 28223-0001

t/ 704-687-2030 f/ 704-687-3050 <http://library.uncc.edu>

October 24, 2011

Dear SOTL Grant Selection Committee:

I fully support this proposal to apply ethnography to the development of a curriculum for the proposed undergraduate concentration in optical engineering in MEES at UNC Charlotte.

The project will allow the library to achieve important goals, including supporting research and curricular needs, providing services to increase the success of our community, and designing systems that support the discovery and use of scholarship. We are excited by the prospect of learning more about the nature of student collaboration and current work practices, and applying such knowledge to curriculum development.

It is with optimism and enthusiasm that I endorse this project.

Sincerely,

A handwritten signature in black ink, appearing to read "Stanley Wilder".

Stanley Wilder

University Librarian



UNC CHARLOTTE

*The* WILLIAM STATES LEE COLLEGE *of* ENGINEERING

**Office of the Dean**

9201 University City Boulevard, Charlotte, NC 28223-0001  
t/ 704.687.8244 f/ 704.687.8267 www.coe.uncc.edu

October 26, 2011

Dear SOTL Grant Selection Committee:

I fully support this proposal to apply ethnography to the development of a curriculum for the proposed undergraduate concentration in Optical Engineering within the Department of Mechanical Engineering and Engineering Science in the Lee College of Engineering. This work will also help develop optimum working methods for cross-disciplinary graduate work.

The project will support research and curricular needs. We are excited by the prospect of learning more about the nature of student collaboration and current work practices, and applying such knowledge to curriculum development.

It is with optimism and enthusiasm that I endorse this project.

Sincerely,

A handwritten signature in black ink, appearing to read "Robert E. Johnson", with a long horizontal flourish extending to the right.

Robert E. Johnson  
Professor and Dean



UNC CHARLOTTE

College of Liberal Arts & Sciences

Office of the Dean

9201 University City Boulevard, Charlotte, NC 28223-0001

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October 26, 2011  
SOTL Grants Committee  
Center for Teaching & Learning  
[ctl@uncc.edu](mailto:ctl@uncc.edu)

Dear Committee Members:

I am writing in support of the SOTL proposal submitted by Thomas Suleski in the CLAS Department of Physics and Optical Sciences with his collaborators in the Library and the Department of Mechanical Engineering—Donna Lanclos, Matt Davies and Christopher Evans. The project they propose will inform the development of an interdisciplinary undergraduate Optics program and advance understanding of the nature of collaborative research.

The project is consistent with a number of the objectives in our CLAS strategic plan including support for new programs in the areas of Materials/Optics and Nanoscale Science and engaging undergraduate students in research. Further, we have consistently supported interdisciplinary approaches to scholarship and programs that involve partnerships across Colleges in the University. It is especially exciting to see collaborations between the social and physical sciences. Therefore, it is my pleasure to recommend the proposal for your consideration.

Please let me know if you require further information. Thank you.

Sincerely yours,

Nancy A. Gutierrez, Dean  
College of Liberal Arts and Sciences

## **Project Narrative**

### **A. Specific Aims**

#### **1. Overall Purpose**

The purpose of this project is to conduct ethnographic research that will inform the creation and continuing development of the proposed undergraduate concentration in Optical Engineering in The Department of Mechanical Engineering and Engineering Sciences (MEES) at UNC Charlotte. This project will also stimulate efforts to improve the efficacy of cross-cultural and cross-disciplinary research, education, and industrial development in optical science and engineering .

Optical engineering research at UNCC is an interdisciplinary endeavor, and has up to now been housed as a graduate emphasis in MEES and the Department of Physics and Optical Sciences (POS). The proposed new undergraduate concentration will provide an important pipeline of local students for the increasingly important Optical Science and Engineering program in the Colleges of Engineering and Liberal Arts and Sciences. Current multidisciplinary research and cross-listed courses provide an opportunity for the ethnographic investigation of collaborative, interdisciplinary research.

This research will be conducted under the direction of Donna Lanclos, Atkins Library Ethnographer, in consultation with Chris Evans and Matt Davies in MEES, and Thomas Suleski in POS. The results will be presented not just at UNC Charlotte, but also online and at one or

more Optics conferences, so that the contributions to the field will not simply be felt locally, but across the interdisciplinary field.

The proposed research can serve as a model for future curriculum development at UNC Charlotte. It is also our hope that our internal, interdisciplinary collaboration, and our presentation of our research results via publication and conference presentations, will lead to interest in our research findings from academic, government, and industry contacts outside of the university, who have a vested interest in finding and hiring well-trained optics scholars.

## **2. Specific Objectives**

The overall purpose of this project is to observe, describe, and analyze the nature of academic work as it is currently being carried out at a graduate level in Optics at UNC Charlotte, such that the analysis can be fed into the development of curricular materials for the Optical Engineering focus in MEES and in the development of OSE graduate programs. The content of those observations will inform the development of structured interview questions, and possibly other research instruments (to be determined as necessary in the course of research) to be deployed among graduate students and faculty currently working on Optics projects.

The specific objectives of this project are as follows:

- 1) Hire a graduate student to conduct ethnographic observations of current Optics research at UNC Charlotte. Ethnographic observations will be carried out by Dr. Lanclos and by one graduate assistant from the social sciences (most likely from anthropology or organizational

science).

2) Assess the nature of Optics work via ethnographic observation as well as structured interviews, and other instruments in the ethnography toolkit, supervised by Dr. Lanclos. There are several current opportunities for ethnographic observations to inform future curricular and programmatic development. For example:

- In Spring 2012, Dr. Evans will teach a cross listed class “Introduction to Optical Fabrication and Testing” which will register MEES seniors and graduate students as well as OSE graduate students. Planned activities include in-class observation and observation of group experiments where groups can be set up as all MEES, all POS and mixed teams
- Ongoing cross-college graduate research projects provide a population of graduate students from different backgrounds, at different stages of their projects, and at different points in the continuum of attitudes and capabilities for working in a team. Conducting interviews of these students offers the prospect of investigating the development of understanding the skills brought to a multi-disciplinary team.

3) Take these observations and subsequent analysis, and incorporate the research results into the curriculum development for the proposed Optical Engineering undergraduate concentration, and in structuring future research teams at graduate as well as undergraduate levels.

4) Disseminate information about the project and its findings at UNC Charlotte via Center for Teaching and Learning events, departmental brown bags, and at regional and/or national conferences

5) Disseminate information about the project and its findings via published articles in

*Educause Review*, the *Journal of Further and Higher Education*, and *ASEE Prism*.

### **3. The rationale**

a) Multi-disciplinary teams are frequently required to address complex problems merging optics, mechanical engineering, chemistry and physics. For example, in the 15 years before joining UNCC, Dr. Evans worked on a number of projects with such teams. One involved groups in Japan, Holland, Germany and the US, each with very different work habits and decision making processes. Cross-cultural, cross-disciplinary teams are becoming the norm, rather than the exception, in today's work place. Effective teams involve subject specialists and broadly educated "system architects"; traditionally educated subject specialists frequently lack the appreciation of issues (and competencies) outside their field and good systems architects are vanishingly rare. With this developing MEES program for undergraduates, there is an imperative for a curriculum that provides for the training of students in the interdisciplinary nature of the work they have chosen to do, so that they can be a success in their chosen field within and outside of academic contexts. Understanding the nature of collaborative scientific research is crucial to crafting effective curricular materials for the training of new collaborative scholars.

b) The proposed ethnographic research will also constructively expand the purview of the current Atkins Ethnography Project, as directed by Dr. Lanclos. Revealing new information about the nature of collaborative work, especially in the physical sciences, will be a service not only to this university, but to the field of optical engineering as a whole, as well as a contribution

to the social scientific study of scientific collaboration.

c) Prior planning: Dr. Lanclos is already supervising Organizational Science students (in a methods seminar taught by Loril Gossett) conducting ethnographic observations of work in the Atkins library, so this would be an extension and elaboration of ongoing research. The instruction and research within Optical Engineering are already planned, and will be underway regardless of our research project, and so we do not have to create projects or classes to observe from whole cloth.

#### **4. The impact of the study on undergraduate or graduate teaching and learning**

This project directly addresses important educational priorities of the University as well as pedagogical and professional demands of the field of optics. Optical engineering requires an interdisciplinary literacy, as well as the experience and ability to work with scholars from multiple disciplines—optics scholars trained exclusively to work with those in their own sub-field are at a distinct disadvantage in academic as well as industry contexts.

This work will inform what goes into the proposed undergraduate concentration in Optical Engineering, as well as the development of collaboration in graduate education. Our research results also have the potential to affect how cross-listed classes (e.g., cross-listed MEES and Optics classes that are taught now) are taught.

We additionally intend to use this research as a pilot study that can serve as the basis for a future grant submission to NSF (IGERT), so the impact of this research will go beyond local

pedagogical concerns and into larger contributions to the international field of Optics .

## **B. Literature Review**

Ethnography is more than a bundle of techniques for observation, but is an analytical way of seeing culturally and socially situated practices (Forsythe 1999; Wolcott 1999). The anthropological investigation of everyday practices (DeCerteau) has been applied to science settings for quite a while (e.g. Rabinow 1999, Rabinow and Dan-Cohen 2005, the recent work on collaborative research from Cummings, Hackett, Lee, Shrum, and Wong, all published in a special issue of the *Social Studies of Science* 2005; Wong and Hodson 2010). The everyday practices and conventions of scientific investigation, as revealed through ethnography, can yield an awareness of how these sub-cultures of science facilitate (or get in the way of) research.

Professionals currently in the field of Optics know that there are practical and intellectual challenges in the kind of collaborative work required of its practitioners. Attempts to hire students with effective backgrounds in interdisciplinary collaboration are frustrated by a lack of supply; however publications in that field do not tend to refer to this lack of training, because the vast majority of people who publish within that field are academics who do not recognize the problem. The applied experience of our research team members gives us the perspective necessary to perceive the problem, a necessary first step before investigating possible solutions.

## **C. Methods**

The ethnographic toolkit is a varied and flexible one, and for this project it is anticipated that a few techniques in particular will be well-suited for this relatively small-scale and short-term

project:

1) observations: the ethnographers (the graduate student, under the supervision of Dr. Lanclos, and to a lesser extent Dr. Lanclos herself) will be in the Optics labs and/or classrooms as work and instruction are taking place. They will watch what is happening, take field notes, and ask questions (the latter only if it is relatively unobtrusive; clarification on unclear actions or interactions will be acquired during the interviews).

2) interviews--structured and unstructured. About a month into the observations, Dr. Lanclos and the graduate student will get together and analyze what data has been gathered so far, to inform the creation of structured interview questions. Consenting researchers, instructors, and students will be interviewed by the graduate student and Dr. Lanclos, and the interview transcripts will be coded and analyzed. Unstructured/less formal interviews will take place at opportune moments, and the coded content will become part of the larger body of data being accumulated.

3) photographic and video data: work spaces in the Optics lab will be photographed over the course of the semester by the ethnographers. The researchers themselves will also be encouraged to take photos, create photo diaries, or even video diaries or commentaries about the work in which they are engaging. These data will be coded along with the interview transcripts and field notes.

OSE Faculty members (in particular Dr. Suleski, Dr. Davies, and Dr. Evans) have already been consulted about the nature of the work, and will be contributing graduate students and projects to

be studied. All data will be discussed in regular meetings with Dr. Lanclos, Dr. Evans Dr. Suleski, and Dr. Davies; to check the trajectory of the project, and to recalibrate if necessary.

Once the ethnographic part of the project is complete, discussions over how to use the information to inform curriculum development will take up the bulk of the rest of the time (May-June), as well as presentations on the research results.

#### **D. Evaluation**

The effectiveness of this proposal will be evaluated with a series of self-reflective interviews with Drs. Evans, Davies, and Suleski how novel information about collaboration in the field of Optical Engineering can be used to craft the proposed curriculum. Presentations to the faculty in MEES and POS will provide an additional and important opportunity for internal review of our research results. Department chairs and other interested faculty will give us feedback, and if possible prospective changes that are immediately apparent could be implemented in the short term, as well as laying the ground for long-term development of the nascent Optics program.

As an ethnographic project, this research contains within itself the means to constantly evaluate and adjust its methods and approaches. Should the project require more or different information than what Dr. Lanclos and the graduate student are discovering, we have opportunities throughout the semester to recalibrate and gather different perspectives. The measures of success in this case will in part be subjective in the moment, but will also be objectively substantiated by the responses gathered in the end-of-semester presentations at UNCC, as well as at conferences.

### **E. Knowledge Dissemination**

In addition to on-campus presentations on our project via CTL programs, and brown-bag talks within the departments of Anthropology, Mechanical Engineering, and Physics, conference presentations are planned for at least one of the following venues: the 2012 Optical Fabrication and Testing Conference, the Optics Education and Outreach II (to be held August 2012), ETOP 2012- Education and Training in Optics & Photonics; and at the 2012 Educause SE Regional Conference. We expect to publish the research results in one or more journals such as *Educause Review*, the *Journal of Further and Higher Education*, and ASEE Prism.

### **F. Human Subjects**

The current Atkins Ethnography project, under the direction of Dr. Lanclos, has a protocol on file with the UNC Charlotte IRB (#09-11-18). That protocol was broadly written to include a variety of research methods concerned with the nature of academic work on campus. It is our intention to write an amendment to the existing protocol, with new consent forms to account for the photographic and video-recording of the Optics research workspaces (and the researchers therein). The protocol amendment will detail our intentions as laid out in this proposal, as well as propose revised consent forms for this project.

The argument for an amendment, as opposed to an entirely new protocol, is that the ethnographic observation of academic work in Optics is a low-risk research endeavor, and that this project fits easily under the broad IRB umbrella already established by the Atkins Ethnography Project.

**G. Extramural funding:**

It is our intention to use the research made possible by the SOTL grant as a pilot project, the results of which will allow us to apply for a larger, national grant such as the NSF IGERT awards (<http://www.nsf.gov/crssprgm/igert/intro.jsp>).

Travel money will be required for attendance at conferences. Budget restrictions at UNC Charlotte have made departmental resources for travel quite scarce. If our requested travel budget cannot be fully funded, we ask that the SOTL consider at least partially funding (e.g., only paying for plane tickets, or only funding one researcher's travel) our travel budget, to facilitate our sharing of our research and curriculum building results.

**H. Timeline, January -June 2012:**

January: hire and training of graduate student, CITI certification of same. Introduce ethnographers (Dr. Lanclos and graduate students) to researchers in Optics. Generate preliminary schedule for work, and observations of that work.

February: ethnographic observations continue. Dr. Lanclos and graduate student do preliminary coding and analysis of initial results, use them to generate interview questions for semi-structured interviews of Optics researchers. Begin to schedule and conduct interviews.

March: ethnographic observations continue. Interviews continue, and analysis of interview texts, as well as photographic and video data collected thus far.

April: ethnographic observations conclude by the end of this month. Last sets of interviews conducted. Dr. Lanclos and graduate student generate preliminary report on nature of collaborative work for the project team. Team begins to analyze results with an eye to the curriculum for the Optics Program.

May: further analysis of results, continuing to work on curriculum development. First set of internal presentations planned after teaching semester is over.

June: presentations of preliminary results at conferences

## References Cited

Sources of strategic plan documents:

[http://clas.uncc.edu/doc\\_details/1-2010-2015-clas-strategic-plan.html?view=document](http://clas.uncc.edu/doc_details/1-2010-2015-clas-strategic-plan.html?view=document)

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