OPERATION MINERVA

Planning Guide for Educators

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Hosted and sponsored by:

AWSN NSERC CRSNG

About the guide

The “Operation Minerva Planning Guide for Educators” has been prepared to assist educators in planning and hosting Science, Technology, Math and Science (STEM) mentorship programs for grade 8 girls. The guide is a starting point to be adapted and molded to fit each group’s needs. Alberta specific information and links are provided from 2021, though the overall program is easily adapted to bring benefit to students from any geographic area. The strategies and information can also be used to expose any under-represented segment of junior high students to STEM opportunities through exposure to mentors with similar life experiences to the students.

“If you can see it, you can be it”

This phrase has been attributed to and used by many people and been adopted in many arenas lacking in diversity. It is important that youth are exposed to examples of people with similar life experiences in all arenas in order to increase and encourage diverse participation and inclusion.

Reach out to AWSN with any questions, feedback or support needs.

Introduction

The Operation Minerva (OM) Program has been running in Calgary since 1988, stewarded by AWSN from 1993-2019 and by Telus SPARK since 2019, and is designed to provide Grade 8 girls with a one day hands-on experience in STEM workplaces throughout Calgary. OM seeks to maintain, foster and promote interest in STEM paths by encouraging female students to continue their science studies in high school, university, and as a career choice. After participating in Operation Minerva, an increased number of girls choose to pursue post-secondary education with further studies or careers in STEM (MacDonald, 2006).

OM's focus is placed on Grade 8 girls because studies show that this is the age when they will lose interest and confidence in STEM due to societal pressures and perceived gender norms (MacDonald, 2006). While the program has historically served girls, the same model could be used to reach all under-represented genders with appropriate curation of gender diverse mentors and students.

For the one day program, young women meet peers from all across the city and job shadow women in their STEM workplace. This is a unique opportunity as it does not rely on students having a connection to someone in the workplace (e.g. Bring Your Kid to Work Day). Additionally, the program immerses youth into the workplace instead of bringing a speaker into the classroom, which enables interaction with a wide network of both of their peers and female STEM mentors.

The vision for the program has been to broaden its reach and support areas of Calgary that have been less active in the existing program. In 2019, AWSN was the recipient of a 3 year NSERC grant to design and pilot an OM expansion, culminating with the production of documentation to share with educators to help them host their own Operation Minerva events for grade 8 girls, typically including all of the grade 8 girls from one school. The program was also expanded to include 3 sessions over the course of the school year for the same students to increase their exposure to varied STEM career options and mentors.

AWSN Background

AWSN has been fostering connections between 30+ STEM initiatives and member organizations from across the province since 1993, when STEM advocates from across Alberta, including OM, created a non-profit centralized hub called the Alberta Women's Science Network (AWSN). With a focus on Recruiting, Retaining and Recognizing under-represented populations in STEM fields, AWSN connects, unites, supports and

promotes STEM programs throughout the province. As a network, AWSN creates a collaborative environment where member groups and volunteers help each other, learning from each others' experiences, successes and challenges. AWSN activities focus on supporting host programs through funding, in-kind support and volunteer resource connections.

AWSN Mission:

Enabling a culture of diversity and inclusivity through STEM Programs.

AWSN Vision:

A transformed future with equal opportunity for all in STEM.

In-person and virtual presentation options

While OM has historically been an in-person event enabling interaction with a wide variety of mentors, peers and STEM environments, the COVID-19 pandemic and resulting lockdowns in March 2020 forced a redesign of the planned in-person program. Year one of the pilot program saw the same two groups of students participate in two full-day mentorship opportunities before in-person gathering was restricted. Year two exposed two groups of students to three separate one-hour webinars over the course of the 2020-2021 school year.

Included in this document are suggested planning operations for both in-person and virtual programs. Aside from the different logistical accommodations required for each option (see suggested planning details in Appendix 1 (in-person) and Appendix 2 (virtual)), we have highlighted some benefits of each method of delivery:

The benefits of one-day immersive programs lie in relationship building between students and mentors, often resulting in a more interactive experience as students gain comfort with the mentors and environment over the course of the day. Students have more opportunity to ask spontaneous questions, experience office spaces and hands-on activities to increase interest in STEM pursuits.

Virtual sessions present a unique opportunity to introduce students to geographically diverse mentors and work opportunities. Being able to prepare video content ahead of webinars offers flexibility in highlighting lab work, field work and other workspaces that

students would not otherwise have access to due to security, safety or location issues. Virtual sessions also remove transportation and physical accessibility barriers and ensure that all students are able to attend scheduled sessions as long as they have a compatible device with internet access.

Student selection criteria

OM is a mentorship event that connects Grade 8 girls with professional women working in STEM fields. In addition to the long-standing one day Calgary event in May, OM is providing this guide for a new format of the program to better target students who may not have the support or role models in their lives that would encourage them to enter STEM fields.

Many students who enroll in the traditional one-day OM program are already on a path to a career in STEM, are encouraged by parents or other family members working in STEM fields, or are supported by well-funded academic programs. Although OM is still an interesting experience for these students, the goal of the NSERC funded program expansion is to connect with students who may not otherwise have considered pursuing a career in STEM, despite their abilities or interest in STEM subjects.

When selecting students, consider:

- Students who show promise in STEM subjects and are interested in pursuing a STEM degree, but face financial or cultural barriers in doing so
- Students who demonstrate ability in STEM subjects, but lack confidence, interest or motivation to pursue further studies in STEM
- Students who are generally strong academically, but identify primarily with Arts subjects
- Students who are generally average academically, but have an interest in maker culture, design, coding, technology, space exploration, or new scientific or medical research
- Students should be Grade 8 females (or other chosen historically marginalized populations that are represented in the program mentors)

Company and mentor recruitment

Appendix 5 includes a sample of past participating companies. When approaching potential participants, it can be helpful to highlight that all parties benefit from participation in OM. Increasing diversity and inclusion across STEM fields leads to increased profits and innovation, as well as increased productivity and employee satisfaction (Forbes, 2019). Job seekers indicate that a diverse workforce is an important factor in considering potential employers, with approximately 1 in 3 job seekers indicating that they would not apply to a company that lacks diversity in its workforce (glassdoor, 2020).

Participation in increasing equity, diversity and inclusion in post-secondary programs through OM will lead to industry benefits for years to come.

Appendix 1: In-person event planning details

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In-person full day mentorship suggested planning timeline

September

- Schedule OM days - up to 3 to expose students to various career options
- Put a process in place for obtaining police checks from Mentor Companies
- Compile contact information for potential mentor companies and initiate contact
- Book substitute teachers
- Book busses

8-12 weeks before event

- Confirm company participation
- Provide Mentor registration package (details of requirements: insurance, police checks, lunches, programming best practices, career options) See *Mentor Company registration information and best practices* on following pages

4 weeks before event

- Prep Schedule handout for students
- Prep information binders for Teacher Bus Supervisors with: pick up & drop off lists (including emergency contacts and all other documentation required by school), extra risk and photo waivers, extra schedules

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In-person mentor company registration information

1. Company name
2. Primary contact
    a. Name
    b. Job title
    c. E-mail address
    d. Mobile phone number
3. Secondary contact
    a. Name
    b. Job title
    c. E-mail address
    d. Mobile phone number
4. Student drop-off location
5. Are there any on-site allergens participants should be made aware of?
6. Do you require a waiver form?
7. Do you have company liability insurance up to [fill in the required amount]?
8. Do your mentors have current vulnerable sector Police Information Checks? If yes, we ask that you send the file to us. If not, we will provide information on how to go about obtaining one.
9. Will lunch be provided for participants?
10. What is the dress code for participants?
11. What hands-on activities do you have planned for the participants?
    a. If possible, refer to relevant program of studies to incorporate learning outcomes
        i. Alberta Education Science Program of Studies
        ii. Alberta Education Math Program of Studies
        iii. Alberta Education Career and Technology Foundations Program of Studies
        iv. Alberta Education Information and Communication Technology Program of Studies
12. Any additional information you would like to share?

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In-person Program Best Practices

Logistics

- Students will always need to be in the same room as one of their school-approved supervisors (teacher or parent volunteer)
- Create opportunities for casual social interactions with mentors. Students are not likely to ask a question in front of a whole room, but incredible conversations happen in small groups and when students/mentors eat lunch together
- Break into smaller groups (max 5 students) to maximize engagement with hands-on activities. If space is a concern, split up into groups of 10-15 and rotate through activities in different time blocks
- Minimize travel time around the facility when possible to maximize time doing things or meeting people
- Do some activities seated to save energy
- English Language Learners may have some difficulty following conversations, but will still benefit from being in the room

Mentors

- Share your personal experiences and professional path, this helps students imagine themselves taking that path (including setbacks - maybe you failed physics the 1st time!)
- Take a positive angle: Instead of emphasizing a lack of women or stereotypes of who is/is not in the industry, model examples of inclusion, resilience and engagement
- The majority of mentors should be women! It's awesome when men are allies to women in STEM, but it's important that girls see people they identify with in these roles
- Consider the identities of the students coming to visit you: race, faith, and sexuality are also factors for inclusion, are there mentors that share these student identities?

Activities

- Should connect concepts, processes or tasks from the industry and/or jobs to Grade 8 curriculum (see Science, Math, CTF, ICT programs of study, links to Alberta Education included)
- Should reflect or be connected to what people do in their roles, but does not have to be a direct job-shadow experience (spreadsheets and emails aren't fun!)
- Should be hands-on, project-based, and involve collaboration and problem-solving
- Mentors are there to guide and talk to students, but do not need to over-explain or do tasks for students. In Grade 8, students are capable of designing and executing experiments, if given the project parameters!
- A payoff or take-home element helps build engagement and counters short attention spans. If students aren't able to do something themselves or see a result from their work, they'll lose interest
- In classroom environments, girls will often take on a note-taking role, and let boys do the hands-on tasks. This is an opportunity to get their hands on things!
- A tour of the facility should give an idea of how the organization is structured, the different roles and teams, and how people work. Workspaces can be a bit unremarkable, but if there's a particularly interesting space (a lab, prototyping, coworking, special machinery) that is the space you want to visit!

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In-person Itinerary (sample)

Logistics

Company:

Company address:

Date:

Time: 9:00 AM - 2:00 PM

Contact list:
Primary company contact

Secondary company contact

Agenda

Time	Action	Responsibility	Actions
9:00 am	Bus Arrives for drop off		
9:00 – 9:30	Welcome, introductions and sign in		
9:30 – 10:30	Activity #1 – Team Building & Tour		
10:30 – 11:30	Activity #2		
11:30 – 12:30	Lunch and Photo Booth		
12:30 – 1:30	Activity #3		
1:30 – 1:45	Cleanup and closing		
1:45 – 2:00	Bus arrives for pickup		

Activity #1- Team building activity hosted by [abc] which will include 2-3 fun activities from 9:30-10:30

Activity outline

Activity #2: hosted by [abc] from 10:30-11:30

Activity outline including learning outcomes

Lunch:

Add lunch details (hosted by company or bring your own)

Activity #3: hosted by [abc] from 12:30-1:30

Activity outline including learning outcomes

Appendix 2: Virtual event planning details

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Virtual mentorship suggested planning timeline

Ideal sessions have 2 complementary organizations each provide 1-2 volunteer mentors for one 55-75 minute webinar.

September

- Schedule OM sessions - up to 3 x 55-75 minute webinars to expose students to various career options
- Book substitute teachers as required
- Compile contact information for potential mentor companies and initiate contact

8-12 weeks before event

- Confirm company participation
- Provide Mentor registration package (details of requirements: volunteer commitment, video submission guidelines) See *volunteer panelist commitment and video submission guidelines* on following pages

3 weeks before event

- Obtain video and mentor headshots and bio
- Prepare one-pager for student review, share with students

1 week before event

- Meet with participating students to formulate questions to present to the mentors

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Virtual volunteer panelist commitment

Operation Minerva (OM) exists to share womens' experience in STEM fields with grade 8 female students ahead of high school course selection.

- One hour virtual session (adjust session length as needed)
- Panelists commit to showing up online for a one hour time slot scheduled at the discretion of participating schools at least 2 weeks in advance
- **Provide headshot and ~100 word bio to teacher 3 weeks before the scheduled event**
- Program outline (adjust times to match session length):
    - Opening remarks and land acknowledgment [5 minutes]
    - Present 2 x 3-5 minute videos provided by participating companies (videos provided in advance and shared by teacher) [10 minutes]
    - Panelist introductions (led by teacher, **panelists will have 1-2 minutes to introduce themselves**) [10 minutes]
    - Live Q&A moderated by teacher; **questions asked of panelists by moderator and students**. [25 minutes]
    - Closing remarks [10 minutes]

Virtual session conversation topics & questions

- Don't be afraid to get personal! It's important that students see all the parts of your professional journey, so they can relate to you and imagine themselves taking a similar journey
- Get specific! Don't assume students understand how the post-secondary system works, or the purpose of your work, etc. The host will ask a lot of "why" questions!

Possible topics and questions:

- What were your interests as a teenager?
- What classes did you take in High School? What did you like or dislike?
- How do you approach learning or studying something that is difficult for you?
- Did your family encourage you or expect you to study STEM while you were growing up?
- How did you decide what/where to study for your undergraduate degree?
- What has been your most challenging/inspirational/engaging experience on this journey?
- Did you have any mentorship/internship/workplace experiences that helped you decide what you wanted to do?
- What really captures your passion for the field you study in? What motivates you and gets you excited?
- Why do you think underrepresented people should go into STEM?
- What words or roles would you use to define yourself?
- What stage of your career journey are you on now and what is your planned trajectory?
- What is the most challenging situation that you have overcome?
- What makes you feel included in a STEM work or school environment?

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Virtual video submission guidelines

Operation Minerva exists to share womens' experience in STEM fields with grade 8 female students ahead of high school course selection. We will start virtual sessions with short 3-5 minute video compilations introducing students to the broad options available in STEM careers.

Video Conversation Topics & Questions

- Please submit videos to organizer at least 3 weeks prior to event
- Don't be afraid to get personal! It's important that students see all the parts of your professional journey, so they can relate to you and imagine themselves taking a similar journey
- Get specific! Don't assume students understand how the post-secondary system works, know the purpose of your work, etc.
- Some questions/statements to guide you:
    - Overview of your field/what you do: purpose, main goals and projects
    - What stage of your career journey are you on right now?
    - What really captures your passion for the field you study in? What motivates you and gets you excited?
    - What was your most challenging or dis-engaging experience that you have overcome?

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Virtual session intro page

Promoting STEM to Grade 8 students

[Insert date and time, adjust times below]

Introduction and Opening Questions: 15 minutes
Live Q&A: 25 minutes
Wrap-up: 10 minutes

Mentors:

100 word mentor #1 bio

100 word mentor #2 bio

Appendix 3: STEM Student Resources

Want more experiences related to Science, Tech, Engineering, Math and related careers?

- **First Robotics** https://www.firstinspires.org/robotics/frc
    - **Intimitrons - Robotics Competition Team** https://intimitrons.ca/
      Western Canada's first all-girls First Robotics team! Recruiting team members from grade 9-12

- **CyberMentor** https://cybermentor.ca/
  Cybermentor offers online mentorship and outreach programs for youth who face barriers to accessing STEAM education

- **IndigeSTEAM** https://indigesteam.ca/
    - **Power to Choose** https://indigesteam.ca/power-to-choose
      Summer STEM mentorship program for indigenous youth (grade 7-12) with indigenous mentors

- **Engineers Canada - National Engineering Month**
  https://exploreengineering.ca/
  Online resource to learn about engineering fields, how to become an engineer, and profiles of people working in engineering

- **Simone Giertz** - YouTube
  https://www.youtube.com/channel/UC3KEoMzNz8eYnwBC34RaKCQ/
  A "non-engineer" building and engineering all kinds of wild projects on YouTube

- **APEGA** https://www.apega.ca/educators-students/
  Association of Professional Engineers and Geoscientists of Alberta. Student and teacher programs like Science Fairs, Teacher Conferences and a pilot of a semester-long STEM immersion program.

- **The STEM Girl** https://www.thestemgirl.com/
  The STEM Girl teaches parents, educators and young girls the steps for a successful future in STEM.

- **Beakerhead Digital Discussions** https://digitaldiscussions.beakerhead.com/
  Enriched learning linked directly to curriculum.

Appendix 4: Operation Minerva student video project

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Student Video Project

Video Goals

- Show the next class of Grade 8 girls why they should consider STEM, and get them excited to try Operation Minerva
- Reflect on your thoughts & feelings about the Operation Minerva experience

Video Content

- Explain how Operation Minerva works to someone who's never heard of it
- Explain why it's important for women to be engaged in STEM
- Show some of the field trip experiences
- Student testimonials - what you learned, how it changed your perspective, what was interesting or cool

To Prepare:

Storyboard

Explain chronologically what is going to happen in your video. Try to break it down to 5-10 second sections. Can be a written description, or images/sketches. See example on page 3.

Try a practice storyboard based on a short YouTube video (2 minutes or so) to warm up!

Shot List

Based on your storyboard, what do you need to capture on video? As well as what you've described in your storyboard, include any other cool ideas for shots, even if you're not sure how they'll fit in yet. It's better to have too much content than not enough! You might find as you put the video together, that you end up using shots differently than you had planned-- that is totally OK!

Script

There will likely be speaking in your storyboard, either voiceovers or interviews. For interviews or testimonials, make a note of approximately what you'd like the person to be talking about. For voiceovers, you can write a specific script for someone to read.

Possible Project Schedule (based on 2 mentor company visits, Feb 20th and May 28th)

February 10th - February 20th
Students to draft video storyboard, shot list & script

February 20th
Trip to mentor company #1
Teachers to record shots during trip according to shot list

February 24th - March 6th
Students to record testimonials and gather images from mentor company visit

March 9th - March 20th
Students to put together first edit of video, including music and voiceovers

March 30th - April 10th
Students to record any missing testimonial shots or voiceovers, and edit into video

May 28th
Trip to mentor company #2
Teachers to record shots during trip, according to list of missing shots prepared by students

June 1st - June 12th
Teachers share shots from mentor company #2, as needed
Students to edit mentor company #2 shots into video
VIDEO DONE!!!

Example Storyboard / Shot List

Science Genius Rap Battles Video - Beakerhead
https://www.youtube.com/watch?v=wmJd4cLQ1U0&feature=youtu.be

Intro: 20 seconds
0:00-0:03: program logos
0:03-0:10: quick cuts between performance shots and workshop shots, high energy
0:10-0:18: student rap demo

Explain program: 40 seconds
0:18-0:25: teacher explaining purpose of program
0:25-0:35: shots of workshops, with program coordinator voiceover

School Example 1: 1 minute 15 seconds
0:35-0:55: teacher testimonial, cut with shots of workshops
0:55-0:58: transition to student rap demo
0:59 - 1:09: student rap demo
1:09-1:20: student testimonial
1:21-1:34: student rap demo
1:35-1:45: student testimonial

Explain program: 15 seconds
1:45-2:00: Teacher explaining program over shots of workshops

School Example 2: 40 seconds
2:00-2:15: shot of facilitator working with students
2:15 - 2:26: teacher testimonial, cut with shots of workshops
2:27- 2:37: facilitator testimonial, cut with shots of workshops

Finals: 1 minute 15 seconds
2:38- 2:48: Introduction/transition: voiceover explanation of finals, cut with shots of outside building and stage
2:48 - 2:58: Shots of one performing group, cut with shots of crowd
2:59 - 3:04: Parent testimonial, cut with shots of performing students
3:05 - 3:19: Shots of second performing group
3:20 - 3:29: Testimonial of student performer, cut with shots from the performance
3:30 - 3:48: Parent testimonial, cut with shots from performances

Outro: 6 seconds
3:48 - 3:54: program and sponsor logos

Appendix 5: Sample of participating companies 2019-2021

- BGC Engineering
- University of Calgary Global Research Institute
- SAIT, School of Construction
- Benevity
- Stantec
- Enmax
- Urban Systems
- Wood Canada Limited, Downstream & Chemicals
- KCP Energy
- Longview Systems
- Calgary Zoo
- Alberta Bat Community Program