Optics-Ed: A Photonics Outreach Program for Silicon Valley

Recruiting young minds to the ‘Order of Photonics Wizards’

Presented at the CPO meeting
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Outline

• Introduction & History
• Goals & Philosophy
• Projects
  – Consumable Item Account
  – Laser Kit Circulation
  – Resource List
• Topics & Progress
Introduction

• What is Optics-Ed?
  – A science education outreach program (OP).
  – A group of volunteers interested in K-12 science education.
  – Governed by a steering committee.
  – An e-mail list with over 100 members.
  – A web site.
  – Various projects.
Introduction

• Who is Optics-Ed?
  – Professional optics and photonics societies
  – K-12 science teachers
  – 3\textsuperscript{rd}-party facilitators
  – Manufacturers of kits and materials
  – Grass-roots science workshops
  – University and government entities
  – Local Corporations
  – Science museums
Introduction

• Where is Optics-Ed?
  – San Francisco Bay Area and N. California.
  – Virtual group, communicates via the internet.
  – Face-to-face meetings at RAFT in San Jose.

• When is Optics-Ed?
  – Email reflector discussions at any time.
  – We do not want to meet face-to-face more than once or twice yearly.
  – Schedule for face-to-face meetings as required.
Introduction

• Why Optics-Ed?
  – Government reports indicate a technologist shortage.
  – Encourage K-12 students toward Science Technology Engineering and Mathematics (STEM) studies.
  – Prime the education pipeline for post-secondary schools.
  – Attract historically under-represented groups to STEM.
  – Create a strong “need to know” about optics and (insert favorite topic here) starting in 5th or 6th grades.
  – To encourage and facilitate students that already have interest in STEM studies.
  – Market optics, photonics, and STEM positively to teachers, students, parents, councilors, and the public.
History

• 1998 – Joint meeting of two professional societies.
  – Santa Clara Valley chapter of IEEE/LEOS (SCV-LEOS) officers
  – Northern California Chapter of OSA (OSNC) officers
• 1999 – Memorandum of understanding signed.
• 1999 – Brainstorming & discussion w/members.
• 1999 – SCV-LEOS purchased one laser kit.
• 2000 – Given action item given by the Coalition for Photonics and Optics (CPO)  www.cpo-optics.org
• 2000 – Ad-hoc committee formed, several meetings.
• 2001 – Established email reflector and web site.
• 2002 – Established steering committee.
Steering Committee Members

• California Science Teacher’s Association
• The Exploratorium
• East Side Union High School District
• IEEE Santa Clara Valley K-12 Committee
• Santa Clara Valley chapter of IEEE/LEOS
• Lawrence Livermore National Lab
• Optical Society of Northern California
• The Perham Foundation
• Resource Area for Teachers
• Schmahl Science Workshop
• San Jose City College
• San Jose State University
• Silicon Valley Engineering Council
OESC Officers

- Chairperson – Robert Dahlgren
- Vice-Chairperson – Paul Griffiths
- Secretary – Paul Grossi
- List Owner – Edwin El-Kareh
- Webmaster – OPEN
- Promotion – OPEN
- Membership – OPEN
- Resources – OPEN
- Fundraising – OPEN
Optics-Ed Vision
Draft Mission Statement

• “Help to generate the wonder and excitement of optics for students in school and beyond.”

• PLEASE PROVIDE YOUR INPUT
Operational Mission Statement

• Create a framework for interaction that leverages existing local resources in such a way to create a sustainable, low maintenance k-12 optics outreach program that is scalable, durable, flexible, and affordable.

• Explore, develop, and support members of the community that want to be part of a science outreach program.

• Coordinate with local industry and other local STEM organizations in reaching out to our educators in order to meet their needs.

• Coordinate with meta-organizations such as professional societies, foundations, and government agencies for support, content, and best practices.
Philosophy to Date

• Philosophy is independent of location and discipline.
• Fiscally conservative & technically imaginative.
• Maximum return for minimum effort.
• Build tradition of success, increasing equity and momentum.
• Use available resources (usually match local needs).
• Avoid rigorous approach, allow teachers options.
• Adopt best practices, and not re-invent the wheel.

• Assumptions
  – Volunteers have very limited time.
  – There will be no paid staff.
  – Entities exist for focus groups, vetting, distribution, monitoring, etc.
  – Content will be provided by national-level entities at no cost.
  – Money is readily available locally (OP needs to pass legal muster).
Philosophy, continued

• Identify and leverage existing local OPs wherever possible.
• Create a framework for interaction of the various local Ops and users.
• Local and national entities maintains resource lists.
• “Exploratorium” model
  – Low budget, low glitz, high robustness, high longevity.
  – Carefully crafted, objectively tested, and qualified content.
  – Continuous improvement of content (the hard part).
• The OESC should play a “matchmaker” type of role, to establish linkages between various local entities:
  – Connect teachers, content, distributors, volunteers, societies…
  – Scalable without major OESC intervention.
  – Eventually get involved only when a phone call is needed.
• Content should be as free as possible to end-user.
• We want to establish metrics to evaluate our success.
Optics-Ed Projects
Generic Project Structure/Roadmap

• Steering Committee Approves Project
• Identify Needs
  – ESUHSD and Silicon Valley school district science coordinators.
• Identify Funding
  – National societies, NSF, local corporate and non-profit foundations.
  – IEEE K-12 to market our OP to them, send out proposals.
  – Cash donations via our 503(c) tax-deductible fund.
• Obtain and/or Develop Content (cheaply)
  – Procure Kits, lesson plans, teacher training materials, equipment.
  – Assume national entity will provide for custom CD-Rom and video production, and significant other content and lesson plans for free.
  – Local industries, academic, and government facilities for speakers, field trips, and other activities.
Generic Project Structure/Roadmap

• Review and Approve content
  – Exploratorium for best practices, safety, ergonomic, psychological...
  – Focus group and dry run provided by Schmahl Science.
  – Steering Committee for technical and practical issues.
• Identify Distributor(s) and donate content to them.
  – RAFT for equipment, video/CD/print media, and teacher training.
  – SVEC “Discover E” for presentations.
• Promote availability of the project
  – CSTA and ESUHSD promote to science teachers.
  – SVEC to promote to engineers.
• Commence Monitoring and Continuous Improvement
  – TBD for non-profit or consulting firm.
• Annual review by steering committee
Examples of Project Needs

• Needs will vary geographically and with time.
• Example from East Side Union High School District:
  – Consumables: Batteries, bulbs, paper towels, books, magazines.
  – Learning: Speakers, tours, shadowing days, tradeshows, internships.
  – Volunteer: Ask-an-expert, mentoring, judging, science fair projects.
  – Training: Develop lesson plans using optics, optics videos.
  – Grants: Fieldtrip, awards, sponsoring, Radio Shack, VWR Scientific.
• Getting teachers comfortable with teaching optics.
• Some teachers will not use resources.
• VHS Video and CD-Rom are preferred over the WWW.
Example Project Resources

• Funding
  – Funding can be raised, because IRS requirements have been met.
  – Government, society, individual, and corporate.
  – Equipment, journal, kit, book, and in-kind donations.

• Volunteers
  – Science fair judges, mentors, boot camp, speakers.
  – Webmaster, promotion, membership, *please ask*.
  – Instructor training.
  – People to review and vet the material.

• Executives that encourage volunteerism.
  – Volunteers, tours, job shadowing, mentoring, internships, etc.
Project No. 001 – Consumables

• Problem
  – It has been identified that science teachers often spend their own cash on consumables such as batteries.

• Solution
  – Set up account at Radio Shack, e.g. $10 max. purchase.
  – Endow with donation from SCV-LEOS funds.
  – *Teachers may procure items until account is exhausted.*
  – Statements go to SCV-LEOS chairman.
  – How to have accountability?
  – How to get the word out?

• Is there a better long-term solution for batteries?
  – Rechargeable NiMH batteries suggested.
Project No. 002 – Introduction

• Problem
  – Schools lack science equipment for optics.

• Solution
  – Study how optics is integrated into curricula and review and approve the optics kits.
  – Procure optics kits and donate to 3rd-party, who *circulates the kits to middle and high schools.*
  – Provide training (required) for teachers to use kits.
  – Get national society to provide lesson plans.

• How does this integrate into the standards?
• How do we get the word out and get participation?
• Are there alternatives to circulation?
Project No. 002 – Optics Kits

- Funding needed (TBD).
- Kit manufacturers: LaserLightLab, FOSS for high schools, “optics suitcase” for middle schools.
- Lesson Plans and other content (kit manufacturers, national societies).
- Evaluation (ESUHSD, Exploratorium).
- Focus Group (Schmahl Science).
- Distribution (propose RAFT).
- Training (volunteers, at RAFT, et. al.).
- Marketing (propose SVEC and CSTA).
Project No. 002 – Teacher Training

- Get free training if we buy enough kits.
- Have volunteers do the training.
- Use SJSU and/or RAFT facility.
- Pre-service and in-service training, to ultimately make science teachers feel comfortable teaching optics.
- Teachers need to be trained and certified before optics kits may be reserved, like SCCEBP biotech and NASA moon rocks programs.
- Use best practices developed by Exploratorium/LL/SJSU.
- Need to give teachers incentives to partake.
  - Honorarium
  - Good food, etc.
  - Turnkey lesson plans and media
Project No. 003 – Resource Book

- Master Resource List for Teachers
  - Optics kits and equipment available.
  - Class lesson plans incorporating optics.
  - WWW sites, VHS, CD-Roms for content.
  - Career info for kids and councilors.
  - Volunteers, tours, speakers, mentors, etc.
  - Awards, funds, grants, recognition.
  - Optics workshops, boot camps, fairs, etc.
  - Essential books.
- Training for teachers.
Project No. 003 – Resource book

• Living lists, maintained at local level
  – List of local teachers, schools, and projects, and what are their needs to encourage STEM.
  – List of local distributors, non-profits, OPs and what type of content and equipment is available.
  – List of local volunteer opportunities and companies that encourage volunteerism, tours, lectures, etc.

• Living lists, maintained at national level
  – Aggregated best practices for OPs.
  – Content for instructors, students, parents.
  – Pointers to navigate to the above local web sites.
  – Lesson plans meeting science education standards.
Topics and Progress
Questions

• What should we be doing?
• What should we NOT be doing?
• Who are we and how should we work together?
• How do we fit into the larger picture?
• What niche should we serve?
• How do we reconcile our goals with our resources?
• How do we keep from burning-out our volunteers?
• How do we monitor and continuously improve?
• How do we get the word out?
• How do we fit into curricular standards?
• How do we ensure continuity?
Ideas and Suggestions

• Keep asking until we find some administrative help from one of the national optical societies.
• Can we recover optics from industry scrap cribs?
• Work with magnet schools, non-public schools.
• Generate prizes for science fairs and science challenges.
• Solicit volunteer judges for science fairs.
• Get local optics trade shows to admit children.
• Work with guidance and career councilors.
• Help organize high school optics clubs.
• Optics Night at Lawrence Livermore with UC discount.
• Coordinate with the Merced or other Photonics Consortia.
Continuous Improvement

• This is the hard part.
• Use best practices developed by the Exploratorium.
• Done professionally, is expensive.
• Ask kids for feedback on optics exams.
• Annual focus groups.
• Require teachers to give feedback.
• What metrics to use?
  – Changes in post-secondary enrollment?
  – Number of grass-roots interactions/year?
  – Number of kit usages/year?
Progress Since Last Meeting

• Optics-Ed Steering Committee formed.
• Interim officers and philosophy adopted.
• OESC email reflector established.
• Drafted mission statement.
• Updated the Web site.
• 2 judges for 3/2/2002 Sciencepalooza.
• $200 donated to K-12 Fund of the 503(c) IEEE Foundation, to be earmarked for Project 001 – Radio Shack Account.
• Identified local players with resources for distribution, focus groups, evaluation, and promotion – who joined OESC.
• Still looking for real funding.
Electronic Communication

- Established e-mail reflector
  - optics-ed@ieee.org
  - Minimize the need to physically meet
  - Over 100 members

- Established web page
  - www.ewh.ieee.org/r6/scv/k-12/optics.html
  - For use of the group
  - Need a webmaster

- Established promotion partner