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Case Report Open Access

A Canadian Medical School in Partnership with an Inner City School Division and Community Organization to Promote Interest in Science to Aboriginal and Disadvantaged Youth: Plugging the First Leakage in the Medical Pipeline

Francis M Amara*

Biomedical Youth Program and Inner City Science Centre, University of Manitoba, Canada

Abstract

The Biomedical Youth Program and the Inner City Science Centre are the main components of a partnership between the Faculty of Medicine, University of Manitoba, Winnipeg School Division, and the Winnipeg Foundation. This partnership serves the inner city elementary schools that have a predominant population of aboriginal youth. It aims to promote diversity in health professions education, which have underrepresentation of aboriginal and inner city youth. Although aboriginal people represent 4% of the Canadian population, they make up less than 0.25% of the physician workforce. The partnership has three main goals: to provide professional development for teachers; mentor students to build their knowledge, motivation, and confidence in science; and to promote teachers', students', and parents' interests and excitement in the sciences and health professions careers. The partnership's activities include workshops for teachers to teach science from a lecture-based format into a problem-based curriculum and to develop their leadership skills in order to positively influence science education. Since 2006 approximately 4035 elementary pupils, of whom 43% are aboriginal, have participated in the activities. Evaluations provide evidence of the activities' effectiveness in promoting teachers' and students' interest in science and the health professions, and significant gain in students' achievements. 75% of the aboriginal participants are now in high schools, and 46% of them have gone on to participate in science fairs, with a success rate of 37% medal awards. 27% of the teachers have been recognized as science consultants, and appointed as site facilitators. These facilitators are now providing workshops for other teachers. Thus, enhancing science education early on in elementary school rather than in high school is likely to stop the leakage in the medical pipeline.

Keywords: Outreach; Aboriginal; Disadvantaged; Inner city; Youth; Medical pipeline

Introduction

In Canada the health of the aboriginal people (First Nations, Métis, and Inuit) is severely affected [1,2]. Aboriginal people make up approximately 4% of the Canadian population but represent less than 0.25% of the physicians [3,4]. Canada needs 2000 Aboriginal physicians; however in 2007 there were 200 Aboriginal physicians [5]. In 2008 the Indigenous Physicians Association of Canada (IPAC) and the Association of Faculties of Medicine of Canada (AFMC) recommended to help in increasing the enrollment and retention of Aboriginal students entering medicine [5,6]. This recommendation was also prescribed in the Future of Medical Education in Canada Collective Report [7]. Increasing enrollment of Aboriginal medical students is still a daunting task. For example, the University of Alberta, has only trained 73 Aboriginal doctors in 23 years (1988-2011) [8]. Canadian medical schools should pay attention to the unsuccessful and successful health professions partnerships in the United States of America [9].

The underrepresentation of Aboriginal students in education cannot be disassociated from socioeconomic status, racism, and colonization [10-12]. All of these factors impact on the adverse educational outcomes for Aboriginal youth [12-14]. The achievement gap in science between non-Aboriginal and Aboriginal children begins in elementary school [12]. Most on-reserve and remote Aboriginal schools lack adequate science budgets, access to science enrichment activities and career counseling services [12]. These problems are exacerbated by the mismatch between Aboriginal and Western science world-views [14], the lack of integrating indigenous knowledge into curricula, and connecting with Aboriginal communities [13]. In addition, there are very few professional development opportunities for teachers, especially elementary teachers [15-17]. In this article, we describe a partnership between the Winnipeg School Division One (WSD1), Faculty of Medicine of the University of Manitoba (FMUM), and the Winnipeg Foundation (WpgFdn). This Partnership provides programs and opportunities for teachers, pupils, and parents to learn and be excited about science and health careers.

Partnership's History

The Partnership was established in September 2006 to reverse the trend in underrepresentation of Aboriginal students in medicine. Manitoba has one of the highest proportions of Aboriginal people. In 2006, Aboriginal people living in Manitoba represented 15% of the provincial population and 10% of Manitoba's largest city [16]. Further, Aboriginal youth in Winnipeg are less likely to attend school than non-Aboriginal youth (58% vs. 66%) [18]. The idea for the partnership originated from a consultative meeting organized by Dr. Francis Amara (FMUM) and Ms. Myra Laramee (WSD1) in 2006. This

***Corresponding author:** Dr. Francis M. Amara, Ph.D., M.Ed. Department of Biochemistry and Medical Genetics, Room 336-Basic Medical Sciences Building, 745 Bannatyne Avenue, Winnipeg, Manitoba R3E 0W3, Canada, Tel: (204) 789-3580; Fax: (204) 789-3900; E-mail: amara@cc.umanitoba.ca

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meeting was supported by the Aboriginal Human Health Resource Initiative (AHHRI) and hosted by the Centre for Aboriginal Health Education (CAHE). The meeting brought stakeholders together to discuss how to effectively engage Aboriginal youth in science education and health careers. In response to the consensus that emerged from the meeting, the FMUM, WSD1, and WpgFdn provided funding support that led to the creation of the Biomedical Youth Program and the Inner City Science Centre (ICSC) Partnership [19]. This Partnership (BYP and ICSC) was mandated to promote science outreach activities to Manitoba's youth, specifically targeting Aboriginal and disadvantaged inner city youth.

Description of the Partners

The three main organizations that are working together to make the Partnership happen are the FMUM, WSD1, and WpgFdn. These collaborators have institutionalized the Partnership.

The faculty of medicine of the University of Manitoba (FMUM)

The University of Manitoba (UM), which is western Canada's first university founded in 1877, has an enrollment of over 26,000 students. In 2012, the UM has 2021 Aboriginal students, 32 faculty members and 210 employees as self-identified Aboriginal. The FMUM admitted 110 students in the Class of 2016, of those students 4 are Aboriginal. In recognizing the severe underrepresentation of Aboriginal students, the UM is committed to indigenous achievement. The UM supports several Aboriginal programs including the Pathways to Indigenous Achievement Strategic Planning, appointment of Executive Lead Indigenous Achievement, and the development of Aboriginal-academic units within the Department of Community Health Sciences: Section of First Nations, Métis, and Inuit Health, Manitoba First Nations for Aboriginal Health Research, J.A. Hildes Northern Medical Unit, and Centre for Aboriginal Health Education [20]. The FMUM provides the bulk of the funding for equipment, and administrative and support staff for the Partnership's programs

Winnipeg school division one (WSD1)

The WSD1 is the largest and most diverse school division in Manitoba with 32, 000 students. It is divided into four school districts, including the Inner City District (ICD). As partnerships work best with a defined population of students and teachers for extended exposures in individual school districts [9], therefore this Partnership focuses mainly on elementary teachers and pupils of the ICD. The ICD schools are located in Winnipeg's inner city core area, commonly known as the North End. The FMUM is located in the North End; and the ICSC is located in the ICD at Niji Mahkwa elementary school. The majority of the students in the 21 schools of the ICD are Aboriginal (33%) [21]. The North End has a diverse neighborhood of about 68,000 residents, half of which leaves below the national poverty line. There are about 41,345 Aboriginal, 15, 789 Caucasian and the rest visible minority (11,567) [18,22]. The North End has a long history of city violence, damages to done to families and cultures, and a disproportionate number of unemployed youth and those not attending schools [22]. Strong leadership from the WSD1 and ICD, and unwavering support from community organizations is seen process of rebuilding to meet the educational and social challenges [23]. The WSD1 covers the costs for the maintenance of the ICSC, and support for the professional development of teachers.

The Winnipeg foundation (WpgFdn)

The WpgFdn, which is a nonprofit community-based organization, is Winnipeg's first community foundation that seeks to connect donors with opportunities to fund causes that they care about. This foundation also identifies and responds to the changing needs of communities, especially the North End community in Winnipeg [24]. The foundation provides financial support, including community grants for educational scholarships, small business, recreational, literacy for life, and nourishing programs. It is committed to the Partnership by providing financial support for equipment, infrastructure, and operating budget for the BYP and ICSC through its Centennial Neighborhood Initiative. This initiative aims to use education to get inner city kids from life of poverty. Also, the foundation has also established an endowment fund on behalf of Friends of the Inner City Science Centre (FICSC) to ensure future financial security for the Partnership's programs.

Description of the Components of the Partnership

The biomedical youth program (BYP)

The activities and projects of the Partnership are coordinated through the BYP for all participants, including teachers, students, parents, and volunteers. Now in its sixth year, the BYP continues to be a catalyst for the FMUM to encourage and motivate disadvantaged youth to be interested and excited about science and health careers. The activities are based on best practices of: science enrichment programs, career awareness and motivation, hands-on experiments, mentorships, science camps, exploration and discovery days, laboratory tours and after-school science clubs (science buddies), career counseling and exhibition, scientist-in the classroom forum, professional development workshops and research apprenticeship for teachers, and service learning opportunities [25-28]. Since parental involvement in partnerships are important for their success [29], the BYP encourages parental and community participation.

The inner city science centre (ICSC)

The ICSC is the hub for the activities and projects of the BYP are delivered. It is located in Niji Mahkwa School, which is an inner city elementary school. At the ICSC there are 3 state of the art laboratories, namely the Biotechnology, Physics and Imaging, and Chemical Sciences facilities. The ICSC can meet the demands of any K-12 science curriculum and also Masters Degree level courses in Biology, Biochemistry and Molecular Genetics. Each laboratory can accommodate a maximum of 20 students. The laboratories are fitted with audio-visual and wireless-internet facilities, and are opened for 12 hours a day, and are available during weekdays, and even on weekends. Typically, the ICSC can accommodate 300 participants per week. The ICSC was developed taken into consideration the model of the now successful City-Labs, which was first developed at Boston University and duplicated in other cities across the United States of America [30]. However, unlike the City-Labs that are located on university campuses, the ICSC is located in the community where it is needed most. The ICSC is the first in Canada; hopefully every Canadian city or medical school can support the establishment of an ICSC in an impoverished community. All the activities conducted at the ICSC are free of charge, which makes it easily accessible.

Key Partnership Activities

The five main activities that help show the successful ingredients of the Partnerships are briefly described below as in table 1.

Professional development of teachers: learning and leading

The Partnership recognizes that direct route to children is a teacher. Teachers are vital to the success of our vision because they

Programs	Activities	Activity Descriptions
Professional Development Workshops for Teachers	Learning science knowledge and laboratory skills, leadership skills, and personal enhancement strategies	Application of problem-based learning approach to teaching, acquire technical and laboratory skills, provide leadership to influence science curriculum and policy, and enhance personal effectiveness. Establish collaboration with scientist and the life science and health industries
Science Buddies	After-School Science Clubs	Provides tutoring and mentoring in science projects. Engaging with visiting scientists, collaborative learning, poster preparation, scientific presentation, and to acquire new technical and laboratory skills.
Health Career Quest	Exploration and Discovery Days about Careers	Career counseling, exhibitions and information on the admission process on different health professions and science-related careers. Workshops, guided laboratory tours, job shadowing, and internships, and laboratory experience
Biomedical Youth Summer Camp	Summer experiential and research opportunities	Summer research opportunities, hands-on activities, acquire new knowledge, exposure to diverse careers in medical research. Laboratory experience through placements.
Friends of the Inner City Science Centre Inc.	Community connections, active participation, and financial support	Recruiting volunteers, fundraising events, social events to connect with the university. Provides parental involvement information, encourages and support parents and families to attend science nights and science fairs. Sponsor workshops and seminars on careers and public health issues for parents and families.

Table 1: The Biomedical Youth Program and Inner City Science Centre: Programs and Activities.

significantly spend more time with pupils and influence their learning and success. However for teachers to do so, they must be provided with opportunities for professional development so that they can be motivated and confident to learn and apply the best teaching practices. To address this concern, during the academic year, selected teachers attend on average 10 days of professional development workshops at the ICSC on a variety of topics, including problem-based learning approach, hands-on activities, seminars, and personal development and leadership skills. These workshops are facilitated by science education specialists and consultants, scientists, biotechnology and life science industry executives, and invited speakers from business and commerce industries. The teachers are generally recruited through an application process administered by their schools and Manitoba Department of Education, which provide funds to cover the costs of hiring substitute teachers.

Science buddies

Science buddies are after-school science clubs during the academic year, specifically targeting elementary Aboriginal and inner city kids (non-Aboriginal), to engage them in creative thinking and problem solving. This is accomplished through hands-on science projects on how to maintain a healthy human body. Each club is composed of 5 participants with a mentor-supervisor. Typically, the clubs start their activities at 4:30-6:30 P.M., once every week for 6 months. The clubs focus mainly on elementary students (grade 1 through to 6) and offer them the chance to generate a vision of positive change in their community by studying themes of heart, lung, brain, skeletal system, and public health. In addition, other activities include audio-visual displays, performing art, reflections in science as art, visiting scientist speaking engagement, and group discussions on public health issues. Students are engaged in these activities with the aim of making it fun and to enhance the Manitoba science curriculum. The Science Buddies link health professionals, medical and science graduates to the kids as role models, and to connect them with the neighborhood community. This provides the FMUM students with service learning and co-curricular opportunities. BYP staff work with ICD school administrators to process applications. Printed applications are taken to schools for distribution to applicants. The only requirement is that pupils who are interested in the sciences and health professions are eligible to apply. However, applicants must be from low income homes.

Health career quest

Throughout summer, elementary pupils from inner city schools are invited to the health sciences campus for the "Discovery Days in Health Sciences", where they explore, and discover about, the diverse professions in the healthcare system. The presence on campus usually last for about 6 hours. Health professionals, scientists, technicians, admission officers, and students from the Faculty of Medicine and Health Profession Schools are recruited as volunteers to participate and to:

- Share their experiences on being a member or student of a particular healthcare profession, or of a basic science or clinical department;
- Do guided tour of their departments, clinics, laboratories, or simulation centre.
- Design and deliver hands-on activities;
- Engage the participants in simulated medical scenarios;
- Present seminars;
- Provide information on the admissions processes;
- Provide opportunities for career experience.

Biomedical youth summer camp

The Biomedical Youth Summer camp is an annual 5-day camp at the FMUM, which is usually held in the last week of July, specifically targeting primary school kids, is free of charge to all participants (Aboriginal or non-Aboriginal). Applicants are recruited and selected via applications from mainly the inner city district schools, although schools all over Manitoba are considered. The camp is divided into 2 sessions: morning session, 10:00 a.m-12:00 p.m. and the afternoon session, 1:00-2:00 pm, with lunch break at 12:00-1:00 p.m. During the lunch break, participants watch educational videos, or enjoy theatrical performance, or listen to music entertainment. Managing and organizing the camp is made possible with help from volunteers. The volunteers are recruited from graduate and medical students, and students from health profession schools, community groups, parents, and health professionals. The volunteers act as supervisors, activity and session leaders, and chaperones. Some of the hands-on activities conducted at the camp are:

- Blood typing
- Fluorescent microscopy
- Immunological techniques

- Basic Anatomy:
- DNA extraction
- Fingerprint Analysis
- Medical Fundamentals of medical rehabilitation

Friends of the inner city science centre incorporation: community involvement and development

Changing lives in the community can only happen when the community itself is empowered to do so, and is committed to its obligations in an equal partnership. Through the WpgFdn, the Partnership has been able to establish strong collaborations with various community organizations in the North End. Determined to show their support of the Partnership, the North End community groups organized themselves, and formally registered a non-profit organization, Friends of the Inner City Science Incorporation (FICSC Inc.), with the Manitoba Business Bureau. The FICSC Inc. is the foundation for the Partnership; its board members are mainly community civic leaders, Aboriginal elders, and social workers. The FICSC Inc. organizes several social events to raise funds to financially support the BYP programs and ICSC activities. It also mobilize parents to actively participate in workshops for families, set up working committees to recruit volunteers as drivers and chaperones for the summer camps and science fairs.

Funding and Administration

After the initial funding to establish the Partnership, all the three partners have now institutionalized the Partnership by committing to seek and provide post-funding support. However, other funding supports are received from grants from local foundations, government, and private donors. It cost on average $250,000 annually to implement the Partnership's programs. From 2006 through to 2012, the average annual contributions are: Faculty of Medicine, $150,000; WpgFdn, $30,000; and the Winnipeg School Division One, $30,000, and $40,000 from Manitoba Education and private donations.

The founding director of the program is responsible for the overall management of the Partnership, with help from the advisory management team, which is composed of community elders and leaders, grants coordinator from the WpgFdn, and science educators and consultants from the WSD1. This team meets quarterly, which is chaired by the director, to oversee the Partnership programs. The student staff consists of three program coordinators that receive honoraria, and the associate director that receives a stipend. Two staff members, at the postgraduate level, are responsible for coordinating and managing the ICSC laboratories. A full time administrative assistant provides all the secretarial, communication, and marketing support; additional support is provided by a community manager and administrative support of the Department of Community Health Sciences, and Center for Aboriginal Health Education (CAHE).

Evaluation and Achievements of Participants

After completion of every activity and project, formative and summative assessments of participants (students, teachers, and parents/guardians), attitudes and performances are determined. This evaluation used survey and inventory methods that have been previously described [28]. The institutional review boards of the Winnipeg School Division and Manitoba Education approved the evaluation studies, which were conducted independently of the FMUM. A summary of the demographic data is provided (Table 2).

Professional Development of Teachers

Now in its third year, 67 elementary teachers mostly from the ICD schools, including 16 Aboriginal science consultants have participated in the workshops conducted by 5 facilitators. Overall, very positive feedback were received from the teachers on: the expertise of the instructors and invited speakers; quality of the presentations and their relevance to the Manitoba science curriculum; visit to the research laboratories to see real life connections to hands-on use of equipment; enthusiastic and positive environment, and the interactive break-out sessions to share their experiences. However, some aspects of the training needs improvement, in particular, the downtime in waiting between activities, and the organization involved in using the ICSC laboratories. As one teacher observed:

"I'm afraid that without having a planned activity but to problem solve as we go along, I may not make full use of this amazing workshop and facility."

Despite these challenges, the teachers felt that they have received useful information that can help them to improve their teaching, and make learning more realistic for their pupils, as noted by some of the participant teachers. For example:

"The facilitator and his team did a wonderful job of providing us with useful information that really helps improve my teaching and make learning science more realistic for my students"

"This week was really great, I enjoyed the workshop, especially the breakout and synthesis sessions when we brainstorm and shared our experiences with fellow teachers on how to plan some activities, and lessons that I can do with my students when we visit the science centre."

Of those teachers that have participated in the workshop so far, 35% of them were able to directly apply the knowledge and skills gained from the workshops to reach, at least, 400 students in a single year. Also, about 27% of those teacher participants are now recognized as science consultants, and have been supported for further workshops. And while this is beneficial, the real advantage of the program is the capacity it builds for those teachers who attend the workshops to train other teachers in their schools. This increases exponentially the number of students who can be reached. Consequently, in the longer-term, this will impact on science learning outcomes for all pupils, Aboriginal or non-Aboriginal.

Characteristics	Number (%)
Gender	
Female	2145 (53.2)
Male	1890 (46.8)
Ethnicity	
Aboriginal	1754 (43.5)
Non-Aboriginal	2281 (56.5)
School Status	
Inner city schools	3093 (77.0)
Non-inner city schools	942 (23.0)
Teacher Status	
Total teacher participants	67 (100)
Non-Aboriginal	51 (76.0)
Aboriginal Science consultants	16 (24.0)

Table 2: Demographic Characteristics of Partnership Participants, 2006-2012.

Impact of Science Buddies, Mentoring For Science, and Summer Camp

1345 elementary inner city district students have participated in science activities, projects, and camp since 2006. More importantly, on average the percentage of Aboriginal participants has been consistently maintained at 43%. Averaging responses from 865 students over a period of 4 years from 2008-2012, suggest that students who participated in the Science Buddies rated science significantly higher than non-participants. Also, in the same period, the total number of group-parental tours to the ICSC increased dramatically from 12 in 2008 to 457 in 2012. Of the first cohort of sixth grade Aboriginal students who were pioneers for the Science Buddies, 75% of them have successfully gone on to grade 12, and more than 46% of them have participated in science fairs, with a success rate of 37% in medal awards. The results suggest that the Partnership had positively influenced interest in, and attitudes to, science for parents and their children. In addition the number of non-inner city schools that are using the ICSC facilities is also increasing at a very fast pace. In 2010-11, thirty-five of those schools were registered for activities at the ICSC, or were given a tour presentation, compared to ten groups in 2009-10. Starting with only 3 science clubs in 2006, there are now 35- after-school inner city science clubs.

In 2010 the first mentorship program was initiated for inner city kids to undertake project and compete in the Manitoba science fairs. Mentorship sessions and activities are hosted at the ICSC from September 2010-April 2011 for 6 hours per week. Of 30 students that participated in the competitions from 2010-2012, eleven of them were Aboriginal elementary pupils. 18 students won medals (5 gold, 11 silver and 7 bronze medals). Amongst those winners, of the 11 Aboriginal students that had participated, 7 won medals (2 silver and 5 bronze medals). These results indicate that the Partnership is having positive effects on the confidence, motivation, and performance of the students. The students are always very excited and enthusiastic to undertake a science fair project at the ICSC; as one medal winner, an Aboriginal grade 5 student of Niji Mahkwa School proudly explained his decision to investigate whether different kinds of shampoos have different anti-microbial effects on the growth of bacteria:

"People said the easiest project is a volcano, but I didn't want to do that, I like to figure out the hard stuff and see if I can do it" [31].

The annual Biomedical Youth Summer Camp continues to be a success. For example, in 2006 about 12 students enrolled, in 2012 well over 250 students enrolled. To date, more than 800 students, with nearly 58% being elementary students, have attended this camp. Of those participants 32% are self-declared Aboriginal. Increasing number of hands-on activities were offered, with 25% more activities offered in 2012 compared to 2011, with the number of volunteers also increasing correspondingly to match the number of activities. Since this camp is free, it provides the opportunity for inner city youth to attend science camp that otherwise they can't afford. It also provide them with the opportunity to learn about real-life medical procedures and emergencies; experiences that they will hardly forget. As one participant, a fifth-grader, enthusiastically said:

"I really enjoyed going into the gross laboratory because the human organs are real and not like the plastic ones we have in school or on the desktop computer."

Preliminary analysis in 2011 indicates that 80% of the participants that had been attending the Biomedical Youth Summer Camp since 2007 regularly attend science classes and fairs significantly more than a comparative group of students who don't enroll for this camp. Taken together, these results indicate that the Partnership is encouraging students to be interested in science and are likely to stay in school.

Exploration and Discovery Days in Health Sciences

Since 2009, Discovery Days in Health Sciences have attracted more than 456 inner city elementary students, including 245 Aboriginal students from the North End exploring career options in the health professions. There are now over 15 exhibition options, ranging from medicine to occupational therapy, laboratory technology, and nursing. In addition to the exhibitions, there are over 13 hands-on workshops that provide the participants the opportunities to interact with health professionals in their research laboratories and clinical settings. The workshops include, spinal instrumentation, resuscitating a mannequin in the Simulation and Clinical Learning Centre, and one workshop dubbed the "Regenerative Medicine-the future of growing organs". In 2011, forty-two health professionals have participated compared to only 13 in 2006, indicating an increasing demand from both students and health professionals of their excitement to participate in these events. As one participant, a grade 6 student highlighted:

"I now know a lot about the world of discovery and innovation for real than seeing it on TV. Occupational Therapy is interesting."

The Discovery Days' activities have also acted as magnets for parents to learn about health and science-related careers together with their children. As part of the Discovery Day events, parents are also invited to accompany their children to view the different exhibits, and try out different exercises at the workshops. To date, over 183 parents have attended Discovery Days. A survey of 76 parents that have attended Discovery Days on more than 3 occasions rated the events very high for its impact on observable interests of their children in healthcare careers. As one parent said:

"It plants a seed in their mind early on about careers in the healthcare and medical research"

These results clearly suggest that the exploration of healthcare careers is having a positive impact on the attitudes of both parents and young students toward the health professions education.

Community as a Nexus for Change

Since 2006 the Partnership through the WpgFdn, has been linked to several local community organizations and with whose support and insight this program will be better able to grow and impact as many youth as possible. From only 2 collaborations initiated in 2006, now the Partnership has established collaborations with 14 local groups, including the Manitoba First Nations and Education Resource Centre, Pathways to Education, Community School Investigators, Boys and Girls club, and Coalition for Newcomer Youth Education Services. The Partnership must be seen to work with the community, and not for the community. As one community activist and leader said:

"The university is finally realizing that we are proud people here in the North End, we want to contribute to our children's future"

Since 2010 the FICSC Inc has raised more than $50,000. This fund has been raised from hosting Arts and Craft Bake Sale, selling memorabilia, street fairs at various inner city schools, and the annual fundraising gala, and mail-in requests for private and corporate donations. This endowment fund, as it grows, will eventually sustain significant funding to the Partnership. The FICSC Inc is currently applying for a charitable status to be able to issue tax receipts, enhancing its potential to raise more funds.

Service Learning and Co-Curricular Activities

Opportunities for service learning abound as medical, health professionals, and graduate students volunteer to take active role in the Partnership's programs. As the university connects to it neighborhood community in the North End, this is very rewarding for many students. The students see real-life benefits for their professional training, as explained by a second- year medical student:

"During the summer camp, I explain to these kids about human physiology and interact with them on how to take blood pressure measurements by putting the pressure cuffs on their arms. This gives me an excellent practice of how to communicate to my patients and know where they are coming from"

In return, the kids are always excited when the meet with the university students because these students act as role models, and make friends with the inner city kids than they otherwise would normally do.

As a sixth-grader said:

"They ask me lots of questions about my project, and it makes me feel good that I can discuss with them my answers if even sometimes they might be incorrect."

Another student, a fourth-grader explained:

"The medical students let us touch and play with their knee caps to examine them, as if we were equals. They can easily make friends"

These results suggest that the community wants to be treated as equals in any university collaborations that affect them. The informal education that takes place as exemplified by service learning provided by the university can have a powerful and lasting effect on the kids.

Conclusions

Vision and Long-Term Effect on the Medical Pipeline: Canadian universities have to courageously confront and deal with the issues affecting the underrepresentation of Aboriginal students. This can begin to happen by a shift in policy for a systemic change in their academic and social structures. For example, the universities have to be explicit in their mission statements on the goal of diversity, with specific commitment to social accountability, community engagement, and Aboriginal achievement. To this end, the BYP and ICSC represent an innovative Canadian Partnership with a long-term aim of increasing Aboriginal representation in medical schools and the health professions. The evaluation results indicate that the Partnership has positively influenced teachers, pupils, and parents in the inner city to pursue their interests in science. The elementary participants have the motivation and confidence to continue with their interests in science to middle school through high school. It is too early to forecast whether those elementary students will go on to enter the health professions. The evaluation of such outcome can be challenging but remains necessary [32]. The Partnership is now tracking the participants, and to use a mixed methods approach focusing on process, achievement, and experiences of the participants that can facilitate reflection and renewal. A true partnership represents a shared ownership, respect for the community, and long-term sustained commitment to enacting positive change [33]. Admission to the sciences and health profession requires a well-planned and targeted program and is best initiated at the elementary school level. These characteristics reflect the attributes of the BYP, ICSC, and FICSC Inc. working in collaboration to reach disadvantaged and Aboriginal elementary pupils.

The professional development of teachers is a critical component of the Partnership's activities. The investment in teachers is crucial to the success of medical pipelines. In future, as more teachers participate in the professional development training; consequently more Aboriginal and inner city students will be gaining knowledge and experience in problem-based learning. This will help them advance through the pipeline. The Partnership plans to incorporate the middle and high schools that accepts the elementary students in order to encourage the implementation of the Partnership's programs from the elementary through to grade 12 educational pathways. If universities can help teachers, especially elementary teachers with their professional development, then they will more likely influence the diversity of their students' populations. Enhancing science education at the elementary level will undoubtedly stop the leakage early on in the pipeline. This is a more effective and long-term strategy than targeting high schools when it is already too late for most of the pupils.

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