PROVOST’S LEARNING INNOVATIONS GRANTS

2016 CALL FOR PROPOSALS

The Provost’s Learning Innovations Grants (PLIG) program was developed to broaden and enrich the learning experience of RIT students by funding faculty-initiated projects that enhance student learning. More than 200 RIT faculty projects have received funding since the program was initiated in AY 2000-2001. (Examples of previously funded projects are available at the PLIG website, rit.edu/ili/plig).

The launch of the Innovative Learning Institute (ILI) in 2012, and its charge to assist in the creation of exceptional learning experiences for students, led to an evaluation of PLIG and a revitalization of the program to:

- Better support dissemination of individual faculty learning to the wider faculty population
- Provide funding for the implementation of successful pilot projects
- Integrate funding with Institute priorities
- Support the scholarship of teaching and learning

The 2016 Application Form is found on page 3 of this document.

I. ELIGIBILITY

The principal applicant(s) must be tenured or tenure-track RIT faculty. PLIG 2016 projects can include visiting assistant professors, lecturers, adjunct faculty, staff, students, and other contributors.

II. PLIG TYPES

There are two types of grants—Exploration and Focus Grants—for PLIG 2016. Full details are available at rit.edu/ili/plig.

III. USE OF GRANT FUNDS

Provost’s Learning Innovations Grants for 2016 may range from $1,000-$5,000.

Examples of the use of PLIG funds include:

- Course release (reasonable, actual replacement costs for full-time, tenure-track or tenured faculty members removed from teaching)
• Development of new technology-based learning tools and/or environments
• Technologies or equipment required by the project that are not normally provided by the department/college
• Resources for research design and consultation, data collection and aggregation, instrument development and/or purchase, secure data storage, data analysis, and report generation
• Travel to support research activity and/or meet with potential funding sources

IV. PLIG TIMELINE
The grant timeline assumes that most recipients will use Summer 2016 to plan and develop their PLIG funded project for delivery or implementation during the Fall 2016 and/or Spring 2017 semester(s). The full timeline is at rit.edu/ili/plig.

V. SELECTION COMMITTEE AND EVALUATION CRITERIA
Applications for PLIG funds are evaluated by the PLIG selection committee according to the following criteria:
• Utility (solves a defined problem, has potential to benefit many courses/faculty)
• Creativity (is a novel approach or application, represents a new paradigm)
• Efficacy (uses an evidence-based approach, impact to student learning and/or the student experience can be demonstrated)

Details on proposal evaluation and selection committee membership is on the website (rit.edu/ili/plig).

VI. QUESTIONS OR COMMENTS
Please email plig@rit.edu with any questions or comments.
INSTRUCTIONS

Complete this form in its entirety and email it to plig@rit.edu no later than January 27, 2016. Please note to save and rename this document substituting your name (in place of “NAME”) in the file name.

Ask your Department Head to complete the Department Head Certification and return the signed copy along with your application. Note: the signed copy may be scanned and emailed.

If you have any questions about completing this application, please email them to plig@rit.edu or call Michael Starenko at 585-475-5035.

APPLICANT INFORMATION

This application is for a:

☑ EXPLORATION GRANT

☐ FOCUS GRANT

Principal Applicant Name: Benjamin Zwickl ______________________________ Email: ben.zwickl@rit.edu

Faculty Title: Assistant Professor ______________________________ Phone: 54512

(Full-time, tenured and tenure track only)

College: College of Science __________________________ Department: School of Physics and Astronomy

Department Head name: Michael Kotlarchyk __________________________ Email: mnkps@rit.edu

Proposed Project title: Creating a flipped lab environment for University Physics 1

Total funds requested (requests of $1,000 to $5,000 will be considered): 4,500.00

Others involved in the project (if any): ______________________________________

__________________________________
BUDGET

There is a fillable PDF worksheet to calculate your budget. You can download the worksheet at rit.edu/plig.

- The total shown on this worksheet must match the “Total funds requested” in the Applicant Information section of this application form.
- If awarded, additional funds will be provided to cover any benefits and ITS expenses associated with the salary budget requested.
- Note that any equipment or other materials purchased with grant funds are the property of your department and revert to the department after your project is completed.

TIMELINE

Please indicate any variances to the planned PLIG 2016 schedule and your reasons. If you do not intend to deviate from the schedule, you may leave this section blank.

<table>
<thead>
<tr>
<th>Task</th>
<th>Date</th>
<th>Proposed variance and reason</th>
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</thead>
<tbody>
<tr>
<td>Full project plan submitted</td>
<td>Aug. 24, 2016</td>
<td></td>
</tr>
<tr>
<td>Preliminary findings submitted</td>
<td>Jan. 25, 2017</td>
<td></td>
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<tr>
<td>Summary of final findings submitted</td>
<td>Aug. 23, 2017</td>
<td></td>
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<tr>
<td>Final budget accounting submitted</td>
<td>Aug. 23, 2017</td>
<td></td>
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<tr>
<td>Faculty Teaching and Learning Commons posting (a summary of findings, examples of teaching designs or materials, etc.) due</td>
<td>On or before Oct. 24, 2017</td>
<td></td>
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<tr>
<td>Participation in Teaching and Learning Services PLIG dissemination event</td>
<td>On or before Nov. 17, 2017</td>
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</table>
STATEMENT OF UTILITY (two pages maximum)

Using the proposal evaluation criteria outlined in the Evaluation section of the website (rit.edu/ili/plig), please provide an overview of the project you are proposing, including:

- Project objectives
- An explanation of the teaching/learning problem(s) it is designed to address
- An explanation of the significance of the project to student outcomes and/or the student experience.
- A brief description of how the project integrates with activity already underway at RIT in the priority area and/or how this approach has been successfully used at RIT already.

Objectives: I am proposing a pilot project for running a full section (42 students) of University Physics 1 (UP1) using an IOLab Wireless Lab System (http://www.iolab.science/) in place of the current Vernier/PASCO lab equipment. The proposal will provide an IOLab for each student to keep throughout the semester and also develop a new lab curriculum for University Physics 1. The curriculum will include: (1) a suite of revised in-class labs that use IOLab in place of the current Vernier/PASCO lab equipment, (2) a suite of “flipped lab” activities where students explore topics experimentally at home before coming to class, and (3) a suite of “physics in everyday life” lab activities where students use IOLab to collect data about their experiences in ordinary life (e.g., how fast does my car accelerate as I round a curve on an exit ramp). Many of these lab activities will be adapted from those being used at other early adopting institutions such as University of Illinois Urbana Champaign and Penn State University.

Teaching/Learning Problems Addressed: (1) The current University Physics 1 lab equipment is costly to maintain, and requires significant effort to keep organized and functioning. The IOLab, priced at $100, contains nearly all of the sensors and data acquisition functionality of our current lab equipment, but at a fraction of the price. As a sustainable model, the IOLab could be purchased by the School of Physics and Astronomy as a class set, or purchased individually by every student, similar to the current system where students purchase an iClicker, access to MasteringPhysics online homework system, and a textbook. (2) The current lab equipment is time-consuming to set up and put back. Given the tight time constraints between the back-to-back sections of UP1, setting up and breaking down labs typically takes place during the lab period, which can easily consume 10-15 minutes of class time. The IOLab greatly reduces the total amount of equipment needed, enabling students to quickly begin their investigations with less class time wasted on organization. (3) As courses move to blended or online formats, it has been challenging to devise meaningful at-home lab investigations. The IOLab enables a student to carry out a wide range of standard experiments with a minimum of equipment and expense. Some institutions are already piloting the technology in online or blended physics class formats.

Significance to student outcomes: There are two primary benefits to providing each student with an IOLab as part of UP1. (1) Within the University Physics 1 lecture-lab classroom environment, the IOLab should enable a more natural flow between discussion and investigation. Because of the significant time required to set up many of the labs, there is usually a sharp distinction between activities focused on delivering theoretical ideas and activities focused on labs. IOLab blurs the lines between lecture and lab. (2) Outside the classroom there are even more unique opportunities. When students take their IOLab back home, it offers them opportunities to investigate physics in everyday life or to conduct exploratory investigations prior to class (e.g., carry out a pre-lecture “flipped lab” activity at home). In this way the experimental nature of science is connected to students’ life and labs are used to motivate the introduction of new physics concepts, rather than merely confirming ideas discussed in lecture.

Integration with RIT priorities and efforts: The project focuses on the novel use of technology (IOLab Wireless Lab System) for improving students’ learning experiences and outcomes. If the pilot proves successful, the IOLab could enable RIT School of Physics and Astronomy to deliver an online or blended University Physics 1 course with a meaningful lab component that demonstrates the experimental and exploratory nature of science. A concern of many physics faculty at RIT and elsewhere has been that online classes may subvert quality hands-on
lab activities that use real data by replacing labs with computer simulations or watching videos. Technologies such as IOLab could alleviate that concern.
STATEMENT OF CREATIVITY (three paragraphs maximum)

Provide a brief description of how this is a novel approach, or a new application of an existing mode or model of teaching and learning, and/or research about how teaching and learning represents an entirely new paradigm. (Please note that special consideration will be given to proposals that demonstrate a new use/application of a model, system, or technology already in use at RIT.)

The IOLab (and similar devices) provide the opportunity to establish a new paradigm for integrating hands-on activities into introductory physics. Thanks to improvements in technology, it is now possible to pack several sensors (i.e., a 3D accelerometer, 3D gyroscope, force probe, optical encoder for displacement of wheel, 3D magnetometer, analog voltage, temperature, pressure, microphone, and light intensity) into a low-cost ($100) wireless data acquisition unit. The functionality of the unit allows students to conduct a wide range of standard physics experiments at a relatively low cost and with a minimum of equipment (i.e., just an IOLab and laptop). The open source software which collects and visualizes data is installed on the student’s own computer.

The IOLab provides a new paradigm for integrating lecture and lab within an introductory physics course. The traditional lab paradigm used at many institutions has relied on separate lecture and lab sections for the physics course. For over a decade, RIT been a leader in utilizing a workshop (i.e., Studio Physics) environment with an integrated lecture and lab. However, the complexity of many of the experimental setups typically relegates experiments to a limited number of pre-scheduled days, typically after a topic has first been discussed in lecture. The IOLab paradigm allows for students to quickly switch between discussing ideas, performing their own investigations, and then resuming with a class discussion. Because of the low cost, each student can have their own IOLab unit and can acquire their own data, which they can compare with classmates and discuss with the instructor. The IOLab pushes the integration of lecture and lab one step further.

Finally, the most radical part of the new lab paradigm is that the IOLab goes home with students. This allows students to conduct “flipped labs” where students explore a phenomenon at home and start to grapple with many of the key ideas through a hands-on experimental approach. This hands-on real-world experimentation takes place before discussing the various theoretical principles needed to mathematically model their observations. The IOLab reinforces that physics is about exploring the universe and explaining real-world phenomena, and is much more than a collection of facts and formulas that need to be used on homework and exams.
STATEMENT OF EFFICACY (two pages maximum)

Provide a brief description of the experiment/research design, methodology, and methods of data collection you will use to gauge efficacy.

Five research questions will be addressed to study the efficacy of the IOLab model. For each question, particular data collection strategies are discussed.

(1) To what degree can the IOLab replace our current set of lab equipment in University Physics 1? Will the IOLab lower the cost of providing a quality lab experience and streamline the delivery of labs within the UP1 class environment? IOLab contains similar functionality to our existing equipment, but it is not identical. In order to make an informed decision about whether or not to scale up to all sections of UP1, we need to understand the limitations and problems that arise with the new technology. Dr. Zwickl and his TA will keep detailed field notes regarding implementation, both successes and failures in converting the existing suite of UP1 labs to work with IOLab.

(2) How do students engage with IOLab outside of the class? How much time do students spend on these activities? Are they meeting learning goals? Does the technology enhance the quality of discussions in class? Student engagement with IOLab outside of class will be established through monitoring the percentage of students completing the required at-home lab assignments and evaluating the quality of those assignments. In addition, students will be asked to periodically self-report the amount of time they spend on the activities (likely delivered as an in-class “clicker” question). Finally, the instructor and TA will keep field notes regarding in-class activities that build upon the at-home “flipped lab” activities. In order to work well, students should consider the new “flipped lab” activities an important part of the course and invest sufficient time in them.

(3) How does the IOLab impact students’ views about the nature of science and experimental physics? The revised lab experiences will prioritize exploring phenomena through quantitative measurements before developing mathematical models to explain them. Also, some lab activities will involve measuring everyday experiences. I hypothesize this will have a positive impact on students’ views about the nature of science by reinforcing the process of science (exploring, measuring, designing experiments, analyzing and visualizing data, developing models, etc.). A widely used survey, the Colorado Learning Attitudes about Science Survey for Experimental Physics (E-CLASS, tinyurl.com/ECLASS-physics) will be used. The survey was developed by Physics Education Researchers at the University of Colorado Boulder and has been applied at over 50 institutions in hundreds of individual classes. A nationwide data set is used as a comparison for presenting results to instructors. A full E-CLASS report will be provided for the UP1 section by the survey administrators.

(4) Does the IOLab impact standard course metrics, such as conceptual learning or performance on exams? The Force and Motion Conceptual Evaluation (FMCE), a validated assessment tool commonly used in physics education research, will be given at the beginning and end of the semester. The FMCE and exam scores will be compared with other sections of UP1 at RIT to ensure that there is no negative impact of the new course structure. Because the proposed structure increases the emphasis on laboratories, there is a small concern it may displace the other course goals, such as conceptual understanding and problem solving. The data from FMCE and exams will ensure the introduction of the IOLab does no harm in UP1, and possibly may show some benefit by increasing students’ motivation and connections to real-world applications.

(5) What are students’ attitudes about the new technology? Surveys of students’ satisfaction will be given at the beginning, middle, and end of the semester in order to find out students’ general attitudes about the IOLab technology and to identify any trouble spots that cause frustration. Ideally, the technology blends seamlessly into class and is a positive enhancement, but given the newness of the technology and the early stage of implementation, we will probably find several ways to improve students’ experiences.
DISSEMINATION PLAN (optional)

Provide details about the journal, conference, show, or other external vehicle with strong potential for dissemination of your results. Include supporting documentation, such as preliminary interest or acceptance, with your application, if available. *(Please note that special consideration will be given to proposals that have a defined opportunity for external dissemination, such as an academic journal or professional conference.)*

ILI will arrange channels for disseminating results within RIT.
ADDITIONAL CONSIDERATIONS

*Please address these questions, if needed.*

Will your project require assistance for extensive or unusual media, multimedia, simulation, and/or software development? If so, please explain?

Yes.

All courses offered by RIT must be accessible to students with disabilities, according to Section 504 of the Rehabilitation Act of 1973 and Title II of the Americans with Disabilities Act of 1990 ([rit.edu/studentaffairs/disabilityservices/info](http://rit.edu/studentaffairs/disabilityservices/info)). Is your proposed teaching approach accessible to all students, with reasonable accommodation? If not, please explain.

RIT abides by the Family Educational Rights and Privacy Act of 1974 (FERPA), which prohibits instructors from making students' identities, course work, and educational records public without their consent ([rit.edu/xVzNE](http://rit.edu/xVzNE)). Will any data gathering or sharing for your project raise any FERPA issues? If so, please explain.

No.
DISSEMINATION AGREEMENT

By completing this grant application, I agree to provide the materials described here, in support of disseminating what is learned from this project to other faculty at RIT.

I also agree to return all/a portion of the funds that I receive for this project to RIT if I fail to complete or provide the materials described here.

• Full project plan (including roles and responsibilities, milestone dates, and pertinent project details)
• Overview of preliminary findings (may include experiment/study design, lessons learned, initial data collection, and/or literature review summary)
• Final project summary (including data collection, lessons learned, implications for further study, and which may be in the form of an article abstract, conference presentation outline, or short report)
• Teaching and Learning Commons posting (a summary of findings and examples of teaching designs or materials)
• Participation in a faculty dissemination event
• Final budget accounting (reconciliation of budget provided with your application and the actual project expenses)

By submitting this application, I accept this agreement. BZ (Applicants initials)
DEPARTMENT HEAD CERTIFICATION

I support this PLIG application and budget, and verify that the principal applicant __________________ is a full-time, tenured or tenure-track faculty member in good standing in my department.

Department Head Name (PRINT): ___________________________ Email: _________________

Department Head Signature: _________________________________ Date: _________________
DEPARTMENT HEAD CERTIFICATION

I support this PLIG application and budget, and verify that the principal applicant is a full-time, tenured or tenure-track faculty member in good standing in my department.

Department Head Name (PRINT): Michael Kotharyk  Email: mksp@rit.edu

Department Head Signature:  Date: 11/27/16
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<th>Personnel</th>
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<tr>
<td>Adjuncts, Part-Time Faculty/Staff, Summer Salary</td>
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<td>Student Workers, Graduate Assistants</td>
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Personnel Total $0

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<th>Equipment</th>
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<td>1 class set (45) of IOLabs</td>
<td>sensors and data acquisition for flipped labs</td>
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Equipment Total $4,500

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Travel Total $0

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Other Expenses Total $0

Total Award Request $4,500