Optics-Ed: A Photonics Outreach Program for Silicon Valley

Recruiting young minds to the 'Order of Photonics Wizards'

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Presented at the Santa Clara Valley Chapter of
the IEEE Lasers & Electro-Optics Society (LEOS)
www.silicavalley.com

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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
  - 3rd-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 5^{th} or 6^{th} 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."

DRAFT

- 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.
  - Tools: meters, reference materials, useful web sites, laser kits.
  - 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
  - ❖ http://www.svec.org/news/societyevents.html

Upcoming Events

- "Where are the future engineers coming from?" March 28th at Mission College www.svec.org 408-735-3303 Larry Bethel

- "Photonics Technology Consortium"
  April 12th at UC Davis at Livermore
  www.merced.cc.ca.us/mcti/consortium
  530-639-1655 Mike Moyers

- "Photonics Technology Consortium"
  May 21st at Xerox PARC www.osnc.org