Post-secondary Work Integrated Learning Through STEM Outreach

Ms. Tracy L. Ross, Actua

Tracy Ross holds a B.Sc. (Hons) in Environmental Chemistry from Queen’s University and a M.A. in the History and Philosophy of Science and Technology from University of Toronto. She has overseen high quality, targeted STEM outreach programs at a national level since 2003. At Actua, Tracy’s team ensures strong relationships between Actua and its network of post-secondary Institutions, providing support for youth STEM Outreach programs that reinforce Institutional priorities around equity, diversity, inclusion, community engagement and research profile.

Lisa Romkey, University of Toronto

Lisa Romkey serves as Associate Professor, Teaching Stream and Associate Chair, Curriculum, Teaching and Learning with the Division of Engineering Science at the University of Toronto. In this position, Lisa plays a central role in the evaluation, design and delivery of a dynamic and complex curriculum, while facilitating the development and implementation of various teaching learning and assessment initiatives. Lisa teaches undergraduate courses in engineering & society, and graduate courses in engineering education. Her research interests include teaching and assessment practices in engineering. Lisa also serves as Associate Director for the Institute for Studies in Transdisciplinary Engineering Education & Practice (ISTEP) in the Faculty of Applied Science and Engineering, which serves as a hub for pedagogical innovation and transdisciplinary engineering education.
Abstract

This work in progress paper reports on a multi-year project designed to articulate the learning and employability skills gained by a pan-Canadian group of undergraduate students, by way of their training and work experience as youth program “instructors” delivering STEM outreach activities for youth. In order to further examine the development of employability skills, a framework of 12 “Future Skills,” was developed, drawing on existing competency frameworks, Engineering graduate attributes, and through interviews with program directors and employers. This framework and the instructor experience was subsequently explored through a pre- and post-program survey, as well as a smaller qualitative study, using semi-structured interviews and reflection pieces. This research has demonstrated that the instructors develop more confidence in a subset of skills, including adaptability, communication, collaboration and creativity through their STEM outreach instructor experience. This project as a whole presents a valuable opportunity to connect and leverage other post-secondary initiatives underway to prepare undergraduates with the skills and competencies needed for engineering and other STEM careers. This paper presents findings to date, and invites feedback on future phases of the project.

Project Context

Every year, even in 2020, hundreds of undergraduate students in Canada deliver STEM outreach programming to youth across the country, through a number of well-established organizations and university-based programs. These programs offer initiatives ranging from weeklong camp experiences, year-round clubs, to school and community workshops and other programming models. In the 2020 pandemic year, most of the in person programs were able to pivot to virtual or other distance learning opportunities for youth. There is a breadth of research on the impact of the programs on the participants, but very little on the impact of the experience on the undergraduate student instructors and the transferability of skills developed in their outreach work to their future academic and career opportunities. The goal of this project is to address this gap, through the development and assessment of a “Future Skills” framework for transferable skill development.

This work in progress paper documents our efforts towards this goal, in the context of the employment of undergraduate students associated with Actua, which is a large, national STEM outreach organization. Actua partners with universities and other organizations to support and facilitate the programming, and many of the programs are situated within Engineering Faculties. This STEM outreach organization engages youth aged 6-16 in every province and territory in
Canada, and delivers programming in 500 communities each year. The organization has a special focus on breaking down barriers towards youth engagement in STEM, with a focus on Indigenous youth, girls in STEM, at-risk youth, newcomers to Canada, and/or other youth experiencing socio-economic challenges. These youth are developing the skills and competencies they need to ensure they are full participants in tomorrow’s economy.

Annually, approximately 1,000 STEM undergraduate students are hired as “Instructors” by the university and college network member programs. These students facilitate and lead STEM learning programs, providing younger youth with positive role models and direct access to the post secondary experience. Hiring is normally on a seasonal cycle, with recruitment taking place in December and hiring in January and February. Although it varies from year to year and program to program, typically 1 in 3 instructors return for a second or more work term. In 2020 there were more returning instructors than in 2019 (40% in 2020 vs 29% in 2019).

These instructors receive training and deliver programs, and in doing so, they also gain invaluable employability and leadership skills as they launch their careers in STEM. Training typically consists of 40-80 hours of onboarding, which includes training in program operations and rationale, gender equity, Indigenous cultural awareness, classroom management, working with students with special needs, and curriculum development & delivery. Themes addressed are similar across network members. In some cases locally customized training content is necessary, or the network members leverage specific resources available from their host institutions to deliver training modules. Normally the training is delivered in person, but with the restriction of most programs to have instructors working remotely in 2020, network members delivered instructor training online through asynchronous and synchronous online modules. When instructors return for a second or third year, they are often asked to share lessons learned and act as guides for newer instructors. Generally, instructors are required to participate in assigned training and orientation.

Instructors are also involved in working collaboratively in teams to research, develop, test and document appropriate STEM content and activities for youth. The activities must adhere to age appropriate learning, safety protocols and content direction. During program delivery, instructors are mainly responsible for delivering activities with participants, normally in a team with one or two other instructors. They are responsible for overall participant supervision, safety, and enjoyment, and adhering to the hourly or daily program schedule as well as standard institution policies and procedures. In addition to ensuring that they are a positive role model for youth, instructors regularly have interaction with parents, faculty members or other guests, and are responsible for professional conduct and maintaining those positive relationships on behalf of the organization. Further, instructors are asked to contribute to the evolution of the program by participating in program evaluation, providing feedback and sharing successes and lessons learned.
In 2016, a sample of the 1000 instructors who work across the network were surveyed, to begin the process of documenting the instructor experience. The survey indicated that instructors greatly valued their training and work experience, with 89% agreeing that they would use their training and related experiences in the future. This initial research provided a baseline upon which to build a more proactive approach to documenting, measuring and improving the experiences of instructors. The survey was repeated in 2017 to similarly promising results.

These instructor experience surveys drew on the NSSE [1] and CCR [2] frameworks/tools to develop questions. The survey asked 33 questions about increased employability skills, strengthened career identity, enhanced leadership and emotional intelligence and increased advocacy for diversity in STEM. From these questions, we were able to develop a draft list of instructor-reported competency areas. Second, we conducted interviews with program directors. They were asked to what degree they felt that their instructors’ competencies were aligned with the competencies self-reported by the instructors. It is important to note that the directors did not
claim that the instructors necessarily learned these competencies completely during their work term with them; causality was not explored during this initial exercise.

Simultaneously, a literature review of competency and engagement frameworks was conducted to review models used by both employers and educational institutions. This was used in conjunction with the initial instructor surveys noted above, alongside interviews with member program directors and employers to establish a working framework. There are a number of different competency frameworks in place at various postsecondary institutions in Canada, including co-curricular records, co-op education competencies, and others specific to faculties or disciplines such as Engineering, for example, the Graduate Attributes, which represent 12 competencies that must be taught and assessed in undergraduate engineering programs [3]. The competency frameworks reviewed were those linked to the University of Toronto Co-Curricular Record [2], The Canadian University Survey Consortium Survey of University Students [4], The National Survey of Student Engagement [1] and the Memorial University Career Integrated Learning Initiative [5].

Finally, interviews were also conducted with several potential employers, including the Actua’s corporate partners, regarding their hiring processes and the competencies they seek in newly graduated STEM candidates. Collectively, the eight participating employers represent the resource and energy sector, heavy equipment, software, manufacturing, consulting and financial sectors, and between them hire hundreds of Canadian STEM co-op/intern students and new graduates annually. Regardless of the sector, employers typically sought candidates who demonstrated adaptability/ flexibility, analytical skills, ability to collaborate and work in teams, initiative/impact, and self-awareness. Depending on the role to be filled, additional competencies sought included innovation, leadership, customer focus and attention to detail. These findings are consistent with other more exhaustive surveying on employer-sought competencies by the National Association of Colleges and Employers (NACE) [6].

**Future Skills Framework Development**

Actua developed the Future Skills Framework to capture and articulate the instructor experience, and to provide a foundation for additional support to member programs and their instructors. In addition, a strengthened instructor experience framework is seen to have potential for improved recruitment, training and retention of future instructors, increased transferability of the instructor experience to future career opportunities, and increased quality and consistency in youth engagement by the network. The potential to shape a national, post-secondary work integrated learning experience reflects activity by universities and affiliated organizations to better document the contribution of extra-curricular and co-curricular activities to the student experience [7], [8], [9] and the understanding in the higher education sector of the benefits of
extra and co-curricular activities [10], [11], [12]. Further, this work is also informed by post-secondary sector initiatives to map the rapid development of work-integrated-learning, or experiential learning [13], [14], and by private sector initiatives to assist youth preparing to enter the workforce in a time of significant economic, social, and technological change [15].

All the feedback related to competencies gathered from instructors, network member directors and employers was synthesized into a single table for comparison. In Table 1, the first column includes competencies self-identified by instructors as having been further developed through their STEM outreach experience based on the results of the 2017 instructor survey. The second column lists the competencies that program directors (supervisors) observed to be strong among instructors, using the same list that appeared in the instructor survey. The third column lists the competencies most frequently mentioned by employer interviewees as being important when hiring new STEM graduates or interns. In all cases, the competencies are listed starting from the greatest degree of development, demonstration or importance, and ordered by decreasing emphasis.

Next, we identified competencies that were apparent from all three groups of stakeholders, which are represented in column four. As indicated in this column, more than half of the employers’ top ten competencies also appeared high on the instructor competency lists. Arguably, there could be greater alignment if “decision-making and action” is assumed to be equivalent to “initiative.” Unfortunately the competencies of “adaptability/flexibility” and “innovation/creativity” were not asked as such on the instructor experience surveys conducted in 2016 and 2017 and cannot be reported; however based on the job responsibilities of instructors and anecdotal comments of Directors, those competencies are central to successful performance as an instructor. Going forward, we felt that those competencies would also be important to highlight and measure.

Table 1: Instructor Competency Mapping against Employer Criteria.

<table>
<thead>
<tr>
<th>INSTRUCTOR SELF-REPORTED</th>
<th>DIRECTOR OBSERVED</th>
<th>EMPLOYERS SEEKING</th>
<th>COMMON COMPETENCIES</th>
</tr>
</thead>
</table>

Collaboration & Teamwork  
Decision-making & action  
Leadership  
Enthusiasm for learning  
Social intelligence  
Self-confidence  
Speaking clearly & effectively  
Self-awareness  
Understanding people of other backgrounds  
Being informed & active citizens  
Goal-setting & prioritization  
Advocacy  
Reflective thinking  
Solving complex real-world problems

<table>
<thead>
<tr>
<th>Collaboration &amp; Teamwork</th>
<th>Collaboration &amp; Teamwork</th>
<th>Leadership</th>
<th>Decision-making &amp; action</th>
<th>Leadership</th>
<th>Decision-making &amp; action</th>
<th>Enthusiasm for learning</th>
<th>Fostering inclusivity &amp; equity</th>
<th>Social intelligence</th>
<th>Advocacy</th>
<th>Speaking clearly &amp; effectively</th>
<th>Self-awareness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adaptability/flexibility</td>
<td>Analytical skills &amp; problem-solving</td>
<td>Initiative &amp; positive impact</td>
<td>Self-awareness</td>
<td>Innovation &amp; creativity</td>
<td>Leadership</td>
<td>Ability to learn</td>
<td>Communication</td>
<td>Customer focus</td>
<td>Commitment</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

As a secondary exercise, we also examined alignment with the list of skills targeted through the RBC (Royal Bank of Canada) Future Launch program. The focus of this program is to support programs that allow young people to gain new skills, grow their professional network, and gain work experience, and so there is a demonstrated alignment with Actua and the focus of this project. Through this exercise, we found a strong alignment, and added social intelligence/social
perception, adaptability, and creativity & innovation, all of which were identified by our review of employer interests.

Based on this entire exercise, we developed a list of 12 competencies or “Future Skills” to be used in the next phase of the project, which were subsequently organized into three skill areas: Delivering Results, Working with Others, and Future Readiness. The three skill areas have some alignment with the three competencies recently presented in the Conceptual Model of Core Competency Development through Experiential Learning, developed by E. Bowering et al [4], and present an interesting opportunity for further exploration.

Table 2: Future Skills Framework

<table>
<thead>
<tr>
<th>Delivering Results:</th>
<th>Working With Others:</th>
<th>Future Readiness:</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Critical Thinking &amp; Collaboration</td>
<td>Communication</td>
<td>Flexibility</td>
</tr>
<tr>
<td>4. Commitment</td>
<td>7. Leadership</td>
<td>Creativity</td>
</tr>
<tr>
<td></td>
<td>8. Social Intelligence</td>
<td>11. Ability &amp; Eagerness to</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Learn</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12. Self-Awareness</td>
</tr>
</tbody>
</table>

|                      | (Social Perceptiveness) |

Future Skills Assessment and Development

Once the Future Skills Framework was established, the next phase of the project was to look at strengthening capacity to train and develop high impact instructors, as well as coaching instructors to identify and articulate their transferable skills. We took a two-pronged approach here, on the one hand inventorying the training and work experiences materials used by each network member and examining each for skill development, while at the same time conducting qualitative and quantitative research to gather more detail from the instructors on which skill areas they felt were being developed and how.

Experience Inventory and Skills Mapping

For the initial inventory work, conducted in 2019, the Instructor experience was broken down into three parts; training and orientation, on the job work experience, and feedback and evaluation. Network programs were asked to submit resources used in each of these phases of the Instructor experience; 18 programs provided materials. We examined the materials collected
under each of the categories using document analysis in an effort to better assess how the participants’ experience in the network member programs helps to prepare them for the broader workforce through skills development. Our analysis focused primarily on training resources, job descriptions & instructor manuals, and feedback & evaluation resources.

When looking for opportunities to develop skills through training, the project team looked for evidence either of the specific skill-related vocabulary, or activities or direction in the training materials that would require exercise of one or more of the future skill areas. In training materials, the Future Skills were fairly to exceptionally represented in the most common training pieces. To a lesser degree was there evidence to support that the training sessions themselves held opportunities to develop Leadership, Innovation & Creativity, and Self-Awareness. Table 3 provides the review of common training areas and their mapping to the Future Skills Framework.

**Table 3: Training Inventory Mapping to the Future Skills Framework**

<table>
<thead>
<tr>
<th>Common Training modules</th>
<th>Problem Solving</th>
<th>Critical Thinking &amp; Analysis</th>
<th>Initiative</th>
<th>Commitment</th>
<th>Teamwork &amp; Collaboration</th>
<th>Communication</th>
<th>Leadership</th>
<th>Social Intelligence</th>
<th>Adaptable &amp; Flexibility</th>
<th>Innovation &amp; Creativity</th>
<th>Ability &amp; Eagerness to Learn</th>
<th>Self Awareness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lab Safety &amp; Emergency Procedures</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Actua 101</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equity/Diversity/Inclusion</td>
<td></td>
<td></td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Managing Stress/Mental Health</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indigenous World Views</td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teaching Children with Special Needs</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Conflict Resolution</td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Classroom Management</td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STEM Content/Curriculum Development</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For the inventory of on-the-job experiences, our primary means of assessing skill development was to draw from the materials submitted to create a master list of tasks that make up the core responsibilities or work activities for the Instructor role, and then map that work activity against each of the Future Skills. The results of that mapping are in Table 4. Our mapping of the functions/responsibilities for the instructor role against the future skills suggests that while not necessarily equally represented, there is a documented opportunity for each of the Future Skills to be developed throughout the performance of the instructor role during the course of the term.
The inventory of on-the-job experience was conducted using job descriptions based on the pre-pandemic experience, but even through virtual or remote delivery the main responsibilities, to deliver STEM learning experiences, remained consistent.

### Table 4: On-the-Job Mapping of Future Skills

<table>
<thead>
<tr>
<th>Instructor Preparation &amp; Administration</th>
<th>Problem Solving</th>
<th>Critical Thinking &amp; Analysis</th>
<th>Initiative</th>
<th>Commitment</th>
<th>Teamwork &amp; Collaboration</th>
<th>Communication</th>
<th>Leadership</th>
<th>Social Intelligence</th>
<th>Adaptability &amp; Flexibility</th>
<th>Innovation &amp; Creativity</th>
<th>Ability &amp; Eageriness to Learn</th>
<th>Self Awareness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work collaboratively to plan, design &amp; develop curriculum and programming including researching, developing, budgeting and testing activities for workshops, camps, or special events...</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Participate in certification and training relevant to program delivery.</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organize and prepare camp program activities to support learning</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complete evaluations and reports</td>
<td>x</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contribute to space cleanliness including light cleaning and physical duties.</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assist with camp registration, attendance, and other paperwork</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assist in organizing training &amp; reporting, scheduling, data collection.</td>
<td>x</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Create hazard assessment documents for activities and ensure safety protocol is followed.</td>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Provide proper and timely documentation on personal timesheets and expense claims.</td>
<td>x</td>
<td></td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maintain current online and offline filing and organization systems as directed</td>
<td>x</td>
<td></td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Program Delivery</td>
<td>x</td>
<td></td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Work collaboratively to deliver programming to a number of participants of varying ages in a fun and innovative manner by engaging participants in hands-on activities</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Provide supervision for program participants and act as a positive role model</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Develop and support positive relationships with campers, parents, teachers, media, community partners, staff and other stakeholders</td>
<td>x</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Be responsible for the health and wellness of self and co-workers during programming (ie taking breaks, drinking water, eating lunch)</td>
<td>x</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Train, supervise, and provide guidance to volunteers</td>
<td>x</td>
<td></td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adhere to policies &amp; procedures at all times and ensure policies are being followed by others</td>
<td></td>
<td></td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aid in maintaining a healthy relationship with the post-secondary institution, which includes ensuring that all instructors and participants are respectful of the property, staff and facilities.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Supervise participants to/from and during classes and lunch</td>
<td></td>
<td></td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Act as a substitute instructor in the event another instructor is unavailable</td>
<td></td>
<td></td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effectively manage the classroom, supporting meaningful student learning and managing camper behavioural issues as they arise</td>
<td></td>
<td></td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Follow safety &amp; risk management policies</td>
<td></td>
<td></td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assist in prep tasks at the end of each day</td>
<td></td>
<td></td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Other</td>
<td>x</td>
<td></td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assist with the documentation of current programming, workshop and outreach events through taking photographs and sharing them via dropbox</td>
<td>x</td>
<td></td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deliver presentations at community events and outreach opportunities</td>
<td>x</td>
<td></td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Participate in regular reflection activities regarding personal learning, team development, challenges and success of programs, etc.</td>
<td>x</td>
<td></td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
</tbody>
</table>

Finally, our inventory of Feedback & Evaluation Mechanisms found some inconsistency in the availability of tools and practices around providing feedback to Instructors during their employment. While Instructors are well supported and provided with regular feedback by their
supervisors, and there were a few instances of strong processes and tools, this is generally seen
as an area of opportunity for the network to reinforce performance outcomes, as well as
objectives around skill development. Further, and in general, through the inventory exercise, we
were only able to identify a small number of instances in which instructors are being alerted to
the fact that they are building skills throughout the program and how those skills can support
them in their future careers. Bringing awareness to the opportunities for skill development and
reinforcing those with instructors is seen as an opportunity for Actua.

Findings from the mapping work indicate that while the Instructors have at least some
opportunity to develop most of the future skills through either job-specific training or work
experience or both, there is room to develop standardized training, skills articulation and
evaluation materials in order to enhance the experience.

*Instructor Perceptions of Future Skill Development*

The second prong of our research was designed to examine more closely instructor perceptions
of the training and work experience, and the contributions of these training and work experiences
to the development of future skills. The initial work in this area was conducted using both
quantitative and qualitative methods over the summers of 2019 and 2020. More specifically, a
survey focusing primarily on future skills development was deployed to all instructors employed
with Actua both prior to and at the completion of their instructor experience in both years. In
2019, a small subset of instructors (15) were invited in parallel to participate in semi-structured
interviews and written reflections to better understand the development of future skills, and the
relationship between training, work experience and future skill development. The research was
not repeated in 2020 due to the added burden it would place on already challenged network
member programs delivering new programs in a new context, but the 2019 findings provide
important findings about the in-person Instructor experience. Specific details for each of these
components are discussed below.

The Survey

As a partner with the RBC Future Launch program, instructors participated in an online survey
developed by program evaluation specialists affiliated with RBC. As established earlier, the list
of skills identified by RBC was well aligned with the list of Future Skills initially created. The
survey asked instructors to report on the frequency of a number of activities and practices
associated with the RBC skills, and their self-confidence in a set of skills and competencies
related to the frameworks described earlier in the paper. Prior to use, the survey was reviewed by
a set of program directors and organizational staff, providing an opportunity to improve the
validity of the survey through minor changes.
The survey was deployed to participants prior to initial training for their summer employment, and for a second time within the last few weeks of their summer employment. This allowed for the possibility of making pre- and post-comparisons with respect to future skill practice, confidence and acquisition. In total in 2019, 635 instructors participated in the pre-survey and 350 instructors participated in the post-survey, with 201 surveys matched pre and post. For the survey conducted in 2020, 313 instructors participated in the pre-program surveys, and 189 in the post-program surveys, with 140 paired responses. These instructors represent a diversity of academic programs and geographic locations across the country.

Interviews and Reflections

In 2019, three partner programs from the national network were invited to participate in the qualitative component of the research project. Through purposeful sampling, five instructors were selected from each of the three programs, with a goal of including instructors representing a diversity of academic program backgrounds and levels of experience with STEM outreach. In total, 13 individuals participated in this component of the research.

The interviews and reflective pieces gave the instructors the opportunity to discuss their work and training experiences, and the development of the future skills described in the frameworks above. The overarching goal of this component of the research was to better understand the development of future skills through STEM outreach program employment, and to use instructor insights to help improve our training efforts. More specifically, the following questions guided the interview and reflection component:

i. How does the STEM outreach work experience contribute to the development of employability skills? Which aspects of the work experience are most effective in preparing instructors for future employment?

ii. How do the STEM outreach training programs contribute to the development of employability skills? Which aspects of the training programs are most effective in preparing instructors for future employment?

iii. How do the training programs prepare instructors for their work in STEM outreach?

iv. How do instructors articulate the skills and competencies acquired through their STEM outreach program experience?

The qualitative component consisted of three interviews and two reflective pieces, which were facilitated over the instructor summer employment period (and extending to post-employment, to
appropriately capture reflections on the summer period from the point of view of completing the session). The interviews and reflective pieces were designed to capture the arc of the instructor experience, as they gain experience and, ideally, develop confidence in their role as STEM instructors. Most instructors facilitate in-school workshops in May and June while developing camp curriculum, and lead more intensive STEM camps in July and August, and so the questions posed were reflective of these programmatic elements and their timing. This component of the research is reflective of Donald Super’s work [16] on the developmental process of vocational behaviour, which examines the relationship between self-concept and vocational choices. The STEM outreach instructors are in Super’s ‘exploration stage’, in which tentative career choices are based on academic and other life experiences, and students are able to conceptualize links between what they learn and do, skill development, and future career choice. Based on this framework, it’s an ideal time to engage these instructors in reflection on the development of future skills.

Participants were given the opportunity to present their reflection in a variety of ways; the instructors opted to email their reflection in a written format to the research assistant. The interviews were conducted by telephone or through online video conferencing. As semi-structured interviews, a set of questions was prepared and used in the interview, but flexibility was employed in using additional questions specific to the individual. After the first two interviews, transcripts were reviewed and 1-2 individual questions were designed for each of the participants, to capture further insights on their experience. Examples of these questions are included in table 5, below.

The development of the interview questions was influenced by structured conversations with a set of program directors. For example, program directors felt that instructors were reinvigorated in their field of study through the act of teaching and mentoring youth in STEM outreach programming, and so it was determined that this phenomena was worth exploring further. It was also through a discussion with program directors that led to the second reflection question on challenging assumptions, as they identified this as part of the learning experience for their instructors.

A summary of key questions and themes is outlined in table 5, below, and the full reflection and interview protocol is available upon request.

**Table 5: Interview and Reflection Protocol**

<table>
<thead>
<tr>
<th>June: Interview 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Why did you pursue this opportunity?</td>
</tr>
<tr>
<td>● How does it link to your future plans/field of study?</td>
</tr>
</tbody>
</table>
● What training did you receive this summer? What additional training would you like to see?
● What have you used from past experiences/academic program training?
● Reflecting specifically on workshops, what future skills have you developed?

Early July: Reflection 1
● What has surprised you in your work experience so far?
● What are the skills and competencies that you developed through your work with this program so far that you value the most? That you think employers will value the most?

Early August: Interview 2
● How have you been using your training?
● Reflecting specifically on camp, what have you learned about yourself? What future skills have you developed?
● Has your work experience enhanced your interest in your field of study?
● Have you added to your professional network?

Late August: Reflection 2
● Tell us about a time that your assumptions (about yourself, about others, about STEM or a combination of the three) were challenged this summer.

Early September: Interview 3
● How did you use your program training? What challenges required different training?
● What were the indicators of your success?
● How did you change over the summer? Have your future plans changed?
● What future skill did you develop that employers will value? That you value?
● Reflection on development of each of the future skills
● Personalized Question

Sample Individualized Questions
● In our past discussions, you mentioned both the relevance and value of being able to improvise in your work this summer, as well as the importance of learning quickly - for example, you might review new curriculum, prep for the lesson, and teach, all within a short period of time. Do you think your development in these areas will be of benefit in the future, either as a student or in your career?
● In our previous conversations, you spoke about the teaching and learning environment in university - and how it can be quite limited and uninspiring in its focus on transmission-based lectures. In contrast, you described your work with (outreach program) as reflecting a broader set of teaching and learning activities, giving you an...
opportunity to explore subject matter and your understanding of it in different ways. Can you speak a little more to this contrast? What could universities learn from the “(outreach program)” approach?

- As a former participant and volunteer, what unique insights did you bring to your work this summer?

Interviews were transcribed on an ongoing basis throughout the duration of the data collection period. After each interview and reflection, transcripts were given a brief review. At the completion of all interviews and reflections, thematic coding was utilized to identify themes in the research. Both inductive and deductive approaches were applied to the data; interview transcripts and reflections were reviewed for evidence of the future skills identified at the end of the first phase of the project, along with ‘digital literacy’, ‘financial literacy’ and ‘building networks’ (which were identified as additional priorities by RBC). However, the interviews and reflections were also reviewed for the presence of emergent themes related to the efficacy of training and future skill development.

Results and Discussion

Survey Results

In the RBC standard pre/post surveys, overall, the instructors began the experience reporting very high confidence in skills, particularly when compared to individuals participating in the RBC program from other organizations. However, improvements in confidence were noted; for example, confidence improved on nearly all questions related to communication, critical thinking, collaboration, and creativity. Table 6, below, includes questions demonstrating the most significant increases in confidence between pre and post, as reported in both 2019 and 2020 editions of the survey. Instructors rated their confidence on a scale of 1-10, with 1 meaning “not at all confident” and 10 meaning “very confident”.

Table 6: Increase in confidence in eight skill areas as reported on the RBC survey

<table>
<thead>
<tr>
<th>Skill area</th>
<th>Question</th>
<th>Average Score /10</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2019</td>
<td>2020</td>
<td></td>
</tr>
<tr>
<td>Critical Thinking</td>
<td>Thinking about your life in general, please indicate how confident you are thinking through and identifying causes of problems.</td>
<td>Pre: 7.98</td>
<td>Pre: 8.11</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Post: 8.36</td>
<td>Post: 8.21</td>
<td></td>
</tr>
<tr>
<td>Problem-Solving</td>
<td>Thinking about your life in general, please</td>
<td>Pre: 8.15</td>
<td>Pre: 8.15</td>
<td></td>
</tr>
</tbody>
</table>
indicate how confident you are considering pros and cons of different opinions and deciding which is best.

<table>
<thead>
<tr>
<th>Persistence/Grit</th>
<th>Thinking about your life in general, please indicate the extent to which you think the following statement describes you: I am a hard worker.</th>
<th>Pre: 4.56</th>
<th>Post: 4.56</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collaboration</td>
<td>Thinking about your life in general, please indicate how confident you are contributing your ideas and suggestions to a group.</td>
<td>Pre: 8.01</td>
<td>Post: 8.27</td>
</tr>
<tr>
<td>Communication</td>
<td>Thinking about your life in general, please indicate how confident you are speaking or presenting in front of groups.</td>
<td>Pre: 7.64</td>
<td>Post: 8.07</td>
</tr>
<tr>
<td>Creativity</td>
<td>Thinking about your life in general, please indicate how confident you are thinking “outside the box” and developing unique ideas.</td>
<td>Pre: 7.55</td>
<td>Post: 7.75</td>
</tr>
<tr>
<td>Adaptability</td>
<td>Thinking about your life in general, please indicate the extent to which you think the following statement describes you: I don’t adapt to change very easily.</td>
<td>Pre: 2.31</td>
<td>Post: 2.43</td>
</tr>
<tr>
<td>Digital Literacy</td>
<td>Please indicate how confident you are using technology to use software to create slides and charts for presentations</td>
<td>Pre: 8.72</td>
<td>Post: 8.62</td>
</tr>
</tbody>
</table>

Participants reported declines in confidence in adaptability skills, which matched the trend across all RBC partner programs. Survey questions on adaptability skills had a double negative structure designed to prevent “straight lining” which might have confused respondents, and so these results should be interpreted with caution.

When asked whether they felt more prepared for the workforce after participating in the program, in 2019 76% of the responding instructors indicated that they felt more prepared, while in 2020 that number increased to 83%. While this demonstrates that the majority of instructors are implicitly linking their STEM outreach experience to their future career, there are a number (26% in 2019 and 17% in 2020 respectively) who are not, further showcasing the need to educate the instructors on the relevance of their training and work experience to future skill development; or re-consider how to support STEM outreach instructors in this space.
In the 2019 distribution of the survey, instructors were also asked to name their top future skill developed during their summer employment. A total of 188 instructors responded to this question, and most competencies listed had less than 5% support with some at 0% (namely financial literacy, initiative, critical thinking, complex problem-solving). The most frequent responses included: (1) adaptability/flexibility at 35.1% (n=66); (2) leadership at 21.3% (n=40); (3) innovation and creativity at 16% (n=30) and (4) self-awareness at 8.5% (n=16). Instructors were also asked to name a future skill they would like further development in; interestingly, two of the top choices were not in the future skills framework: (1) digital literacy (16%, n=30) and (2) financial literacy (19.7%, n=37). Financial literacy was rated low in terms of confidence by the instructors, and so the survey itself may have prompted an interest in improving in this skill area.

Other future skills in the 2019 survey cited with more than 5% support for further desired development include (3) building networks (21.3%, n=40); (4) complex problem solving (8%, n=15); critical thinking (5.9%, n=11); innovation and creativity (5.9%, 11) and leadership (5.3%, n = 10).

In the 2020 edition of the survey, instructors were asked to list the top 3 competencies they developed the most through summer work with their program. 193 instructors responded, each generating three responses for a total of 579 responses. Although all 15 competencies were cited, a large number (over 75%) of responses matched six competencies: (1) teamwork and collaboration (18%, n=107), (2) adaptability and flexibility (16%, n=96), (3) communication (16%, n=90), (4) leadership (10%, n=59), (5) innovation and creativity (9%, n=52), and (6) initiative (7%, n=41).

**Interview and Reflection Results**

The 2019 interviews and instructor reflections represent a rich data set, providing a number of key themes worthy of further consideration. These themes represent the emphasis - or in some cases, lack thereof - on particular future skills in the training and work experience. However, additional themes were also identified related more broadly to the acquisition of skills and the instructor training and work experience.

1. **Self-awareness as an underlying skill of importance**

   It was found that the instructors demonstrated a high degree of self-awareness about their strengths, challenges, and the development of the future skills. Across all of the interviews, instructors spoke in detail about the process of skill acquisition and how their previous
experiences, training and STEM outreach experience influenced these processes. It is proposed that instructors come into their work with a high degree of self-awareness (which is confirmed in the survey data), which acted to reinforce and inform the development and understanding of other future skills. Skills conceptualized as related to self-awareness - the ability and eagerness to learn, the ability to take initiative, and the demonstration of commitment - are other future skills that appear to motivate participation in STEM outreach work.

2. Future Skills with a high degree of emphasis

There was a particular set of skills that instructors reflect on when discussing their training and work experience with STEM outreach programs:

**Teamwork and Collaboration:** The interviews and reflections indicated that STEM outreach instruction provides a significant collaborative learning experience with a strong sense of positive interdependence - in other words, instructors depend on the experiences and expertise of each other and acknowledge that the collaborative relationships between instructors, their varied expertise, and their ability to balance each other’s strengths and weaknesses, are directly related to the success of the programming. The idea of an instructor ‘community’ is seen as an integral part of the experience.

> As I have learned very recently, a lot of adult jobs and big people jobs require teamwork and team settings and group problem-solving, so I feel like working on a team and getting that experience is something that I'll definitely carry with me.

> Working at (the program) has really improved my skills as a team member which include learning to draw on others’ strengths and knowledge for projects that I may not have a lot of background on and sharing the knowledge I have with others so that they may also excel in the work environment.

The instructors interviewed provided each other with feedback and support, but described some room for improvement - and a need for further training in - conflict resolution skills. Teamwork/collaboration was one of two skills that instructors linked strongly with their pre-programming training - the collaborative skills built during the initial training period are essential for a strong team throughout the summer.

**Social Intelligence:** the instructors develop the skill of reading individuals and/or a situation both carefully and quickly, and are particularly aware of the importance of cultural understanding and inclusivity. Several instructors identified the importance of flexibility when communicating with children based on their age, interests and unique learning needs. Furthermore, all of the
Participants demonstrated an interest in social justice, and felt empowered to encourage change - whether this was through encouraging more females to engage with science and technology, working with indigenous youth, or promoting inclusivity from the perspective of neurodiversity.

*Working in an environment with children allows me... reminds me that there are people that learn in other ways, and reminds me that there are people that think differently, and kind of go about life with different cognitive processes than the academic people that I'm used to.*

Social intelligence is the second of two skills, alongside teamwork/collaboration, that instructors linked strongly with their pre-programming training. Most of the instructors interviewed received training on diversity in their student population and identified this as a critical component of their training experience.

**Communication**: instructors must communicate effectively - and frequently - with a number of different stakeholders, including students, parents, and employees of their host institutions, and the instructors see the importance in tailoring communication to a specific audience - and also listening to the diverse stories of other people.

*As instructors we need to be able to quickly and effectively communicate with other instructors, but more importantly this job is teaching me how to communicate some relatively complex scientific principles in a way that children can understand.*

*(In) my previous work experiences, it was very much, almost scripted so it was like, "Hi, how are you today? What can I get you?" And this, it's like, "What do you know about this? Tell me what you know about this. I'm going to use what you know to incorporate it into this lesson. I'm going to cater this information to you so that you understand it. I'm going to perhaps present it differently than it's written down or find examples from your life to teach this to you.*

**Adaptability & Flexibility**: The STEM outreach instructors must constantly adapt to the needs of their program, continually mitigating challenges and finding ways to improve the classroom environment. This need for adaptability and flexibility might be as simple as managing program materials or as complex as adjusting the teaching approach for a particular type of learner. A dedication to continual improvement underlies adaptability and flexibility.

*So the ability to really think on the fly and be able to come up with lessons. In this case, it was in a matter of seconds. Like, "Okay. We need to do something. Let's get some more*
content in." And so that was one of the big things that I've really found of value in this job, is thinking on the fly.

All participants noted the need to be flexible and react quickly in their jobs yet minimal training prepares them for this. Further developments in scenario-based training may prove useful in supporting the development of this further.

**Innovation & Creativity:** Through curriculum and project development, the instructors demonstrate strong capabilities in this future skill. Some of the instructors describe a process from starting with the act of facilitating an existing project, to the challenge of developing program curriculum that is completely original to meet a particular program learning goal. Instructors also link the act of working through challenges with innovation and creativity.

*It's definitely part of the culture because that's kind of the goal I find. So while we were on the road, that's also what we were promoting. We want the kids to have not necessarily failures, but to have bumps in the road so that we can learn from that and that's how innovation is, that's how things are built and ideas are formed, and creativity.*

**Project Management:** Through program planning, instructors experience scheduling and activity planning as a team. There are commonalities between the project management skills developed as a STEM outreach instructor and the project management expectations of an engineering student, for example - they must navigate workflow management, complex scheduling and an understanding of the strengths of each team member when managing the work.

*So far, definitely time management has been one that I've improved on. So when we were told that we have two months to plan some camps we were like, "Oh my God, that's so much time! We're gonna do so well. We'll finish so early." But then we really sat down, budgeted out our time, made schedules, like weekly, daily schedules and realized that we actually have a lot of work to do and this is gonna take us a full two months. And being able to sit down with the team and kind of go through the process of creating schedules, it definitely helped me improve that element of time management.*

3. The need for a vocabulary for skill development

There were signals in the qualitative data indicating a need to provide instructors with a better understanding - and even vocabulary - on the future skills that they develop through their STEM outreach work experience.
For example, while there was some evidence of development in other future skills - namely, problem solving, critical thinking, leadership, building networks and digital literacy - instructors appear to be less aware of how these skills are developed. It was found that instructors discussed the development of their classroom management skills - which inherently requires critical thinking, problem solving and leadership - but the instructors don’t necessarily see it as such. While some instructors see leading a classroom as a leadership opportunity, others felt that the team-based environment required them to take a step back from leadership; at least in terms of their conceptualization of it. While some of the instructors see their co-workers and other program stakeholders as part of a future professional network, others do not.

4. Importance of work-training integration

The instructors described, in particular, the value of what they learned from doing the work required of a STEM outreach instructor. In general, the instructors value training but recognize that much of the learning and future skill development is on-the-job. Training programs that are integrated with on-the-job experiences are recommended, based on the findings of this research. A practice of ongoing structured or semi-structured reflection might help solidify instructor understanding of what they learn from their practice, and training, and how to carry it forward.

5. The Role of STEM outreach work in reigniting interest in one’s field of study

Finally, it was found that the STEM outreach work experience reignited interest in the instructors’ field of academic study, for a variety of reasons - the opportunity to share what they know, the opportunity to utilize skills related to their field in their outreach experience, and the enthusiasm for motivating others towards STEM. The instructors also use their academic program knowledge in different ways as a STEM outreach instructor, and value learning about other disciplines from and with their peers.

*It just really just reiterated why I want to do the research I wanna do and how much... Like getting a young, even a five-year-old to be able to understand that the reason you’re able to feel pain is because there's a signal that's sent along a bunch of neurons to your spinal cord to your brain... Having them actually remember that and retain that, "Oh, the reason I feel that hot water is hot, is because my neuron sent an electrical signal." That just gets me so excited about my field.*

Conclusions and Future Work

Our work in reviewing employability skill frameworks from the literature and practice, and investigating the perceptions of instructors, program directors and employers, has allowed us to
offer a Future Skills framework to represent the high quality work experiences held by STEM outreach instructors. However, this research has demonstrated that the instructors develop more confidence in a subset of skills, including adaptability, communication, collaboration and creativity through their STEM outreach instructor experience. We have also identified opportunities to help instructors build awareness in the skills they are developing, the importance of work-training integration, and the unexpected benefit of STEM outreach work reigniting interest in one’s field of study.

We also reported findings that make a comparison between two very different years and types of STEM outreach programming. Findings of increased competencies was found to be fairly consistent despite introduced differences in how program participants were reached.

There is a need to further explore some of the inconsistencies between the data sources - for example, while leadership was self-reported by the instructors as a top skill developed in the initial survey, the instructors interviewed did not describe leadership as a key area of development in their experience. There was also a lack of focus on leadership in the training - along with innovation & creativity and self-awareness, even though those future skills were emphasized more by the instructors across different data sources. Another inconsistency is in adaptability - the activities and skills associated with adaptability on the RBC survey demonstrated a decline between the pre and post survey, despite instructors naming adaptability as a top future skill developed in the post survey.

Our work to date in program mapping has demonstrated that there is a fair degree of consistency in both the training and work experience of the nearly 1000 instructors who work for Actua at different member sites. Further, the combined impact of that training and work experience shows consistency in the skill development of future employability skills across these programs. The process of developing a future skills framework for STEM outreach instructors demonstrated that the future skills relevant to outreach, according to program directors, instructors and training materials, are in line with other relevant skills frameworks that are utilized in undergraduate STEM education.

The work has also demonstrated that there are some opportunities to offer more thorough reflection mechanisms for instructors to gain their own awareness and vocabulary of the transferable skills they are developing through this work. Across the organization, we need to communicate the desired skill development for instructors to the instructors, so they are aware of our goals and the linkages between outreach training/work and the development of future skills.

Since the collection of this data, we have commenced work on the development and delivery of training modules for program instructors; future work will document that creation and
assessment of these modules. The training modules allow us to encourage consistent learning outcomes in the main topic areas required for program delivery, but which also integrate explicit opportunities for reflection on the development of future skills. This cross referencing work will be complemented by a stand-alone training and reflection tools for instructors to identify and exercise their own familiarity with the list of future skills and how their work experience can be transferable to future employment. We are also working on a set of modules for director training, providing “train the trainer” support to program directors, who serve as the main supervisors of the program instructors. These modules will emphasize best practices on skill development in the workplace, tools and practices for making the most of limited onboarding and training opportunities, and best practices on providing feedback and encouraging instructors to be intentional about skill development. A future paper will describe the implementation and assessment of these modules in the context of reinforcing our Future Skills Framework.

Finally, while the Future Skills Framework was designed and assessed in a STEM Outreach context, given in particular the validation of the framework with STEM employers, there is potential for relevance across a variety of work-integrated learning opportunities, including internships and co-op programs, as well as both course-based and co-curricular experiential activities. The assessment of future skills and their development in these activities can support engineering programs in identifying the link between experiential learning and workplace readiness, as well as the gaps in these experiences that could be addressed through various program enhancements.

Acknowledgements

We would like to acknowledge RBC Foundation for their valued investment, in support of RBC Future Launch, toward Actua’s Future Skills Project. We would also like to acknowledge the STEM outreach instructors who shared their perspectives.

References


