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We are The Champions

TISP Canada volunteers share their passion for helping teachers deliver pre-university science and engineering education

It could be a scene in any middle-school science class. Scissors, electrical wire, various-sized dowels and an assortment of Styrofoam plates and cups carpet the desks. Spying a few quizzical looks, the teacher makes a beeline over and offers a suggestion, then heeds another summons across the room to help with the voltmeter. Smiles break out as the reading stabilizes.

Except that, it's not a middle-school science class. And the "students" are actually science teachers themselves, learning the ABCs of a wind turbine lesson plan at a workshop organized by IEEE Ottawa Section's Janet Davis, as part of the Canada Science and Technology Museum's second annual Summer Institute for Elementary Teachers. Welcome to one arm of IEEE Canada's Teacher In-Service Program (TISP)—a multi-section initiative boasting as many different activities as there are wind turbine designs.

From Victoria to Newfoundland, IEEE Section TISP volunteers share their expertise to promote pre-university science and technology education. In some instances, it's a teacher workshop such as the one described above in Ottawa last July. Other volunteers go directly into classrooms and supervise a "hands on" design activity. Weekly clubs at local schools are another way volunteers — also known as TISP Champions—engage students in math programs, or progressively teach the fundamentals of computer programming. Champions have co-developed four- and five-day teacher workshops on robotics, and captured the imagination of the next generation of space researchers with the launch of high-altitude balloons.

What inspires a TISP Champion? For Vancouver Section's Steven McClain, it's the feedback from students, particularly when they start to take the initiative on a project. "You steer them towards topics and give them some guidance," explains McClain, a support engineer with Cadex Electronics Inc. "Then through the miracle of Google and what-have-you, they start feeding it back to you, and say 'Well, we did such-and-such for a while and it was great. But, now what happens if we try this?'"

For fellow Vancouver Section TISP Champion Tanaya Guha, it's a passion for increasing the standard of science and engineering education. "If we can interest high school students at an earlier age, chances are they will become more successful engineers and scientists. This is the best way to increase the pool of talent in the field." On track to complete her PhD this spring at UBC, Guha gained an interesting insight through presentations at Vancouver's University Hill Secondary School—students' surprisingly narrow perception of modern engineers' work. "Many of them thought all engineers did was design bridges and put up buildings. Biomedical, software engineering, hardware design ... they had no idea these were career options for engineers."

A goal for both McClain and Guha is to reach more teachers, as important as it is to connect with students through classroom visits. Easier said than done. While it requires many phone calls and e-mails to schedule a classroom visit, it can take *dozens* of calls and e-mails to organize a teacher workshop. But Section TISP volunteers, like wind turbines, connect to an infrastructure—in this case the TISP Canada Committee. Headed by Montreal Section's Anader Benyamin-Seeyar, a telecom industry consultant with 40 years of industry and academic experience, the TISP Canada Committee brings together veterans of two nationally-organized teacher workshops and numerous local offerings. The Committee meets roughly every month by TeleConference, giving a forum for Champions from roughly a dozen Sections to report on past and upcoming local activities, and plan major events such as workshops. With the support of Educational Outreach staff at IEEE Headquarters, the Committee is helping Vancouver Section plan a teacher workshop in 2013, in cooperation with Seattle Section.

The 2013 Vancouver TISP workshop will bring together local teachers from the Seattle and Vancouver areas, plus TISP Champions from across Canada. Rolling their sleeves up, teachers will test drive two "tried and true" lesson plans designed to stimulate student interest in the opportunities open to engineers and scientists. For IEEE members, the learning is on a different level at these workshops. Between offering bits of advice

on matters such as the whens and hows of the western union splice, they hear first-hand about science/technology teachers' challenges.

"The Mississauga TISP workshop in 2011 was a turning point for me," says Kingston Section Champion Umar Iqbal, who teaches at Queen's University. "It was very motivating." With no prior experience with TISP, a somewhat hesitant Iqbal was persuaded by Section Chair Shahram Yousefi to accompany him to the event, held in late April. That fall, Iqbal and fellow TISP Champion Basel Nabulsi began joint planning with R.G Sinclair Public School for an afterschool robotics club. The first meeting was held early in the new year, running until June 2012. The club would have continued this fall, but has been put on hold pending completion of protracted contract negotiations between the Ontario government and the Province's teachers. TISP Champions who attended Canada's first national workshop in Montreal in 2009 similarly report how the experience inspired them to become involved.

"Western area members interested in attending in Vancouver should contact me right away," encourages Benyamin-Seeyar. "Some of our veteran Champions from the east will be returning to lend a hand, but we're primarily interested in linking teachers with IEEE volunteers from the Prairies, BC and Washington state."

While the nationally-organized workshops help forge initial linkages with teachers, most of the local workshops organized with school boards grow out of progressively strengthened relationships with teachers and principals. The experience of Northern Canada Section (NCS) TISP Champions Mooney Sherman and Rossitza Marinova is a case in point. Now an IT security consultant, Sherman had a previous career as a Montessori teacher. Marinova teaches at Concordia University College of Alberta in the Department of Mathematical and Computing Sciences. In the fall of 2011, Sherman, Marinova and three other NCS members were invited to oversee student design sessions as part of an all-day Science Technology Engineering/Environment and Mathematics (STEM) Conference for boys at St. James Elementary School in Edmonton, part of the Edmonton Catholic School Board. The design challenge? A candy bag able to withstand the rigours of a shipping and unintended free-fall, but still economical enough to keep the precious contents within the purchasing power of the "end user." As can be expected, the sessions were well received!

Building on the success of the 2011 All Boys STEM Conference, and ongoing classroom presentations throughout 2012, Sherman and Marinova doubled the number of sessions offered at this fall's Conference. The design challenges this time were a wind turbine and a rubber band race car, the latter taking the checkered flag for popularity. All of these efforts are paying off. "The Principal and Vice-Principal say teachers have already observed changes in the children's reactions," Sherman reports. "They are more engaged, so material can be taught at a higher level. It's a domino effect." Most significantly, the Board science consultant is working to include TISP in a Professional Development day in the New Year, paving the way for broader student impact, says Sherman.

But what if there are no science/technology PD days? Travel four time zones east, and Brian Kidney, TISP Champion from Newfoundland and Labrador Section, faces a much different educational outreach landscape. For three or four years, Kidney and a small but enthusiastic group of other Section volunteers have made steady inroads into schools and school boards — judging at science fairs being one of the arterials. Through a serendipitous introduction at a charity ball, a local high school teacher named Paul King joined them, helping the group navigate their way to regional school district officials. The signs looked promising until it became apparent there were no open PD days where teachers could attend a session of their choice, there are only district-wide closures for cross-curriculum presentations. Undaunted, the group hopes to arrange a session for teachers in August at Memorial University in St. John's.

Kidney, a research and project engineer at Memorial University, is quick to point out the benefits of a teacher joining the Committee. In particular, he cites the difference between lesson plan exercises at a teacher work-



by Bruce Van-Lane

shop versus classroom delivery. “At the Mississauga workshop, the groups spent maybe 45 minutes on the wind turbine design,” he notes. “Paul teaches it over four classes.” In the last, each straw and coffee filter in the kit is assigned an economic value, with the goal of maximum performance for the least cost. “It’s a real world approach, which works particularly well for high school students,” says Kidney.

It is this emphasis on design that sets TISP apart from other classroom resources, says London Section TISP Champion Murray MacDonald. “Teachers know the scientific method: observe, generate a hypothesis, conduct an experiment to test it, that approach . . .,” MacDonald explains. “If you want to become a scientist, that’s fine. But if your goal is to be an engineer, you’re going to need some exposure to the concept of design.” Not that MacDonald, an electrical/electronic manufacturing consultant, is averse to helping teachers with the pure science part. That need can be particularly acute at the primary school level, he says. “I’ve seen Grade 5 and 6 English teachers struggling to deliver the science curriculum—those teachers are desperate for any kind of help we can provide.”

MacDonald echoes Brian Kidney’s respect for teachers’ classroom expertise. He recalls a mildly perplexing experience delivering the previously described “Candy Bag” design lesson to two consecutive classes—with dramatically different results. The first spent relatively little time recording their ideas on paper, without seeming to connect them much to the upcoming task—then “jumped right into building.” The second spent a lot of time on the paper design—even asking MacDonald to review it—before proceeding to execute. In discussion later with the teacher about the two classes’ contrasting approaches, MacDonald wondered what accounted for the difference. Had he just managed the second group better, having just seen the first largely skirt the design task? The teacher had a different take. “There will be some students that are the natural leaders,” MacDonald recalls the explanation proffered. “Their style will tend to dictate how the whole group operates.” MacDonald’s insights from this and other similar classroom experiences? “Engineers have to follow the teachers’ lead in figuring out how to deliver lesson plans. That’s what teachers do for a living. And engineers don’t.”

No argument here from Ottawa’s Janet Davis, engineering manager with Wind River. In fact, the Section has three teachers on its TISP committee. Paralleling the recruitment of teacher Paul King in Newfoundland, a personal connection played a role in bringing the trio onboard—a Committee member’s child attended Ottawa’s All Saints Catholic High School, which has a strong robotics club, thanks in part to ongoing support from the IEEE Canadian Foundation. A bit of parent volunteering brought an opportunity to meet the club’s teacher mentor, Paul McDonough. Through McDonough, two other Ottawa-area teachers became converts: Ross Morrison from Longfields Davidson Heights Secondary School and Richard Seniuk from Glebe Collegiate Institute (also an IEEE Canadian Foundation grant recipient). It was actually McDonough, Morrison and Seniuk together with Davis providing the encouragement/support at the Summer Institute for Elementary Teachers session. “We have teachers helping teachers,” says Davis. Morrison also brought a few wind turbines his high school students had constructed, which was particularly motivating for attendees. “They were really surprised at the level of sophistication of the designs, especially from scrap materials,” Davis says.

For Anis Haque, Southern Alberta Section TISP Champion, teacher input prior to classroom visits is every bit as vital, notwithstanding he faces students himself from the front of lecture halls at the University of Calgary. “It’s totally different teaching elementary school students—keeping their concentration, finding content they’re interested in, those kinds of things.” Haque requests feedback from the teacher for every classroom session he gives, modifying the program as he goes along. Where possible, he’ll try to meet with the teacher beforehand to exchange ideas about what will work best with his/her particular class(es). Keen to make the most amount of difference in his outreach, Haque frequent targets schools 25-40 km outside of Calgary, locating them through Google maps, then looking at individual school profiles.

“There are other organizations that can offer enrichment in the city,” Haque explains. “I like to go into schools where the students wouldn’t otherwise have these opportunities.”

Preferring to teach primarily first-year engineering courses, Haque sees the results when students enter the program without adequate knowledge of the field or adequate preparation, at times complaining they simply don’t like the subject matter. “Today’s elementary school children, they will be coming to my classroom,” he observes. I want future science and engineering students to come with true passion. That’s my objective.”

NCS’s Rossitza Marinova also works with undergraduate students in the IT and Computer Science courses she teaches at Concordia University College. A founder of the Canadian Math Kangaroo Contest in 2006, in 2010 she started a weekly Math Kangaroo Club in Edmonton that offers five levels of exercises/quizzes for participants ranging from Grade 1 to Grade 9. Born and educated in Bulgaria, Marinova believes math and science competitions are neglected in Canada as motivating tools for awakening and developing curiosity. “I’ve often been asked whether a competitive environment is actually good for children. But everyone appreciates sports competitions,” Marinova quips. “For those that do well in math and not in sports, why shouldn’t they be given a chance to shine?” A long-term goal of hers is to offer some parts of the program on-line.

Umar Iqbal in Kingston can definitely see the difference enrichment makes when students enter the robotics and applied science classes he teaches at Queen’s University—some being far ahead of their peers. “When students come to university with background knowledge and excitement they are very easy to teach,” says Iqbal. The additional exposure seems to have been usually at the high school level, a situation he’d like to remedy. “If we start motivating children at a very early age, we can avoid them being confused later on when they choose a career.” Certainly Iqbal and his TISP colleague Basel Nabulsi have opened up more than a few young minds. Upon asking one of his afterschool club members about what her future career might be, the response was “I had different plans, but now I want to be a robotics engineer!” Iqbal and Nabulsi hope to enlarge the number of schools they reach through a future two- to three-day student workshop that would be held at Queen’s University. A small number of students from each school would be invited along with one or two teachers, who can then share material with other teachers from their schools.

Dave Hepburn from Hamilton Section and instrumentation consultant Patrick Finnigan from Toronto Section are TISP Champions who have pioneered another way to deliver teacher workshops—through science teachers associations. For the last half-dozen years they’ve presented a lesson plan at the annual Science Teachers’ Association of Ontario (STAO) annual conference. At last month’s event they were a marquee attraction, drawing 25 teachers into “winding” their way through the “Build a Transformer” lesson plan Hepburn has created. Fully bilingual, Hepburn had barely unpacked his suitcase from Quebec’s annual counterpart conference, organized by l’Association pour l’enseignement de la science et de la technologie au Québec (APSQ). It was here the switch was first publicly thrown on the transformer lesson plan. “With 16 participants, they found at least 17 wrong ways of building it,” recalls Hepburn. “But that was OK,” he reassures us. “Firstly, you learn more from your mistakes. It also resulted in a good deal of hilarity and bonhomie all around.” Be sure to read the full account of both events’ activities in the upcoming February 2013 issue of the *TISP Canada Courier*, whose Editor-in-Chief is Canadian Atlantic Section TISP Champion Dirk Werle of AERDE Environmental Consulting. Werle, whose graphic design skills and sparkling turn-of-phrase make each issue a delight to read, is backed by Associate Editors Dave Hepburn and Murray MacDonald.

Are there other equally dedicated Champions? Most definitely! You can meet them all by browsing back issues of the *Courier*. They, and TISP Canada contact information, can be found at <http://www.ieee.ca/tisp>.

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