THE UNIVERSITY OF BRITISH COLUMBIA
Faculty of Education

Master of Educational Technology Program

Professional Development on Makerspaces

Curriculum Area: Professional Development for Middle School Teachers (ADST Focus) **Grade:** 6-9 Educators

Teacher(s): Amanda Botelho, Harleen Deol, Neal Donegani, Danielle Lusk, Brendan Stanford,

THE UNIVERSITY OF BRITISH COLUMBIA

Vancouver Campus

Master of Educational Technology

Professional Development on Makerspaces - Unit Plan

Curriculum Area: Professional Development for Middle School Teachers (ADST Focus)

Grade: 6-9 Educators

Strands: BC's Three Core Competencies: Communication, Thinking, and Personal and Social

Teacher(s): Amanda Botelho, Harleen Deol, Neal Donegani, Danielle Lusk, Brendan Stanford,

Assistive Technologies and Tools: Google Read & Write, Google Translate, Auditory Aids, Visual Aids (multimodal presentations and approaches), Alternate Assessments, etc.

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Lesson Overview

1. **Introduction:** Maker Mentality and Empathy, Danielle Lusk

- Participants will learn about the concept of intersectionality and how in turn, they consider empathy in conjunction with EDIDA frameworks. Participants are then encouraged to consider implementing makerspace frameworks and mentalities into their pedagogy and educational practices.
- Participants will participate in a provocation that helps me to start thinking about maker mentality in juxtaposition to empathy.
- During their first maker challenge, participants will work through a treasure hunt to start compiling potential materials that exist within a no-tech makerspace.

2. **No Tech**: Intro to Cardboard, Brendan Stanford

- Participants will apply what they gather from completing an empathy interview to create a bag for their partner. The bag will represent their partners needs, wants, etc. - Participants will engage in a hands-on challenge using cardboard to create a bag for their partner.
- Participants will use the design thinking process to create a bag for their partner.

3. **Low Tech**: Video Production, Harleen Deol

- Participants will learn about what GIFS are, how they can be used in lessons, and how to create their own on the website, http://giphy.com. This session will also focus on how people of color are represented in GIF/meme culture and how as creators we can break and avoid stereotypes in popular media.

4**. High Tech A:** Textiles With Tech, Neal Donegani

- Participants will sew beads and will code LED lights through a programmed circuit using a Microbit and conductive thread to help tell someone else's story through the beading and LED design on a moccasin vamp.
- Participants will apply the methodology in completing the empathy interview as they fill out the empathy interview sheets.
- Participants will reflect on their peer's background knowledge, life experiences, and personal identities within the artifacts they create for their peers (through FlipGrid). - **Lesson Extension**: Research where the materials from the machines come from for a territorial acknowledgement (i.e. Where are Micro:bits created?/Where is the headquarters of Microsoft and who lives there?

5. **High Tech B:** Sphero Shoe, Amanda Botelho

- Participants will apply what they gather from completing an empathy interview to create a shoe that demonstrates their partner's identity.
- Participants will engage in a hands-on challenge using any materials available to create a shoe representing their partner identity.
- Participants will code the sphero or use it in drive mode while sharing about their partner. - Participants will use the design thinking process to create a shoe for their partner.

Culminating Task Description:

- At the end of each lesson there will be a summative assessment
- When all lessons are complete teachers will be asked to use one of the above levels of tech to express their identity within a makerspace to create a Personal Identity Artifact - Please refer to our FlipGrid to post your final "Here's what" to demonstrate what you have then applied to your classroom for your students

Lesson Extensions

- Research where the materials from the machines come from for a territorial acknowledgement. (i.e. Where are Micro:bits created?/Where is the headquarters of Microsoft and who lives there?)
- An environment can be created to drive the shoe through or the shoe can be taken to a new environment to add to the story of their partner's shoe.

Unit Overview

Expectations/ Competencies *Overall expectations (Link to list of specific expectations addressed)*	**"Big Idea"** *This will be the overriding theme, question, focus for the teaching and learning inquiry.*	**Learning Goal(s)** *(Can be overall; might change throughout inquiry)*

Specific Competencies we want teachers to leave with: Makerspaces - Understanding who a maker is. - Be able to identify what makerspaces look like. - Differentiating between no tech, low tech, and high tech tools. - Understanding maker mentality, tinkering, and attempting the design-thinking process. - Participating in different makerspace challenges and experiencing positive failure. Foundational knowledge regarding intersectionality - What is privilege - What is intersectionality - How do these two forces have the potential to interact within the classroom and society - How do we become more conscientious of these forces and how to create sustainable and inclusive activities for our students Familiarity with 3 novel technologies	To encourage teachers to implement makerspace frameworks and maker mentality within their pedagogy and educational practices. To encourage teachers to consider the role of empathy and EDIDA frameworks within their teaching practices in relation to makerspaces.	- Demonstrate a maker mentality within their classrooms - Understand the difference between a fixed and a growth mindset - Can identify at least one no tech, low tech, and high tech tool. - Demonstrate adherence to CRP tenets - Understand how to apply EDIDA within a makerspace - Apply their own background knowledge and experiences to projects - Demonstrate their knowledge through an artifact representing their personal identity. Be able to: - Recall what a makerspace and maker mentality is. - Identify at least one no tech, low tech, or high tech tool. - Differentiate between fixed a growth mindset. - Apply CRP tenets in their making.

- Cardboard - Micro:bit - Video Production		- Apply their own background knowledge and experiences to projects. - Define what the EDIDA framework is and how it can be applied to future lessons. - Design or construct an artifact representing their personal identity.

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Assessment

Assessment For **Diagnostic Assessment** *(At the start of the cycle/unit)*	**Assessment As** *The overall teaching should prepare students to complete this task.*	**Assessment Of** **Culminating Assessment Task** *(At the end of the cycle/unit)*

Introductory Lesson: - Mentimeter to establish an understanding of the learners current level of foundational knowledge Cardboard: - Brainstorm (Think) and Empathy Interview (Pair & Share) to identify and articulate component parts of one's identity & culture Video Production: - Teacher's will answer a question to check their understanding of what a GIF/meme is. Textiles & Tech: - Questions before the "Roc Your Mocs" slides and video - Ask group who has hand-sewn before - Ask group who has worked with Micro:Bits before Spheros: - Graffiti wall - Teacher's will engage in dialogue to show their prior knowledge of Sphero and coding.	Ongoing peer feedback: - Observations - Critical conversations - Demonstration - teacher and peers FlipGrid: - Flipgrid: (What? So What? Now What?) - at the end of each lesson - Flipgrid: "Here's What" at the end of the unit	Personal Identity Artifact - Learners will be asked to create a final artifact using one (or more) technologies taught throughout the unit to demonstrate their learning - Learners are encouraged to reflect on how (or how not) their pedagogy or teaching philosophy has changed or adapted - The final artifact will be a reflection of the learner's identity which considers their personal intersectional context One-Point Rubric: - Does the artifact utilize one of the technologies taught throughout the unit? - Does the learner reflect on their learning? - Does the artifact demonstrate one's identity? - Does the artifact consider one's intersectional context?

Conceptual Development, EDIDA, and Rationale

Summary (DESCRIPTION) Conceptual Development *200-300 words*	**Equity, Diversity, Inclusion, Decolonization, Anti-racism (EDIDA)** *How the unit is situated in EDIDA*	**Rationale** *Why it matters to student, why it matters to community, why it matters to world, how it connects to STEAM, EDIDA, TPACK/SAMR*

We are creating a unit to introduce classroom teachers to makerspace pedagogy and EDIDA frameworks. Our intention is to ensure that teachers adhere to the diverse learning needs of their students while remaining conscientious of their cultural backgrounds and identities. These tasks will ensure teachers remain reflective in their own learning as a maker and a development of their growth mindset. This unit will include activities focused on educators incorporating their background knowledge, life experiences, and personal identities within the artifacts they create while providing foundational knowledge regarding intersectionality and empathy. Educators can choose to attend some or all of the sessions to further encourage autonomy as a learner. Session one is mandatory as it is foundational knowledge throughout the various lessons/maker challenges.

This unit is meaningful for educators regardless of their current experience within makerspaces. By providing multiple entry points within our unit plan, teachers can feel comfortable joining in at their current comfort level. By offering foundational knowledge for teachers, our intention is to motivate teachers to apply a maker mentality and demonstrate positive failure to their future lessons within the unit. Characteristics inherent within a community of makers and makification includes (as cited in Cohen et al., 2016, p. 220):

- Physical making that employs multidisciplinary approaches to solving problems
- Sharing ideas and artifacts with others
- Iteration that has a failure-positive approach
- Individual autonomy that empowers maker/learner choices and control

Following this unit plan, teachers can apply their learning by providing their students opportunities and abilities to develop a variety of skills derived from makerspace activities that are critical for a 21st-century learner. 21st-century skills include (*21st century competencies*, 2015, p. 12-13):

1. Critical Thinking 3. Communication
2. Collaboration 4. Creativity and Innovation

These opportunities to develop such 21st-century skills are demonstrative throughout the following frameworks:

- Transformative Pedagogy of Multiliteracies (Cope & Kalantzis, 2009, p. 184-186)
    1. Experiencing (the known and the new)

2. Conceptualizing (by naming and by theory)
3. Analyzing (functionally, critically)
4. Applying (appropriately and creatively)

- Constructivism:
    - A learning framework that establishes knowledge through "making an artifact for and with other people, which, to be built, requires the builders to use that understanding" (Holbert, et al., 2020, p. 1)

- Constructionism:
    - Participants construct knowledge when they collaborate in the making and public sharing of an artifact to demonstrate their learning. This aligns with Piagetian constructivist views of learning, which hold that the process of learning involves the active construction of knowledge and the continual revision of mental representations of that learning. (Cohen, et al., 2017, p. 219)

- Inquiry:
    - The instructional design principles (Han et al., 2020, p. 158)
        1. Engage learners in higher-order problem solving activities that focus on cross-disciplinary integration
        2. Engagement → Exploration → Execution → Exhibition → Evaluation
        3. Flexible with the mode of collaboration (role-based or task-based)
        4. Comprehensive and detailed scaffolding
        5. Manipulate the similarity of the learning task for different classes to promote both near-transfer and far-transfer of learning
        6. Increase class time when needed to allow for more learner exploration, teacher facilitation, project demonstration, and reflection

The EDIDA frameworks and professional resources will serve as foundational knowledge to assist educators in creating lesson plans with a direct focus on inclusion and student identity reflected in their making. EDIDA frameworks are reflected through the following:

- Equitable:
    - Principles for Equity-Centered Design (Castek et al., 2019, p. 4-10)
        1. Support Generative Justice of Community Empowerment
        2. Build Networks
        3. Develop Innovative Assessments
        4. Support Innovative Professional Learning
- Diverse
    - Guidelines for Makerspaces (Dousay, 2017, p. 72)
        1. Accepting and learning from failure
        2. Encouraging experimentation
        3. Supporting unintentional consequences of damage to equipment

4. Facilitating collaboration

- Inclusive
  - Guiding Principles of Makerspaces & Libraries (Yi & Baumann, 2018, p. 3-4)
    1. The Design of the Physical Space - Accessibility
       - Physical and Virtual
    2. Inclusion
       - Opennenes and welcoming
    3. Diversity
       - Diverse population of users
       - Diverse purposes for usage
       - Diverse tools and supplies
       - Diverse training and instruction styles
- Decolonization
  - First Peoples Principles of Learning (*First peoples principles,* n.d.)
    - Learning ultimately supports the well-being of the self, the family, the community, the land, the spirits, and the ancestors
    - Learning is holistic, reflexive, reflective, experiential, and relational (focused on connectedness on reciprocal relationships, and a sense of space)
    - Learning involves recognizing the consequences of one's actions
    - Learning involves generational roles and responsibilities
    - Learning recognizes the role of indigenous knowledge
    - Learning is embedded in memory, history, and story
    - Learning involves patience and time
    - Learning requires exploration of one's identity
    - Learning involves recognizing that some knowledge is sacred and only shared with permission and/or in certain situations
- Anti-Racism
  - Culturally Responsive Tenets (Kye, 202, p. 2)
    1. Developing a knowledge base about cultural diversity
    2. Including ethnic and cultural diversity content in the curriculum
    3. Demonstrating Caring and building learning communities
    4. Communicating with ethnically diverse students
    5. Responding to ethnic diversity in the delivery of instruction

Moreover, this unit will have educators start thinking about technology (no, low-, or high- technology) in a way that can "transform a student's experience" (*SAMR Model*, 2021), overall equipping teachers with tangible tools to become 21st-century educators.

Instructional Strategies & Approaches

Accommodations	Maker Challenges, Inquiry, Design-Based Thinking, & STEAM	Collaborative & Instructional Strategies
- Visuals aids - Multimodal presentations - Multimodal approaches - Auditory aids - Google R&W - Choice of which lessons to attend. - Record and post lessons to an LMS. - Provide alternatives to assessment. - Printed and online materials. - Multiple ways to access learning materials and lessons.	Inquiry: - Promote discovery and investigation - Develop skills to seek new information - Assess problems and needs and develop potential solutions Design-Based Thinking: - Provocations prompt participants to begin with empathy - Empathy interviews throughout the unit are designed to be iterative - Public sharing allows for prototype feedback and refinement Lesson 1: “Sweet Cocoon” animated short - Video exemplifies empathy within a positive failure approach to solving a problem - Teachers are asked to consider how we approach challenges and how does our perspective change when	Experiential Learning: - Teachers will interact with the activities and reflect on their learning Interactive Instruction: - All 5 lessons will have collaborative challenges for teachers to participate in. - Discussion and sharing. - Building a community of learners. Inquiry - Instructional design principles - Engagement → Exploration → Execution → Exhibition → Evaluation

	collaborating with others Lesson 2: Empathy Interview & Make a Bag Challenge – Multi-phase Empthay Interview prompts participants to learn about & appreciate the experiences of others – Participants must consolidate their interview findings to decide how to best design a solution for someone else's needs Lesson 3: Think-Pair-Share: 1) What is a	Design-Based Learning - Empathy - Iterative Designs through defining a problem, ideating, prototyping, testing, and assessing

	meme? What is a GIF? What is the difference between the two? - Have teachers do a google search of GIFs and memes and use these specific keywords: - Annoyed GIF - Sassy GIF - Happy GIF - Angry GIF - Unbothered GIF - Ask teachers to take note of what images they find. - Who is being represented in these images? - How are people of color represented in meme/GIF cultures? - Are all GIFs okay for everyone to use? - If you sent or used a GIF before, what have you considered before choosing one? Lesson 4: With facilitation from the Indigenous Education Support have participants go through slides (with video) on “Roc Your Mocs Week”. - After the video ask the following questions again: - What is a Moccasin? - When do you would give moccasins to someone? Empathy Interview: – Multi-phase empthay interview prompts participants to learn about & appreciate the experiences of others – Participants must consolidate their interview findings to decide how to best design a solution for someone else’s needs STEAM: - Include choice into making - Each maker will create unique prototypes to solve equally unique

	user problems - Makers will incorporate beading, sewing and computer code intentionally within their designs Lesson 5: Video: "Putting Yourself In Someone Else's Shoes" - Video exemplifies empathy and the story behind everyone's shoes - Discussion around assumptions of someone's identity - Graffiti wall and reflection Design Cycle Scaffold Guide - Create tests, prototypes - Providing opportunities to share their making and learning. STEAM: - Include choice into making - Each maker will create unique prototypes to solve equally unique user problems - Makers will incorporate art intentionally within their designs

Resources, Concepts, and Connections

Tech-Enabled Learning	**Professional Resources**	**Subject Specific Concepts**	**Connection to Current Events & Issues**	**Communication**

- Google Slides Lesson -Mobile Devices (Phone/Tablet) for flipgrid -text to speech/speech to text	- Critically Responsive Pedagogy (CRP) tenets (Kye, 2020) - First Peoples Principles of Learning (FPPL) -Multiliteracies pedagogies (Cope & Kalantzis, 2009) - Principles for equity-centered design (Castek et al., 2019) - Guiding principles for designing an accessible, inclusive, and diverse library makerspace (Yi & Bauman, 2018) - Instructional Design Principles (Han et al., 2020)	- BC Applied Design, Skills and Technologies (ADST) Curriculum - BC Core Competencies - First Peoples Principles of Learning (FPPL)	- Development of 21st-century competencies for students (Critical Thinking, Communication, Collaboration, & Creativity and Innovation) - Throughout the lessons, teachers are encouraged to consider their intersectionality and how their positionality exhibits or does not exhibit power within today's society -Participants are encouraged to look at the assumptions we make with one's	Teachers are encouraged to share their learning, successes, and potential struggles throughout the following: - Flipgrid - Critical professional learning conversations

		identity and the biases that we carry with us

Lesson Sequence

Lesson #1: Introduction (Danielle Lusk)	**Lesson #2: Cardboard (Brendan Stanford)**	**Lesson #3: Video Production (Harleen Deol)**

Title: Introduction to Maker Mentality and Empathy **Big Idea**: - Introduce the following key terms: intersectionality, empathy, makerspace, maker mentality **Assessment**: Diagnostic: - Mentimeter (code 91518138) - Padlet Formative: - Ongoing instructor-peer and peer-peer conversations Summative: - FlipGrid describing their learning and next steps	**Title**: Intro to Making with Cardboard **Big Idea**: Use empathy to consider the role of identity & culture in the design cycle **Assessment**: Diagnostic: - Empathy Interview 1st/2nd phase prompts participants to listen to the experience of others & assess their needs Formative: - Sharing of backpack with an explanation of how their design addresses their partner's needs Summative: - FlipGrid describing their learning and next steps	**Title**: GIFs/Memes **Big Idea**: Use the EDIDA framework and design-thinking process to investigate and create GIFs that represent different identities. **Assessment**: Diagnostic: - Teacher's will answer a question to check their understanding of what a GIF/meme is. Formative: - Variety of checks for understanding throughout the lesson. Summative: - Creation of three GIFs representing their

	partner's answers to the interview questions - FlipGrid describing their learning and next steps

Lesson #4: Textiles with Tech (Neal Donegani)	**Lesson #5: Sphero (Amanda Botelho)** **Culminating Task**

Title: Textiles with Tech

Big Idea:

- Design can be responsive to identified needs.
- Complex tasks require the acquisition of additional skills.
- Complex tasks may require multiple tools and technologies.

Assessment:

Diagnostic:

- Questions before the "Roc Your Mocs" slides and video
- Ask group who has hand-sewn before
- Ask group who has worked with Micro:Bits before

Formative:

- In-session discussions
- Instructor feedback throughout discussions

Summative:

- End of unit sharing circle
- End of unit participant-led rubric assessing culminating task: FlipGird
- One point Rubric

Title: Sphero Shoe 4 You

Big Idea:

- Use the EDIDA framework and design-thinking process to create a Sphero Shoe that represents different identities that can move around in a space.

Assessment:

Diagnostic:

- Graffiti Wall, Quick check in on learner's understanding of content at the start

Formative:

- Variety of checks for understanding throughout lesson (thumbs up, down,, Think, Pair, Share, etc)

Summative:

- Create the Sphero shoe for

Title: Personal Identity Artifact

Big Idea:

- Apply your understanding of various tools, maker mentality, and intersectional context to create an artifact that represents your identity

Assessment:

Formative:

- Variety of check-ins for understanding throughout the unit and subsequently the culminating task

Summative:

- Here's What FlipGrid
- One point Rubric

	their partner, - post video on FlipGrid describing their learning

Lesson Extension
Big Idea: - Research where the materials from the machines come from for a territorial acknowledgement. (i.e. Where are Micro:bits created?/Where is the headquarters of Microsoft and who lives there?) - An environment can be created to drive the Sphero Shoe through or the shoe can be taken to a new environment to add to the story of their partner's shoe.

References

21st century competencies: Foundation document for discussion. (2015). http://www.edugains.ca/resources21CL/About21stCentury/21CL_21stCentury Competencies.pdf

Castek, J., Schira Hagerman, M., and Woodard, R. (Eds). (2019). *Principles for equity-centered design of STEAM learning-through-making*. Tucson: University of Arizona. Retrieved from https://circlcenter.org/events/synthesisdesign-workshops

Cohen, J., Jones, W. M., Smith, S., & Calandra, B. (2017). Makification: Towards a framework for leveraging the maker movement in formal education. *Journal of Educational Multimedia and Hypermedia*, *26*(3), 217-229.

Cope, B. Kalantzis, M. (2015). The things you do to know: An introduction to the pedagogy of multiliteracies. In B. Cope & M. Kalantzis (Eds.), *A Pedagogy of Multiliteracies* (pp. 1-36). New York, NY. Palgrave Macmillan UK.

Dousay, T.A. (2017). Defining and differentiating the makerspace. *Educational Technology*, *57*(2), 69-74.

First peoples principles of learning (n.d.). First Nations Education Steering Committee. https://www2.gov.bc.ca/assets/gov/education/kindergarten-to-grade-12/teach/teaching-tools/aboriginal-education/principles_of_learning.pdf

Han, X., Liu, Y., Li, H., Fan, Z., & Luo, H. (2020). Augmenting the makerspace. Designing collaborative inquiry through augmented reality. *Blended Learning: Education in a Smart Learning Environment, 1044*(12218), 148-159. https://doi.org/10.1007/978-3-030-51968-1_13

Holbert, N., Berland, M., & Kafai, Y.B. (Eds). (2020). *Designing constructivist futures: The*

art, theory, and practice of learning designs. Massachusetts: The MIT Press. Kye, H. (2020). Who is welcome here? A culturally responsive content analysis of makerspace websites. *Journal of Pre-College Engineering Education Research (J-PEER)*, *10*(2). https://doi.org/10.7771/2157-9288.1190

SAMR model: A practical guide for K-12 classroom technology integration. (2021, April 13). Powerschool. https://www.powerschool.com/blog/samr-model-a-practical-guide-for-k-12-classroom-technology-integration/#:~:text=The%20SAMR%20Model%20is%20a,Augmentation%2C%20Modification%2C%20and%20Redefinition

Yi, F. & Baumann, M. (2018). Guiding principles for designing an accessible, inclusive, and diverse library makerspace. In *International Symposium on Academic Makerspaces*.