OPTICS OUTREACH AND GENDER EQUITY IN PAKISTAN

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ABSTRACT

An overview of the optics outreach activities conducted under the banner of Active Learning in Optics (ALO), a self-funded program established in January 2016, will be provided. This initiative operates under the umbrella of both Quaid-i-Azam University (QAU) and the Abdus Salam International Centre for Theoretical Physics (ICTP). In past nine years 75 outreach activities in various educational institutions, focusing primarily on public sector girls' schools, colleges, and universities have been successfully coordinated. The outreach activities conducted aim to bridge educational gaps and promote the understanding of optics, especially among female students. Towards the conclusion of presentation, I will briefly elaborate on the establishment of the Pak-ICTP Alumni Society in January 2021. This initiative was conceived to effectively reach undergraduate and graduate students during the challenging times of the Covid-19 pandemic. In past three years, PIAS organized 40 online scientific talks, including the Abdus Salam and Steven Weinberg lectures series, by eminent scientist from ICTP and around the globe.

Keywords: Optics, Outreach, girl's education, STEM, remote areas

1. INTRODUCTION

Pakistan, as a developing nation, is actively pursuing economic growth to align itself with the rapidly advancing economies in the region. Women constitute approximately 49.2% of Pakistan's total population. The country is actively working towards development, concurrently placing a strong emphasis on reducing gender disparity at all levels, particularly by addressing inequalities in education. To promote national development, it is imperative to provide comprehensive training for young female students, fostering an environment that encourages them to appreciate and draw inspiration from the field of science. To address this issue, we must initiate efforts in foundational science education, focusing on both young students in general and, specifically, young female students.
The challenge is how and where to start. Our ideas are to

- Reach out to government girl's schools/colleges to do outreach activities, using Active Learning in Optics (ALO) platform.
- Reach out undergraduate students- boys and girls, in public sector universities to do outreach activities using Active Learning in Optics (ALO) platform.
- Reach out undergraduate /graduate students in Physical Sciences to help them virtually/ online using Pak-ICTP Alumni Society (PIAS) forum.

1.1 Roadmap to Active Learning in Optics (ALO)

The year 2015 was very special for many of us in Pakistan and elsewhere, as it was designated by the United Nations as the International Year of Light and Light-based Technologies (IYL 2015). That fact in itself created a special environment and "endorsement" that gave life to many ideas for outreach that could have a positive and lasting impact on society. I had a chance to be one of the facilitators for UNESCO teacher-training workshop namely ALOP in Islamabad in connection with IYL in 2015, with Prof Niemela [1].The success of ALOP broaden my vision and guided me to establish an Active learning in Optics (ALO), a self-funded program under the umbrella of ICTP and QAU to bring physical sciences to underprivileged high schools and college girls in remote areas of Pakistan. It has started in January 2016 as a way to provide girls an enriching science experiences, in a very friendly atmosphere [2].

During one coffee break at ALOP, Prof. Joseph Niemela and I discussed the need to take some of this material directly to students at both the undergraduate and high school levels, and in particular to give special opportunities to young women for the related hands-on activities in optics. He had very kindly sent me some Photonic Explorer kits (EYEST),

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from ICTP. Later he received some APS kits, which he delivered during a visit to Islamabad in July 2016, in which he was able to observe and photograph an outreach event for 20 female undergraduate students at Quaid-i-Azam University.

Winding back to 2015, I realized that I had all needed ingredients to take hands-on activities to schools and do something personal for IYL 2015. I discussed this with my colleague Dr. Raheel Ali, a laser physicist, who at that time had agreed to work with me for the ALOP project, held during second week of December 2015. Our dream was to do something to help inspire a new generation to study science, through a hands-on, active learning-based session in optics dedicated to IYL 2015. For our first outreach visit we went to a private school in Islamabad. When we were discussing the possibility of this visit with their science teacher he was very enthusiastic about it. At that school the teacher was much more involved in the learning process, than the students. This experience taught us a number of things and one of them was the realization that private schools didn't really require our support, whereas public or government schools had a real need.

1.2 Bringing The Joy Of Scientific Inquiry To Girls In Pakistan

In January 2016, we started our optics activities at large scale by inviting undergraduate girls from local government colleges and schools for a one-day active learning event in optics. Each experience inspired us to do more. It is hard to describe the enjoyment of seeing young enthusiastic girls so keen to learn, so eager to get their hands (and minds) engaged. In fact, it was always difficult to say good-bye to these girls at the end of the day and they always wanted us to invite them again. And this was not something they got credit for. They did it presumably for the enjoyment of discovery, the same motivation that often inspires graduate students and established researchers to work the long hours that are necessary. It of course is our hope that some of these girls will decide to continue in science and that we may see them in our classes and, most of all, that they may choose to do outreach themselves one day and be a role model for a new group of girls [3].

One day hands on Optics workshop at Department of Physics at Quaid-i-Azam University on 16th July 2016

2. OPTICS OUTREACH DURING 2017: NATIONAL AND INTERNATIONAL

In 2017, apart from our usual outreach activity, we organized a five days international workshop on Optics and Photonics (IWOP) at the Department of Physics Quaid-i-Azam University (QAU), Islamabad, Pakistan (11th-15th December 2017) [4].

2.1 International Workshop On Optics And Photonics (Iwop 2017)

The purpose of the workshop was to bring together the ICO-ICTP Gallieno Denardo Award winners and other leading scientists from around the world, working in the area of Optics and Photonics. Our chief guest Prof. Niemela (ICTP, Italy), while inaugurating the workshop said that it an excellent platform to gather together talent from different parts of the world. He emphasized that science is international and naturally involves collaborations across diverse national boundaries, and so it was good to have so many scientists from different parts of the world together, sharing their knowledge.

The activity was designed to promote light sciences and applications within Pakistan's scientific community including students. The workshop structure allowed students and young researchers to meet and interact informally with the plenary speakers and other international participants. We were honored to have Prof. Joseph Niemela (ICTP, Italy), Prof.

Miguel Alonso (University of Rochester- USA), Prof. Ali-Reza Mouradi (University of Zanjan-Iran), Prof. Parviz Elahi (University of Bilkent- Turkey), Prof. Humberto Cabrera (Institute of Scientific Research, Venezuela).

A variety of topics were addressed in the workshop, including Classical Optics, Quantum Optics, Atom Optics, Nonlinear Optics, Optical Engineering, Fiber Optics, Optoelectronic Devices, Laser Spectroscopy, and Optical Imaging. In addition to the lectures, hands on activities were also conducted, covering a variety of topics, including the basics of optics, information processing, Fourier optics and laser spectroscopy.

International speakers, foreign participants with organizers at IWOP 2017

3. OPTICS FAIR AT DEPARTMENT OF PHYSICS QAU

Two days Optics Fair organized at the Department of Physics, Quaid-i-Azam University Islamabad, on 27th -28th April, 2018. The purpose of the Optics Fair was to celebrate International Day of Light 2018 in collaboration with SPIE. We received almost 250-300 students on the first day of fair and approximately 80-100 students on second day from different schools of twin cities, including 50-60 faculty members from these Institutes

Some participants of two days Optics Fair in connection with International day of light in 2018

4. OPTICS OUTREACH DURING 2019

After the cold period of winter, the month of March is a real spring season in Islamabad, as beautiful as it can in any other part of the world. The leafless trees start a new life cycle with fresh green, tiny leaves, fruit trees are full of blossoms and violet patches of wild flowers grow up in grass beds. Quaid-i-Azam University, situated at the foot of the Margalla Hills, shares this Spring season with the rest of Pakistan; its various plants show many shades of green from deep hues to lighter ones.

This beautiful and peaceful atmosphere, with its implicit hope for rebirth, brings a lot of energy to do something positive and useful for the people of Pakistan; in our case especially the young and talented female students in high schools and the university.
Unfortunately, while Nature was celebrating its annual passage from winter, it was a very tense time for mankind, especially at the Eastern border. Our airspace was closed repetitively during this time and the peace and tranquility was quite fragile. But we Pakistani as a nation, have learned over many such years that life must go on in it's own pace.
Inviting students from schools, which are far from Quaid-i-Azam University (QAU) appeared to be problematic at the time, so a decision was made to invite students from a government school located near QAU on the 13th of March (2019). The purpose of this activity was to celebrate the International Day of Light in collaboration with The Abdus Salam International center for Theoretical Physics (ICTP), Optica, SPIE, and the International Commission for Optics (ICO).

4.1 There Is Always A Light Around The Corner

The first activity had been designed to promote Optics, Photonics and its applications among students in Pakistani Government (public) schools. The intent was to allow students to understand, using their minds and their hands, the natural phenomena of light and to develop new perspectives on related natural processes. This particular activity was mainly focused on students of 7th, 8th standards. An opening lecture was delivered to students about the importance of light and optics in daily life just to get them oriented towards science and society at the beginning. The rest was lots of active learning to let them -if nothing else- enjoy a day of science without any barriers [5].

Group photo of participants with tutors and foreign delegates (13th March 2019)

Fun with diffractions glasses for all young and old

4.2 Hands On Optics For Girls In Remote Areas Of Khyber Pakhtunkhwa

The twin cities of Rawalpindi and Islamabad are always convenient for us, in terms of facilities, we also felt it was important to go where fewer other opportunities presented themselves to students. Specifically, we arranged a one-day

event “Hands on Optics for Girls”, in Mardan Women’s University on the 12th of April 2019. Mardan is a city in the Khyber Pakhtunkhwa Province of Pakistan, home to the Pakistani Nobel Peace Prize laureate Malala Yusufzi. Located in the Valley of Peshawar, Mardan is the second-largest city of Khyber Pakhtunkhwa, after the nearby city of Peshawar, and is known for the hospitality of it citizens. Mardan is also known for its archaeological importance, particularly because of the Buddhist stupas of Takht-e-Bhai.
It was our first Hands on optics activity in that region. Being a conservative part of Pakistan, female education is a challenge. We were expecting to have some variety of audience, from local girls’ school/colleges and of course undergraduate students from Mardan University. After spending whole day with beautiful young enthusiastic girls we left quite satisfied that we had made a difference.

Some of the participants from Mardan Women University (12th April 2019)

4.3 Illuminating Masses Including Laymens

As a third step to celebrate IDL we arranged a one day activity named “Illuminating Masses” at Department of Physics, Quaid-i-Azam University Islamabad, Pakistan on 29th April 2019 in connection with International Day of light 16th May 2019. We invited young female students of undergraduate level from a new emerging university “Rawalpindi Women University”. For this activity we used Photonic Explorer kits (courtesy of EPS Physics for Development Group), the Explore Optics Kit by SPIE and the Optics Suitcase from OSA. We had also arranged a special activity for Laymen to Sciences on the same day, which included clerical staff and security personnel from Quaid-i-Azam University in general and from the Department of Physics in particular.


Laymens, young girls and female participants along with their teachers and organizers.

In all, it was a successful Spring for many young women in Pakistan, a time to flourish in scientific discovery alongside Nature’s display of colors, and a brief moment in which to join others from around the world to experience joy and peace within the UNESCO International Day of Light.

5. IN PERSON OUTREACH DURING COVID -19

There is no doubt that 2020 has been one the most challenging years in recent memory for all of us; a year that will be marked in our lives. We faced difficulties and uncertainties and we did our best to face the situation. Despite the

challenging realities of 2020, some positive things also happened. We learn to have unity in the necessary things, respect freedom in doubtful things and to show solidarity in all things.
Countries around the world began closing their educational institutes in March 2020. For a developing country like Pakistan, with limited Internet facilities, going for online education was not an easy step. Reaching out to students virtually, especially those living in remote areas of Pakistan with no electricity at times and no connectivity most of the time, was the biggest challenge. It was difficult for students to take online classes and virtual laboratory sessions and it was almost impossible to do outreach in person activities. In the most challenging times, we find our strength, and Active Learning in Optics (ALO) group at Department of Physics Quaid-i-Azam is no exception.

5.1 Let The Light Always Be On

After the end of first lock-down in Pakistan, Active Learning in Optics (ALO) group found a narrow window of time and decided to make good use of it. Our group is among the ones, if not the only one, which did in-person outreach activity in October 2020, to celebrate the International Day of Light. One-day event was organized at The Swabi Women University, Swabi.

The Swabi Women University is newly established university with non-existent experimental facilities in the teaching laboratories. The city of Swabi is situated in Khyber Pakhtunkhwa (KPK), almost 100 Km from capital Islamabad. The event started with a presentation on importance of female education in Pakistan and especially in KPK. Then role of ordinary light, laser light, LED and light based technologies was explained to the students. Different optical experiments, including but not limited to, scattering, laws of geometrical optics, total internal reflection, polarization, optical fiber communications were performed with students. The Optics kits used were provided by Optica(OSA), SPIE and ICTP. A group of 45 undergraduate girl students attended this activity with full interest along with their Physics teachers, namely Dr. Ambreen Ayub, Dr. Shuja and Ms. Maria Tabraiz [6].

Swabi Women University, Khyber Pakhtunkhwa (KPK) Oct. 2020

6. OPTICS OUTREACH ACTIVITIES IN 2021

In many ways it is a relief to bid adieu to the upheaval of 2020. Nature does not follow any calendar, boundaries, democracy or monarchy and is not aware that we wish for better times. We hope that the experience of last year will leave us with the consciousness to be more respectful of nature and natural resources. Solidarity and open science are the most precious assets for humankind. As we flip the pages of the calendar to the New Year, we should recognize the opportunities before us. We started the New Year 2021 with lot of positive hope, hope to have access to vaccination, hope to have in person education, hope that life will be back to normal soon.

6.1 Optics For You: As You Matter

The first activity of IDL 2021 was organized at Islamabad Model College for Girls (IMCG), a public sector college, situated near Quaid-i-Azam University. This college among many other government schools/colleges that remained closed during 2020. In comparison to the private school students, government school's students were promoted to the next grade without examination as per government policy during pandemic. Students from public schools/colleges have

lost one year of learning. Most of these students belong to families living in suburbs of Islamabad, use public transport to reach school, have no internet at school, no smart phones at home to acquire knowledge [7].

A day full of learning cannot compensate the loss of one year of knowledge but a day full of fun with optics can bring joy for learning. Following the SOPs of Covid-19, we decided to start activities of 2021 with an in-person event for IMCG students. It is not so much about what the girls learned on that day, but rather that they had on that day a level of respect independent of their gender, independent of their social status. It also communicated to those bright-eyed, curious girls that they are important for us, their loss of knowledge matters to us.

Students of grade 10 at IMCG College on 10th Feb. 2021

At the end of fifth wave in November 2021 we decided to do hands on activities in December. Usually these time windows are short and uncertain, so we needed to move fast and did couple of activities, one after another. During first week of December 2021 we had managed to do two hands on activities, especially for under privileged girls' institutions.

6.2 Light On Girls' Education During Lockdowns

We organized and directed one day optics workshop for high school and college students at Sir Syed school and college Campus-IV, Wah Cantt, Pakistan on 3rd December 2021. This institute is a unique example of co-education, boys section is on ground floor of huge building, while girls section is on first floor. I asked why it is no other way around those girls on ground floor and boys on first floor. The answer was in this way they can keep them segregated in a better way.

We initially planned this activity for girl's section only but when we reached, their Principle requested us to accommodate boys at least for my presentation and demonstration of optical phenomena that we usually do on stage. Being an educator I cannot refuse it although I am always more inclined to girls' education than boys. When we entered auditorium it was full to its capacity with almost 150 female and 140 male students, eagerly waiting for this wonderful event. The session started with a lecture on importance of Light and Light based technologies, followed by demonstrations of some properties of ordinary light, LEDs and Laser lights. After this first part boys were needed to leave as school did not have enough space and we did not have enough kits to cater both genders. Before saying goodbyes, we made a promise with boys to visit again for them. The hands on session was consists of various optical experiments, based on refraction, reflection, diffraction and total internal reflection. They were performed with the help of kits provided by OPTICA, SPIE and ICTP.

Sir Syed school and college Campus-IV, Wah cantt. Dec. 2021

6.3 One Day Optics Outreach For Girls

The third workshop was organized on 7th December 2021 at International Islamic University, Islamabad (Girls campus) for undergraduate students. The girls campus of Islamic University lack teaching laboratories of Physics. Therefore they need to walk down to boy's section once per week to perform basic experiments of Physics, that is also not a straightforward arrangement, no boys are allowed near their laboratory on that particular day. The day we conducted this workshop was quite exciting and informative for the girls. The session started with a lecture on Importance of Female education in Basic Sciences, followed by a four hours long hands-on session with girls for experiments of light additive & subtractive colors, filters, polarizers, reflection laws, scattering, converging & diverging lenses. Then time for all of us simply flies and soon we needed to say goodbyes, promises of visiting again were made. On our way back we were taken to a research laboratory and it was surprising to see huge setups of very sophisticated research laboratory on the same campus where there is no teaching laboratory for girls. Again I had no answer to my simple question "Why?".

International Islamic University Islamabad, Female Campus 7th Dec. 2021

The year of 2022 comes with different set of challenges for strangling economies of countries like Pakistan. For Active Learning in Optics (ALO) group, the start of 2022 brings many positive hopes of doing outreach activities uninterrupted. We visited various public sector universities; colleges and schools for outreach Optics activities.

Now as this year is ended we can say it was productive year for us and for students we catered. In first half of this year our first visit was for a newly established university called University of WAH (2nd April2022), Department of Physics. It has total strength of 350 students. The program started with the lecture of light and light-based technologies. Later using Optics kits, we performed different experiments including diffraction, scattering, geometrical laws of Optics, total internal reflection and fiber Optics etc. It was very satisfying experience for us.

Female participants of Department of Physics University of Wah

Male participants of Department of Physics, University of Wah (2nd April 2022)

Then second activity was in a private school named Head-start that is never in our priority list of optics activities. Most of these schools opt for Alternate to Practical (ATP), a theoretical course instead of laboratory but again being educator we cannot ignore students that need our help, knowledge is still their right. We hope students had learn something in one-day activity at least they touched some optical elements and see some optical phenomena first time in their course of studies.

A- and O-level students from Head-start school (6th April 2022)

We would like to mention about our third activity that is very close to my heart. The school we visited on 25th of April is located in a sector that belongs to middle salaried class. Usually in Asian culture, middle class families have many children. One needs to fight for almost everything with your siblings, sometimes even for love. For this hands on Optics

activity we had 73 girls students from grade 4/5. We carried ten Explore Optics Kits by SPIE, so ten reflectors and almost 70 girls. Their effort to hold one and do not let it go till the virtual image of clown is done neatly. They were happy after the activity and what a rewarding day we had. Would like to add one photo that is the reflection of their determination and strong will to learn. Our future is bright if we let these girls to SHINE.

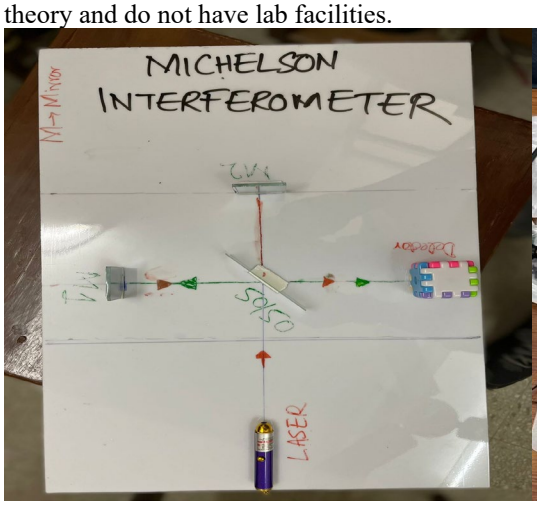
Group photo of young girls of IMCG I-9/4 April 2022

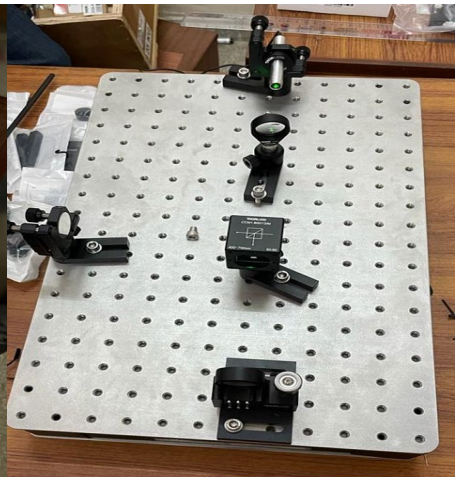
Enthusiastic young girls from IMCG I-9/4

Transition from Toys to Thorlabs (16th -20th May 2022)

In Feb. 2020 Winter College on Optics was last in person activity that took place at ICTP before COVID lock-down. Then ICTP went into silent mode for a long period. Slowly online activities started and first virtual ICTP College on Optics took place from 16th - 20th May 2022, in connection with international Day of Light. The topic was Theory and Applications of LIDAR. The hands on sessions are always very important part of Preparatory School to Winter College on Optics, but for online activity it was not possible. For ALO hands on activities, we planned to make models to describe working principle of LIDAR. We made models of Michelson, Mach-Zehnder and Sagnac Interferometer and two models of Ring-laser and Fiber-Optics Gyros. Our students got an idea how they work but were not able to play with these models made of toys. At this point in time ICO president John Howell made an entry and feel sorry for my students and me. He very kindly offered me whole bunch of equipment to make interferometers, LIDAR. Unfortunately he was not able to send me these equipments from Israel to Pakistan. He came up with many ideas to get support for my students and me. Finally with his sincere efforts we managed to have meeting with Thorlabs representative, Jamie LaCouture. She very kindly agreed to send me two educational kits from their office in Germany and put me in touch with Francesco Zingariello, Sales Team leader. He proved to be very kind and positive person. He supported me all the

way from Germany Sales office to Quaid-i-Azam University. Now I am proud to have two educational kits for my students and a very good friend Francesco. These two kits are most advance equipment for our outreach activities. They will help our under-graduate and even graduate students to see and understand physical effects of experiments.
With addition of these kits, we can now organize some advance workshops on Optics. As these kits are easily fit in car trunk we are planning to take to newly established women universities in remote areas of Pakistan, where they only read theory and do not have lab facilities.





7. OPTICS OUTREACH ACTIVITIES IN 2023

In early 2022, Pakistan witnessed a rapid deterioration in its economic condition. Throughout the past year, the nation has grappled with a mounting balance of payment crisis, marked by depleting foreign reserves, ballooning debt, and record-breaking inflation levels. By the first half of 2023, Pakistan found itself on the brink of a potentially catastrophic economic default. At a critical juncture, the country's reserves could only cover approximately two weeks' worth of imports, owing to the concurrent pressure of debt repayments. In a desperate bid to avert default, the government implemented stringent import restrictions to gain control over dollar outflows. Consequently, the local currency's value plummeted to an all-time low, with a scarcity of foreign currency both in the open market and within banking channels. This scarcity even extended to essential transactions, such as sending funds abroad for purposes like supporting children studying overseas.

The impact of the economic downturn hit the middle-income class particularly hard, affecting many students from modest backgrounds at Quaid-i-Azam University, a public sector institution that draws students from across Pakistan. Many of these students had been actively involved in my outreach initiatives, and often volunteer to help me prepare and on the day.

The Active Learning in Optics (ALO) Group had historically relied on self-funding for most endeavors. On any outreach activity day, I need to leave home early to pick up my team of volunteers. The pickup points vary, ranging from Quaid-i-Azam University, which is 30 km away from my home, to volunteers taking Uber from their homes to a designated meeting point. Once assembled, we load into my car and head towards our destination. However, due to the recent economic crisis, rising fuel prices, and my retirement from my university position, financial constraints posed significant limitations on the scale and scope of my outreach initiatives. Additionally, it has made it harder for my students to help me conduct activities in far off locations and remote areas.

7.1 SPIE Outreach Grant 2023: A bail out from Economic Crisis in Pakistan

As we were limited in our reach and resources, we commenced 2023 with two planned outreach programs at "The Black Hole" catering to different age groups in Islamabad [8]. In early March 2023, a ray of hope emerged with the approval of the SPIE Outreach grant. This support proved to be a blessing, enabling the ALO Group to plan more activities and travel to the remote areas of Khyber Pakhtunkhwa (KPK). As we approach the end of 2023, we can proudly reflect on a

highly successful year for the ALO Group, having conducted a total of 10 outreach activities, including four in the remote areas of KPK. The SPIE Outreach grant played a pivotal role in overcoming financial constraints and facilitating impactful educational initiatives, marking a positive turn for the ALO Group in a challenging economic climate [9].

7.2 Optics outreach 2023: At a Glance

S.No	Date	No. of Participants	Venue	Facilitators	Volunteers
1	03-01-2023	25	Quaid-i-Azam University School	Dr. Imrana	Masad Qayyum
2	05-01-2023	25	Quaid-i-Azam University School	Dr. Imrana	Masad Qayyum
3	16-05-2023	200	Phy. Depart. Quaid-i-Azam University	Dr. Imrana	Masad Qayyum
4	18-05-2023	300	International Islamic University Islamabad	Dr. Imrana	Masad Qayyum Osama bin Ijaz M. Ayaaz
5	22-05-2023	250	Fatima Jinnah Women's University	Dr. Imrana	Masad Qayyum Osama bin Ijaz M. Ayaaz
6	25-05-2023	150	Rawalpindi Women's University	Dr. Imrana	Masad Qayyum Osama bin Ijaz M. Ayaaz
7	13-09-2023	300	Mardan Women's University	Dr. Imrana Dr. Raheel Ali	Masad Qayyum Osama bin Ijaz M. Ayaaz
8	27-09-2023	300	Swabi Women's University	Dr. Imrana	Masad Qayyum
9	01-12-2023	350	Quaid-i-Azam University	Dr. Imrana Dr. Raheel Ali	Masad Qayyum Nimra Gazanfer M. Sami Shahid
10	08-12-2023	250	University of Swat	Dr. Imrana Dr. M. Zahid	Masad Qayyum Sanwal Farooq

8. Optics outreach in 2024 so far…

Active learning in optics group has already managed five outreach activities, in connection with IDL in first half of 2024. We are resuming our activities after summer break in September. These activities were conducted in following institutions on these days:

Optics Fair 16 May

Rawalpindi Women University-10th May

Quaid-i-Azam University- 15th May

Fatima Jinah Women Uni. 8 March

International Islamic University 7th May

9.CONCLUSION

In past nine months we have learned that the active learning environment provides a very friendly atmosphere (potentially different from their normal class experience), where students are encouraged to ask questions (also potentially different!) and make predictions about the possible outcomes of an experiment based on a carefully chosen set of observations, rather than going into mathematical equations. During the process they are encouraged to interact with their fellow students as well as their facilitators. Unheard of! Speaking of light: their smiles, their laughter, the glow in their eyes reminded me of exactly that: a light as beautiful as any rainbow, or reflection from a pool.
If I seem overly poetic about the experiences of these girls it is because I have been affected as well. Being a woman, being a daughter and later a daughter- in law, being a wife, being a mother of young girl and also knowing the realities how female children have been treated in remote areas of my beautiful country makes me want to do so much more, especially in those areas where having an uneducated male heir is a greater source of pride to a mother than a daughter with an advanced degree. Maybe it is not so much about what the girls learned on any particular day, but rather that they had on that day their own voice, a level of respect independent of their gender, and the chance perhaps to just have fun and follow the path where their natural curiosity took them.

Therefore, I slip back into poetry: for me, these young Pakistani girls really do embody light and their faces transmit a positive energy that says clearly: We are your future, take care of us and we will take care of you, as good citizens, mothers, teachers, and as productive members of an enlightened society, where culture and traditions do not have to be in conflict with the realization of the potential of young girls.

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