Student chapters: effective dissemination networks for informal optics and photonics education

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ABSTRACT

Professional societies sponsor student chapters in order to foster scholarship and training in photonics at the college and graduate level, but they are also an excellent resource for disseminating photonics knowledge to pre-college students and teachers. Starting in 2006, we tracked the involvement of SPIE student chapter volunteers in informal pre-college education settings. Chapter students reached 2800, 4900 and 11800 pre-college students respectively from 2006-2008 with some form of informal instruction in optics and photonics. As a case study, the EduKit, a self-contained instruction module featuring refractive and diffractive micro-optics developed by the European Network of Excellence on Micro-Optics (NEMO), was disseminated through student chapters in Argentina, Belgium, Canada, China, Colombia, India, Latvia, Mexico, Peru, Russia, Singapore, South Africa, and the United States. We tracked the movement of this material through the network, up to the student-teacher feedback stage. The student chapter network provided rapid dissemination of the material, translation of the material into the local language, and leveraged existing chapter contacts in schools to provide an audience. We describe the student chapter network and its impact on the development of the EduKit teaching module.

Keywords: Education, informal science, networks, student organization, outreach, language

1. Introduction

Engaging pre-college students in optics and photonics education is of vital importance to developing an educated research and work force that can conduct the exploration of light-based phenomena and technology. Numerous practical curriculum modules, after school experiments, and demonstrations designed to reach pre-college students have been detailed in the ETOP conference proceedings, but the developers of these programs can be stalled at the next step – getting the material into the hands of capable teachers that understand some optics and have significant student contact time. Various teacher networks, such as MESA[1] or Project PHOTON[2] seek to address this issue with teacher training programs, backed up by administrative and networking support. However, these teacher development and linking programs are not present in all communities, and are often absent in developing countries.

How can good materials find the wider audience and support that they need? How can like-minded people interested in this subject work together in a way that helps expose more pre-college students to optics and photonics educational materials? The purpose of this paper is to describe one way that education researchers and curriculum developers in optics and photonics can reach a wider audience of pre-college students world-

Eleventh International Topical Meeting on Education and Training in Optics and Photonics, edited by K. Alan Shore, Deb Kane, Proc. of SPIE Vol. 9666, 96660A
 · doi: 10.1117/12.2207947

wide in a way that responds to local needs and conditions. In section 2, we will describe the SPIE network of student chapters, the characteristics that make them effective, and their involvement in outreach to date. In section 3, we will examine the EduKit project as an example of the use of this network for dissemination of educational materials.

2. Growth of the SPIE Student Chapter network

A student chapter is a campus organization of students who receive funding and networking support from a national or international professional organization. Student membership and chapter membership with SPIE– the International Society for Optics and Photonics – is targeted at undergraduate and graduate students involved in an optics and photonics program, though middle and high school; community college students are involved as well.

Student chapters have been a part of SPIE since the first chapter at California Polytechnic University at San Luis Obispo was founded in the mid-1990s. This chapter languished and the chapter program as a whole grew slowly through the late 1990s, attracting a total of only 5 chapters by the end of 2000. This first group exhibited a wide diversity in education goals – optics research powerhouse University of Central Florida, an after-school program at a Columbia, Missouri area public high school, and the technician-oriented Three Rivers Community College; and geography – with Tsinghua University (China) and the Warsaw University of Technology (Poland). While this diversity speaks to the wide impact of photonics, it also made it difficult to provide a coherent set of benefits to chapters that would satisfy all members.

In 2002, the chapter development effort received dedicated staff support and financial resources to expand. In two years, this modest investment of resources produced a strong return in program interest and new chapter formation. In 2004, SPIE launched a successful three-year student pipeline initiative as part of its strategic plan that resulted in strong growth in student membership and student chapters, as well as programs for non-member students. The goal of the initiative was to increase the visibility of optics while feeding the pipeline of students into optics/photonics education and careers. The initiative was completed at the end of 2006, and the program has continued as part of ongoing SPIE operations since then. Momentum from the program has resulted in continued growth of student programs, student members (Figure 1), student chapters (Figure 2), and the recognition of the need for an Early Career Professional (ECP) program to help support new professionals during their post-terminal degree transition years.

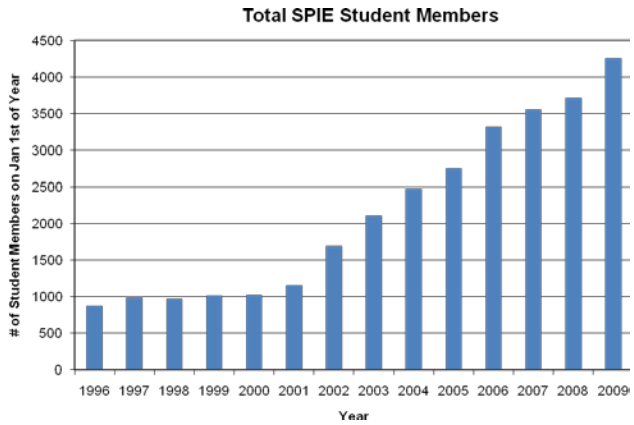

Figure 1 – Total student membership in SPIE over time

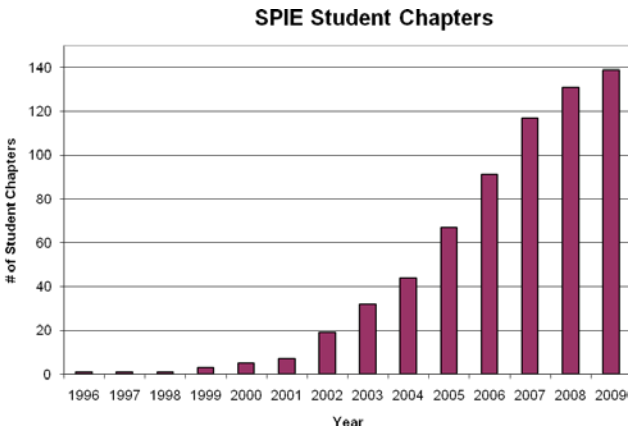

Figure 2 – Growth of SPIE student chapters over time. 145 chapters are anticipated by year-end 2009

Since the initiative launch in 2004, SPIE Student Membership has grown 72% (to 4,260) and Student Members now make up one quarter of SPIE's total membership. Student chapters now number 139. While not all chapters are active at all times, roughly 85% of chapters participate with SPIE for at least one of their chapter benefits in the course of a year. Inactive chapters are removed from the ranks after a one year review process.

2.1 Student chapter benefits

Student Chapters enjoy a wide variety of support from the Society – a yearly activity grant that scales with the size of the chapter, an officer travel grant to attend an SPIE meeting, a workshop on leadership and professional development, support for a Visiting Lecturer to speak at their university or event, free books, and educational outreach materials such as the Hands-on-Optics kits and informational posters. Through the organization of chapter activities, students also become familiar with SPIE programs and opportunities as a whole: submitting papers, serving on governance committees, and networking with current society leadership. Non-member students receive support through our Lunch with the Experts events and professional development speakers at major SPIE meetings. Quarterly student newsletters and networking through Facebook (an online social networking forum) round out the program.

All three professional societies focused on optics and photonics (SPIE, OSA, IEEE-Photonics) support student chapter programs as part of their educational missions. Students at numerous schools have recognized this overlap, the availability of resources through the various society programs, and have formed joint chapters of the three societies. Leveraging resources across the three societies has allowed chapters to pursue ambitious outreach programs.

2.2 Chapter structure and access

The return on the program is that SPIE has gained a large number of young advocates and contacts in universities around the world. SPIE maintains contact with an ever-changing group of student leaders and chapter advisors. Chapters are typically organized with an elected student executive group (President, Vice-President, Secretary, and Treasurer) and a faculty member as chapter advisor. Most chapters observe a one year term limit for each student position. While small chapters sometimes have trouble filling all positions, large chapters often add positions to coordinate specific functions like membership rosters, web management, speaker selection, or outreach efforts. The chapter structure is flexible based on the needs of the group. Currently, 645 students and faculty hold positions within chapters, and this number has grown steadily with the chapter growth. This core leadership group of students and faculty within the chapter program is in more direct contact with SPIE staff than the general membership.

Accessing this network of students and advisors is done by going to the student chapter webpage: http://spie.org/studentchapters or sending an e-mail to students@spie.org with your message and target audience request. Individual chapters are also encouraged to maintain their own websites with expanded program information and contact information – links can be found on the individual chapter pages. The main page will soon be upgraded to provide better geographic information about chapters and more direct links to contact chapter officers via the Profiles feature on SPIE.org.

2.3 Distribution of chapters: geography, language, and economy

Regional development of chapters followed the historical relationships developed through the larger SPIE organization. Strong connections in Eastern Europe led to rapid growth of chapters in Poland, Ukraine, and Russia early in the program. Outreach by 2005 president Malgorzata Kujawinska brought connections and chapters in India. Subsequent presidents have made efforts in China and Latin America to good effect.

The wide geographic distribution of chapters has been particularly significant in providing one of the unique strengths of the program: multi-lingual ability. Although the lingua franca of science is English, outreach instruction in the local community must by nature take place in the local language. Student chapter members

are the best equipped to manage the translation between any instructional materials they might receive, their common language of instruction, and the dominant language of the region. In all, SPIE chapters work in 22 different languages.

SPIE membership costs are reduced for individuals residing in countries that are eligible for Special Economic Consideration, as selected by the World Bank[3]. Seventy-seven SPIE student chapters exist in countries eligible for this rate, or 55% of the total chapters. While this simple binary metric cannot reflect the diversity of the economic conditions in the various countries, it is a useful indicator.

Country	Number of Chapters	Language
Argentina	2	Spanish
Armenia	1	Armenian, Russian
Belgium	1	Dutch, French
Brazil	1	Portuguese
Canada	5	English, French
China	18	Chinese (Mandarin 17, Cantonese 1)
Colombia	3	Spanish
Germany	1	German
India	9	Hindi, Telegu, Malayalam, Bengali
Ireland	1	English
Japan	2	Japanese
Latvia	1	Latvian
Malaysia	1	Malay
Mexico	7	Spanish
Peru	1	Spanish
Poland	6	Polish
Romania	1	Romanian
Russia	13	Russian
Singapore	1	English, Chinese
South Africa	1	English
Spain	1	Spanish
Taiwan	4	Chinese (Mandarin)
Thailand	1	Thai
Turkey	1	Turkish
Ukraine	8	Ukrainian
United Kingdom	2	English
United States	44	English

Table 1 – Distribution of student chapters by country and primary language

Figure 3 – Distribution of 139 SPIE Student Chapters throughout the world as of mid-June, 2009

2.4 Sustainability and development of chapters at different educational levels

Chapters naturally wax and wane in their activity over the course of their existence. While the goal is that once started, a chapter becomes self-sustaining indefinitely, the reality can be different. In addition to the human factors of enthusiasm, connection to the community, and succession of members, external factors also play a large role in whether chapters stay active. In the last five years, experience has shown that the chapters which stay active and engaged with SPIE share certain characteristics of program size, turn-over rate, and relevance. Among them, size of the host optics program has the most direct influence on the continued viability of chapters. Larger optics programs tend to have chapters that remain active and can easily be restarted if activities lapse.

High School chapters suffer the most from these factors. High school chapters have been organized around after school programs and individual technical training classes. An engaged and active chapter advisor is a necessity since often high school students lack the self-confidence and organization to act as a group. In addition to these hurdles, students only become acquainted with the math, geometry, and physics related to optics in their 3rd or 4th year of education, and optics and photonics is rarely included in the pre-college curriculum. With a small number of interested students and at best one year of familiarity with the chapter and the subject material, pre-college chapters rarely remain active from year to year. The SPIE program offerings themselves do not lend themselves well to high school chapters, the primary benefits being related to scientific conference attendance and career development. High school groups interested in optics & photonics are more successful in partnership with an active university chapter, using SPIE resources such as the optics posters as a supplemental resource.

Community college programs face similar issues of turn-over and relevance that high school chapters face. The topics of modern physics and the interaction of light with matter are typically taught as a second year university course in the United States, giving students little time to become versed in the material. Focused optics programs like that at Three Rivers Community College overcome some of this by starting students on optics content early, with hands-on experimentation techniques. Because of the rapid turnover of students, strong faculty leadership is essential to sustaining interest in the chapter in this environment.

Programs consisting primarily of undergraduates have a wider window for student involvement (less turn-over) and relevance than community college programs. Four year undergraduate programs allow students significant time to become familiar with optics and photonics content. In addition, students have the time to

become familiar with the chapter structure, enabling them to develop outreach efforts in their community. Undergraduates can often act as content experts for pre-college students or teachers and welcome the chance to develop their teaching techniques.

Most SPIE chapters consist of both undergraduate and graduate students, with graduate students tending to dominate the chapter leadership due to their optics focus, time availability, and the relevance of optics in their lives. Chapters that manage to integrate their programs so that undergraduate and graduate students work together on projects can be quite successful. Developing activities and systems that engage both the graduate and undergraduate students in chapter activities is quite challenging, and chapters have cited "engaging undergraduates in chapter activities" in surveys of the biggest challenges facing chapter leaders.

2.5 Variety in Outreach by chapters

When chapters have strong leadership, motivation, and access to resources, they can reach large numbers of pre-college students. Not surprisingly, the variety of outreach activities that student chapters conceive, design, and execute is quite significant. Appendix A contains a detailed listing of chapter outreach activities for the most complete years of the survey, 2006, 2007 and 2008. The following list calls out unique projects that have had a wide impact or exhibit a new pathway for reaching students with optics content:

- The **Centro de Investigaciones en Óptica Student Chapter** obtained a monthly spot on children's public television program TV4Ninos, which is broadcast by TV Qu4tro, a state-wide broadcaster with over 3 million viewers. During the spot, CIO members perform different experiments in real time in order to explain basic scientific concepts.

Figure 4 – CIO students and faculty demonstrate how solar panels work in their public television program

- The **Instituto Nacional de Astrofísica, Óptica y Electrónica Student Chapter** created two workshops for the 2nd International Reading Fair, an event attended by 20,000 school children. The workshops involved building periscopes and kaleidoscopes in order to illustrate basic optics principles. Roughly 1,000 children built periscopes and 900 children built kaleidoscopes. Additionally, the chapter brought telescopes to downtown Mexico City for a total lunar eclipse so that people could observe the phenomenon more closely. Roughly 1,000 people participated in this activity.

- The **International School of Photonics Student Chapter** held their third annual Optics Fair on November 28-29. More than 1400 K-12 students attended the fair, where scientific experiments tailored to their age levels were demonstrated.

- The **Nicholas Copernicus Univ. Student Chapter** took part in the 8th Annual Festival of Art and Science, a city-wide science outreach effort. They designed a workshop where they presented physical experiments describing interesting natural phenomena. Their event drew almost 1,000 visitors over the course of three days.

- The **Stanford Student Chapter** hosted an online optics-themed photography contest for 6th-12th graders, receiving more than 50 entries. They also hosted a field trip, called Girls Go Tech 2008, for K-3rd grade girl scouts. They took the scouts to the Chabot Space and Science Center in Oakland where they did a number of hands-on optics activities with them. They expanded content for the Stanford OSA/SPIE Student Chapter YouTube channel, which features videos covering their educational outreach, academic, and networking events.

2.6 Measuring Outreach

On the first of each month, 10-15 chapter reports are due to SPIE covering the annual activities for the chapter. All chapters are expected to provide an annual report of activities whether or not they have received funding in that year. In practice, we receive reports from about 80% of all chapters. Staff provides feedback on the reports, uploads them to the chapter web page for record keeping and dissemination, and notes if there have been any outreach activities performed by the group. If there have been outreach activities during the year, we attempt to determine how many people participated in this activity. Some chapters provide their own estimates of the numbers of students at their events, and this is explicitly part of the chapter report guidelines. In cases where no numbers are provided, we either query the chapter leadership or attempt to estimate the number of participating pre-college students from any pictures of the outreach activity. While counting the number of people in the pictures is crude, it does provide a quick, rough number. Especially notable or well-attended outreach activities are highlighted in the quarterly student newsletter: Wavefront, which can be accessed on the web[4].

In the three years that Outreach efforts have been tracked, 2006, 2007, and 2008, SPIE student chapters reached 2800, 4900 and 11800 students with some form of optics education. Tracking was incomplete in 2006 and has not yet completed for the 2009 school year. Because of the wide variety of outreach projects performed and the uncertainty in the numbers of participants and duration of the events, we do not attempt to count contact hours per student for the events. Certainly, the type of contact varies for each event – some pre-college students take part in multi-day summer programs led by chapters, while others are involved in a series of demonstrations lasting for just an hour. This is especially apparent in 2008, when numerous student chapters undertook exceptionally large outreach events. Sophisticated presentations, such as the Vrije Universiteit Chapter's "Fascination of Light" Science show, brought large numbers of pre-college students and teachers into contact with optics and photonics concepts. Other chapters, like the University of Arizona, worked on a week-long optical sciences camp for high school students. While the numbers of students reached are vastly different, the total contact hours for both projects would likely be approximately equal. Despite the difficulty in finding a way to track these events on a level that recognizes their differences, we believe that even a basic amount of counting helps quantify the impact of student chapters in their communities.

2.7 Face-to-face: Catalyzing the effectiveness of student chapter programs

While online networks can provide the communications infrastructure for educational outreach, face to face meetings have been essential in bringing projects to a wider audience. Annually, SPIE hosts the Student Chapter Leadership Workshop as part of the Optics & Photonics conference in San Diego. This workshop provides funding to bring a representative from all student chapters in good standing to San Diego for a day and a half program of professional development and networking. Since 2004, the Leadership workshop has hosted 50-90 chapter representatives and an additional 30-50 chapter students and veteran leaders each year (80 attendees ('05), 110 attendees ('06), 125 attendees ('07), 135 attendees ('08)).

This face to face meeting has been used effectively to provide both materials and outreach training through optional free courses. The Hands on Optics (HOO) program[5,6], a partnership of SPIE, OSA, and the National Optical Astronomy Observatory (NOAO), has hosted training programs for its optics modules at both the Optics & Photonics conference and Photonics West since 2006. In the last 3 years, the training program has focused on the Terrific Telescopes mini-kit[7], a portable version of the Magnificent Magnifications module. The mini-kit provides materials and instruction for an educator to assist students in constructing a small refracting

telescope and determine the properties of the lenses and structures that make up the telescope. The kits are roughly the size of a thick laptop computer case, and contain enough materials to make 5 telescopes. Throughout the program, the distribution of materials widely to chapters has proven difficult and expensive using standard post and shipping methods. Providing the kits directly to the students at the conference eliminates this issue. More importantly, the training courses get student educators to become familiar with the HOO mini-kit and hopefully to embrace the inquiry-based educational techniques of the modules. Recognizing that students have deeply rooted preconceptions of how natural phenomena like light and reflection actually work is a primary development of recent educational research and has been incorporated into the HOO modules thoroughly[8]. Outreach training lessons serve to model the teaching experience so that student educators can take it out into the pre-college environment the best techniques.

Using the resources and timing of the Leadership workshop to disseminate optics education materials is an effective way to leverage resources. No other SPIE event in the year brings together students from such a wide variety of backgrounds with specific goals like service and outreach in mind. There is a great deal of enthusiasm for quality optics demonstrations throughout the student group, with many students building their own demonstration materials and hosting outreach events. As students work with one another, they share tips and strategies for improving the events. These meetings help students become a part of the broader network of professionals working on the problem of creating effective optics and photonics curricula.

3.0 The EduKit project

Through a grant from the European Commission, the Network of Excellence in Micro-Optics (NEMO) designed an outreach package called the EduKit. NEMO's goal for the EduKit program is to expose students to the potential of micro-optics in science and engineering applications by distributing Edukits for free. The heart of the kit is a plastic card containing diffractive and refractive optical elements. Combined with a laser, this card can produce a large range of beam patterns, from simple splitting and grid patterns to complex images and words. In addition to the diffractive optics card and the laser, the EduKit also contains a DVD with a description of the card and a lesson handbook in the following EU languages: Dutch, German, English, Finnish, French, Italian, Polish, Spanish, and Turkish. The EduKit materials have been described in various papers for this conference[9].

In summer 2008, the SPIE Student Chapter at the Vrije Universiteit Brussel took the initiative in disseminating the EduKit to 21 other SPIE Student Chapters located in Argentina, Canada, China, Colombia, India, Latvia, Mexico, Peru, Russia, Singapore, South Africa, and the United States. Again, the Student Chapter Leadership Workshop provided a venue to inform and solicit volunteers in the project, though no on-site training was provided. The plan was to get a first round of feedback on the kit by the end of 2008 so that the program can be reviewed and improvements made on the materials. The Vrije Universiteit Brussel chapter provided total of 700 EduKits to chapters for distribution in their local communities.

Number of pupils at Edukit activities	1147
Number of teachers at Edukit activities	116
Number of received evaluation forms	17

The evaluation forms asked for a simple response to the quality of the EduKit materials – optics and manual:

	Very good	Good	Sufficient
Manual	35.29%	41.18%	23.53%
Optics	47.06%	47.06%	5.88%

It also surveyed which experiments / demonstrations from the manual were carried out by the chapters:

	Exp I	Exp II	Exp III	Exp IV	Exp V	Exp VI	Exp VII
Completed	82.35%	88.24%	88.24%	58.82%	35.29%	29.41%	41.18%

The challenge of the kit is integrating it into pre-college classroom instruction. Diffractive optics can be a mind-bending topic, especially for young students who are perhaps just being introduced to simple ray-tracing

and basic geometric optics. Although teaching the principles of diffractive optics is not a primary goal of the EduKit, some understanding of the principles at work helps with the instruction and experiments contained in the kit.

Finding good ways to use the kit materials and the included lessons was the subject of the 2008 Outreach challenge that was jointly organized by SPIE and the SPIE Student Chapter at the Vrije Universiteit Brussel. Chapters participating in the first round of the kit evaluation were offered the chance to compete for $2000 in awards by producing short video demonstrations of basic principles and lessons that are possible with the kit. For the competition, videos were uploaded to the SciVee.tv website and judged by a panel of science education experts. The overall goal was to produce a supplement of materials that can expand the accessibility of the kit – essentially providing a quick start guide for teachers that may not have the benefit of on-site training. The challenge received three video lesson submissions which currently can be found on the SciVee.tv website, but will be made accessible through a more open video sharing site like YouTube or Vimeo.

Figure 4a – Student manipulating the diffractive optics card

Figure 4b – Various beam shapes are possible with the card

4.0 Conclusion - Dissemination using the SPIE Student Chapter network

The SPIE Student Chapter network proved effective in distributing both the EduKit material and collecting feedback from users. The general strengths of the network are the rapid dissemination of information and material via the leadership workshop, translation of the material into the local language when needed, and leveraging existing chapter contacts in schools to provide an audience. The importance of this last point cannot be over-emphasized. Many Student Chapters already have local connections with teachers from previous outreach contacts so a new network need not be established to test new materials. As evidence of the effectiveness of the network, dissemination of the EduKit began in mid-August 2008 at the Leadership Workshop and had reached 1147 students in the span of one academic semester.

Improvements to the system are planned primarily in two areas: group communications and post-event information sharing. Group communications for the EduKit project was still handled primarily through email, even though we used socially-based sites like SciVee.tv to store the final outreach projects. Group communications were not self-service and the interaction among chapters involved in the project was

minimal. Helping students organize and providing the tools they need to communicate about relevant topics is a primary goal of the SPIE student program. Some tools have worked well for group collaborative communications; for example, the SPIE Student Facebook group was growing numbers (587 members) and allowed threaded discussions and information sharing. Unfortunately, changes in the Facebook business model have removed much of the visibility from groups, making this tool less accessible. New collaboration and sharing tools must be found to compensate. Google sites – a wiki-based website creation tool - may provide an answer.

The post-outreach event reports are currently available in PDF format as subsections of the chapter reports stored on the individual Student Chapter pages on spie.org. However, just because they are available does not necessarily mean that they are read. Modern information sharing through a more collaborative medium like a blog or wiki dedicated to optics education could help tag and sort outreach events by size and topic. This would make it much easier for other chapters to share outreach event plans and communicate. SPIE's information collection on these outreach events could also be improved with a dedicated feedback form for recording outreach interactions. Ideally, this would ask students to estimate contact hours and key lessons from their events.

4.1 Summary

We have described the size, organization, and key characteristics of the SPIE Student Chapter network; a collection of 139 campus organizations supported by the Society to engage in professional development programs like outreach to pre-college students. This network of students provides needed optics and photonics teaching in their local communities and reaches a very large number of students relative to the size of the chapter program. These outreach events have the advantages of being locally based and available in the native language of the community, relevant to the needs of the community, and employ modern concepts and teaching techniques. Overall, the student chapter network serves a very wide range of cultures, languages, geographies, and socio-economic standings. This network is accessible to people working on outreach curriculum and can serve as a rapid and effective point for dissemination for material. The Student Chapter Leadership Workshop at the SPIE Optics & Photonics conference is an effective venue from which to communicate and distribute material that chapters can use, as we demonstrate with NEMO's EduKit project. We will continue to seek more collaborative and social means for chapters to share their outreach efforts so that quality events can spread throughout the world.

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Acknowledgements:
This project was made possible by the efforts of the Vrijie Universiteit Brussel SPIE Student Chapter and VUB staff Nathalie Debaes and Bernadette Callebaut to distribute the EduKits. Prof. Hugo Thienpont is PI and contact for the NEMO project. DF would like to thank Marie Biondolillo for the geo-coding used to create Figure 3 and for tracking the numbers of students in Chapter Outreach events in 2007 and 2008. Teddy Parker-Renga also assisted with this effort. We would like to acknowledge the EduKit videos created by the Student Chapters from Nizhny Novgorod, Cochin University of Science and Technology, and the Samara region. Thanks are also due to video judges Prof. Judy Donnelly, Dr. Marc Nantel, and Dra. Cristina Solano for providing feedback on the video submissions.

Appendix A: List of Student Chapter Activities by Year

2006 Outreach Activities

Chapter	Activity	# people reached	Type	Counted (how)?
BGSU	High school open house	10	HS student	est by counting ppl in pics
Brussels	BEST Summer School	20	10 adults	in report
	NEMO Edukit proposal	14	misc children	in report
	NEMO Edukit training	10	Teachers	in report
CUSAT	10 day workshop for school children "Physics: Scope and Awareness"	20	Children	in report
Tec de Monterrey	Second Matlab workshop	25	undergrad	in report
	Mood patch workshop	50	Children	in report
	Contact thermomenter & liquid crystal workshop	25	HS student	est by counting ppl in pics
Koç Univ.	Solar Race	24	children/HS	in report
	Science Festivals for Kids	10	Children	est by counting ppl in pics
Samara State Univ.	"excusrions and review lectures for schoolchildren and students in Samara Branch of the Lebedev physical Institute."	?	children/HS	unknown
Silesian	Demonstrations of physical and optical experiments	30	children/HS	est by counting ppl in pics
St. Petersburg ITMO	Scientific Youth School "Optics - 2006"			unknown
U Alberta	SPIE Info Lunch	50	undergrad	in report
	Engineering Open House (Laser Maze to return in 2007)	40	HS student	(estimated)
Wroclaw	"Festival of Science"	250	HS student	(estimated)
	"Magic of Physics"	75	Children	(estimated)
Nicolas Copernicus	Junior High School Presentation "Electric and Magnetic Field"	350	Children	est by counting ppl in pics
Warsaw	Festival of Science	250	HS student	(estimated)
INAOE	Science workshop for HS students "Taller de Ciencia para jovenes"	35	HS student	est by counting ppl in pics
	Science workshop for children "Baños de ciencia con el GTM" GTM = Gran Telescopio Milimetrico	120	Children	est by counting ppl in pics

	13th national Week of Science and Technology Children's workshops	35	Children	est by counting ppl in pics
	13th national Week of Science and Technology Matlab workshop	12	HS / Univ students	est by counting ppl in pics
	13th national Week of Science and Technology Presentation: Optics at the INAOE	20	Children	est by counting ppl in pics
	8th International Festival of Puebla Reading & Science workshop	15	Children	est by counting ppl in pics
	"Baños de ciencia" at "Consejo puebla de lectura"	15	Children	est by counting ppl in pics
UC Davis	"Preview Day" - HS students visit the University	?	HS student	unknown
	Outreach events: Feb 25, April 8, 16, 16, and 27.	?	Children	unknown
	Lazer Maze	500	Children	on website (reported)
Univ. of Dayton	Outreach at Miamisburgh High School	?	HS student	unknown
	Grade 10 outreach in conjunction with Air Force Research Laboratory	?	HS student	unknown
Montréal Chapter	2 Day Optics workshop	37	undergrad & grad	in report
CIO	Hands-on Workshops for teachers	?	Teachers	unknown
	Science Club for Children (4 meetings thus far)		Children	est by counting ppl in pics
	Science club participation (for Children and Teens)	429		
Notre Dame	Academic seminars (invited speaker for students and faculty)	30	under / grad / prof	in report
MEPhI	Alex Radnaev's visit to Irkutsk State Univ (ISU)	10	under / grad / prof	unknown
Alabama A&M	Nobel Laureate Lecture: Frank Wilczek	300	under / grad / prof	in report
	"Senior Day": Physics Demo & Physics Skit	?		unknown
Kent State Univ.	Boy Scouts at Kent State!	12	Children	est by counting ppl in pics

Total: 2823

2007 Chapter Outreach Activities

Chapter	Activity	# people reached	Type	Counted (how)?
CUSAT	10-day Workshop for Children	30	High School	est. by counting ppl in pics
Ctr. de Investigaciones en Óptica - Leon	Hands-on Workshop for Students	60	High School	in report
	Science Club for Children	108	Children	est. by counting ppl in pics
	Visits to High Schools	29	High School, Elementary	est. by counting ppl in pics
Duke University	Wetherstone Elementary Optics Demo day	90	Elm school	reported
Duke University	Career Day - North Rayleigh Christian Academy	50-75	Middle+High School	reported/guess
IUP	High School Outreach	21	High School	est. by counting ppl in pics
Univ. of Alabama	High School Outreach	200	High School	est. by counting ppl in pics
	Elementary School Outreach	5	Elementary school	est. by counting ppl in pics
Univ. of Dayton	Miami Valley TechFest	18	Elementary school	est. by counting ppl in pics
	Optics Demos	14	High School	est. by counting ppl in pics
Univ. of New Mexico	Central NM Science & Engineering Research Challenge	500	Elementary - High School	in report
	Intel Science Fair	30	High School	in report, 1500 attendees
Vrije Universiteit Brussel	Fascination w/Light Exhibition	1000	Elementary-High School	in report
	Edukit Training	7	High School Teachers	est. by counting ppl in pics
Warsaw Univ. of Technology	Optics Workshops for Children	100	K-12	in report
Wroclaw Univ.	Magic of Physics Presentation	36	Elementary school	est. by counting ppl in pics
	Liquid Crystals Presentation	13	High School	est. by counting ppl in pics
Ctr. de Investigaciones en Óptica - Leon	Hands-on Workshop for Students	65	High School	in report
	Science Club for Children	12	Children	est. by counting ppl in pics

Delhi College of Engg	Lecture for High School Students: Optics and The Internet	5	High School	est. by counting ppl in pics.
INAOE	Seminar in honor of the National Week of Science and Technology	150	high school	in report
PUCP	Workshop on Optics for High School Teachers	20	High school Instructors	in report
UNC Charlotte	Nobel Laureate Visits UNC Charlotte/Outreach Activities	250	High school	in report
ISP	Optics Fair	1200	Middle School, High School	in report
	Optics to School	71	Middle School, High School	est. by counting ppl in pics on website of event
Koc Univ	Solar Boat Race	15	High School	est. by counting ppl in pics on website of event
	Solar Car Race	28	High School	est. by counting ppl in pics on website of event
Lehigh Univ	Lab Tour for Local Cub Scouts	5	Children	est. by counting ppl in pics
	COT OPTO Camp	12	Middle School	in report
	Local Middle School Optics Demo	75	Middle School	in report
NITT	Assisting local students w/computer knowledge	34	Middle School, High School	est. by counting ppl in pics
Silesian Univ. of Techn	Demos for High School Students	10	High School	est. by counting ppl in pics.
Stanford	Science Educator's Day	75	(K-12 teachers)	in report
	Community Day Science Demo Booths	198	Children	est. by counting ppl in pics
Taurida	Optics Demos in Classroom	36	5 - 9 yrs old	est, by counting ppl in pics
Univ. of Calcutta Chapter	Outreach at Loreta Day School	140	Children	in report
	Outreach at Our Lady Queen of Missions School	150	Children	in report
	Outreach at Svarna School	50	Children	in report
UCSD	Holography Workshop	24	Middle School	in report
Univ. of New Mexico	organized high school SPIE chapter	12	High School	in report
Wroclaw Univ.	Festival of Science	25	K-12	est. by counting ppl in pics

	Magic of Physics Presentation (for Elementary School Children)	?	Elementary School	unknown
	Liquid Crystals Presentation	24	High School	est. by counting ppl in pics
	MFI (Math/Science Tutorials)	?	High School	according to report, 10 high schools took part, but I don't know how this translates numerically

Total: 4947

2008 Chapter Outreach

Chapter	Activity	# people reached	Type	Counted (how)?
Chulalongkorn	Science Fair	600		reported via email
Ctr. de Investigaciones en Óptica - Leon	Science Club for Children	146	K-12	est. by counting ppl in pics
CUSAT	10-day Workshop for Children	33	High School	est. by counting ppl in pics
INAOE	Periscope Workshop during learning fair/univ. anniversary	1000	Children	in report
	Kaleidoscope Workshop during learning fair/univ. anniversary	900	Children	in report
	Total Moon Eclipse Telescope Outreach	320	(people under 15)	in report/estimated. (See note for how)
ISP	Optics Fair	1400	K-12	in report
Ivan Franko	Amazing Optics Presentation	28	1rst grade	est. by counting ppl in pics
Latvia	Night of Science	700	K-12?	reported via email
Lehigh	Optics Presentations	52	Middle School	in report
Lomonosov	Moscow Science Festival	50	High School	in report
Montana State	High School Visit	30	High School	reported via email
Montreal Chapter	Electromagnetism and Optics Presentations	110	High School	reported via email
	Electromagnetism and Optics Presentations	85	High School	reported via email
Nicholas Copernicus University	Lab visits by Krakow high schools	?	High School	unknown
	Festival of Art and Science Workshops	1000	children, middle, high school	in report
NITT	Awareness Program on Physics Ed & Res. '08	100	college level	in report
Penn State	Electrical Engineering Open House	200	High School	in report
	Nittany Valley Charter School Outreach	21	elementary, middle school	est. by counting ppl in pics
	Kelly Elementary School Outreach	16	elementary	in report

	WISE (Women in Science & Engineering) Summer Camp Demo/Workshop	16	High School	based on WISE website's description of how many students are generally in a workshop
PUCP	Basic Optics Presentation at all-girls school	50	High School	est. by counting ppl in pics
Silesian Univ. of Tech.	Science Festival	100	High School	reported via email
	Lecture on LCD	50	High School	reported via email
Stanford	Girls Scouts Go Tech 2008	100	elementary school	in report
	Optics-themed Photography Contest	50	6th-12th grade	on website
Tec de Monterrey	Terrific Telescopes - used Hands On Optics Kits	38	K-10	in report
	Liquid Crystals/"Mood Patch" Outreach	110	K-12	in report
Three Rivers Comm. College	Demos on Phosphoresence, Luminescence & building telescopes	75	5th grade	in report
	Laser Camp '08	30	High School	in report
	UV demo at Read Across America	?	Children	unknown
CUVO	Workshop on Optics	43	age 8-13	est. by counting ppl in pics
UC Berkeley	Girls Science Workship	25	Middle School	in report
Univ. Laval	Girls in Science Workshop on Optics	12	High School	in report
	Jeux Photoniques	55	High School	reported via email
Univ. of Arizona	Science Fair Judging	?	K-12	unknown
	Optical Sciences Camp	18	High School	in report
Univ. of Calcutta	Outreach Activity at Vidyasagar Study Centre	86	Middle School?	in report
	Scientific Demonstrations	415	Middle School, High School	in report
	Optics Kits Demos	264	High School	in report
CREOL	Expanding Your Horizons in Science & Math (for girls)	200	Middle School	on website
	Optics Day	300	misc. ages	on website
	Super Scientists at Partin Elementary	?	elementary school	unknown

	Lab Tours	? - site says hundreds	Middle School, High School	unknown
Univ. Dayton	Optics Demo	10	High School	est. by counting ppl in pics
Univ. of Guanajuato	Children in Science Academy	15	elementary school	est. by counting ppl in pics
Univ. New Mexico	West Mesa Chapter Lab Tour	10	High School	in report
	Hands-on-Optics Kit Outreach at Kit Carson Middle School	60	Middle School	reported via email
UNC Charlotte	Outreach Tour	15	High School	in report
	Girl Scouts visit	20	Elementary	in report
Wroclaw	Festival of Science	50	Elementary	in report
	Magic of Physics	18	High School	est. by counting ppl in pics
Yerevan	Physics Olympiad	16	High School	reported via email
Vrije Univ. Brussel	Distributed Edukits (free educational optics kits)	1,000	misc. ages	in report
	Photonics Science Show	630	High School	in report
Duke Univ.	Optics Demonstrations and Presentation	30	Middle School	in report
	Outreach Visit	25	Middle School	est. by counting ppl in pics
INAOE	Week of Life and Science	240	Middle and High School	in report
	INAOE talks / workshops with students (16 total)	710	Middle and High School	in report
	Week of Science and Technology	380	misc. ages	in report
	Week of Science in High School	60	High School	in report
Nizhny Novgorod	Developing video to explain basics of Edukits for high school teachers and students	???	High School	unknown
Taras Shevchenko National Univ. of Kyiv	Invited high school students to exhibit and plenary session of Young Scientists conference	???	High School	unknown
	Tutoring middle and high school students in physics and math one day a week	???	Middle and High School	Unknown

UCSD - Triton	Holography Workshop	60	High School	in report
UNC Charlotte	Girl Scouts visit	???	Elementary	Unknown
Univ. of Texas at Austin	"Fun with Optics" program, part of Explore UT open house	150	misc. ages	in report
Warsaw Univ. of Technology	Festival of Science	100	elementary school	in report
	Workshops for Children	?	children	unknown

Total: 11827