Cascading Curriculum:
A choreographed approach to student inquiry

By
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Introduction to sustained inquiry through a cascading curriculum
Consider the language typically used in describing the tasks students complete in school - “assessment tasks”, Summative Assessments, Culminating Activities/task – they all make the task a demonstration of learning that often occurs at the end of the learning to provide evidence of success at achieving the desired outcomes. What if we were to re-frame how we view and label the tasks so that they become the “driving tasks” and rather than being seen as proof that students have successfully learned, the task becomes the invitation for students to learn. By making rich, authentic tasks the drivers for learning we will better be able to nurture the competencies central to 21st century learning: Perseverance, open-mindedness, innovation, critical thinking, collaboration – all are more powerfully nurtured when the learning is launched by an invitation to respond to a meaningful challenge and the teacher then choreographs the learning experiences so that students are able become competent users of the intellectual tools called upon by the nature of the challenge.

The key to creating powerful learning environments to meet the needs of all children lies neither in a “sage on the stage” or “guide on the side” approach but rather is best describe as “teacher as choreographer”. Effective teachers choreograph the learning experiences required by their students to achieve success in meeting the demands of the curriculum. This involves framing the learning around clear provocations or challenges and carefully scaffolding the learning within a supportive community of thinkers.

Developing a “cascading curriculum” is a new approach to designing and implementing curriculum that frames learning around invitations to think critically and blends the best of design-down planning, effective assessment, and sound instruction.

The Cascading Curriculum is built around three core premises:

- learning is best supported through sustained inquiry;
- teachers need to be transparent in their teaching employing a "Design Down teaching" approach;
- education needs to adopt a "fail forward" approach in which failure is embraced as an opportunity for further learning not as a short coming.
Using a Cascading approach is a powerful means to designing learning opportunities whether applied at a course, unit or lesson level. Regardless of the scope of learning intended the fundamental underlying principles remain the same – “launch the birds! by inviting students to immediately consider the driving challenge with an initial speculation, hypothesis, conjecture or proposal; scaffold their learning by building intellectual tools required to successfully engage with the challenge; support failing forward through timely feedback and opportunities to re-think, revise, and extend answer as learning deepens; invite students to share their finished response/design to the challenge to encourage reciprocal learning among students.

The cascading curriculum draws together the strengths of inquiry, critical challenges, Understanding By Design, Differentiated Learning, Authentic Assessment, and Project-based learning to create the winning conditions for student success. Rather than being seen as a new idea or another program to implement, **sustained inquiry is best seen as an evolution in effective teaching and learning that unites many aspects of effective teaching in a manageable, coherent and transparent plan ensuring the understandings and competences required by students are explicitly, effectively and diversely addressed to meet the needs of all students.** Under a Cascading Curriculum the invitation to solve meaningful problems, innovate, communicate and act responsibly is at the core of learning for all students.

**Why is sustained inquiry important?**
In considering the merits of a Cascading Curriculum it may be helpful to reflect on how teaching through sustained inquiry helps to nurture self-extending competence by having students continuously inquiring into what’s working and what’s not. Below are five ways the use of a cascading curriculum supports student learning:

1. **Greater Transparency for the Students:** Students often fail to see the connection between the daily lessons and the broad learning outcomes leading to questions of relevance and a perception that on-going formative assessment has little value. Students often focus their energies on what matters and they believe
what matters gets marked. Consequently, if they fail to see the link between the task, the lessons and the feedback they often choose not to do the “formative tasks”. Students need to see that everything they say, write and do can help to deepen their understanding and contribute to their successful completion of the task. When students ask “Is this for marks?” it is really just another way of asking “do I really need to do this?” We should be careful not to presume laziness on the part of the student who asks this question. In many cases the question reflects thoughtful discernment regarding the use of their time. If the relevance of the lesson or assigned task to the over-arching task that will be marked is not clear students may choose to put their energies elsewhere where they believe it will have the greatest payoff. Transparency with regards to lessons and the learning goals is essential.

2. **Supports innovation and creativity**: If we hope to take seriously the overtures being made in education to promote innovation and creativity we cannot afford to continue with tasks being used as the demonstration of learning at the end of a unit of study. This inhibits risk taking and innovation, undermines perseverance and limits the power of assessment for and as learning. When a task is completed at the end of a unit students have limited time to take risks, innovate, or to pay careful attention to feedback that would allow them to fail forward. Instead students play it safe and produce what they believe the teachers wants often leading more to compliance and replication than to risk taking and innovation. Imagine if the task launched the learning and students had multiple opportunities to revise, extend, re-work and re-imagine their end product as the learning progressed and as they received feedback from peers and the teacher. Presented as a cascade of learning, sustained inquiry increases the time students spend thinking deeply about the curriculum and the opportunities they have to innovate in their application of their learning in authentic contexts.

3. **Promotes collaboration**: When the task becomes the “driver for learning” it creates powerful and meaningful opportunities for students to engage in collaborative exploration of the curriculum from the outset. A cascading
curriculum invites students to initiate their learning by speculating, predicting, offering a conjecture. Right from the start students have the opportunity to learn with each other. As new ideas and concepts are introduced through daily lessons, students are able to collaborate in making connections, revising their thinking, confirming earlier predictions, hypothesis and conjectures. As David Weisberger sagely noted “The smartest person in the room is the room”. When the task lies at the end of the learning many of the rich opportunities for meaningful collaboration are missed.

4. **Supports sustained attention and intrinsic motivation:** Perhaps one of the most powerful arguments in favour of a Cascading Curriculum is the huge potential for improving sustained attention in classrooms. The human brain pays attention when it sees relevance, derives some sense of satisfaction or sees meaning. When the task drives the learning students have a clear and meaningful challenge to engage with and can make links between new learning and their evolving response to the challenge.

5. **Amplifies curiosity:** Perhaps the greatest contribution to learning that digital technology offers is what John Seely Brown refers to as the “curiosity amplifier”. Today students have access to more information than previous generations could ever have dreamed of. We can capitalize on this richness of content available by launching learning with provocative and authentic challenges that invite students to seek out new information as they construct new knowledge in response to the challenge. When the task lies at the end of learning we fail to capitalize on the opportunities to use digital technology as a powerful “curiosity amplifier”. Inviting students to use digital technology to explore ideas and issues ensure classrooms remain relevant in a technology rich world and provide opportunities for teachers to nurture skepticism, exploration, and open-mindedness as they re-imagine, revise predictions and hypothesis. Used effectively in a sustained inquiry context, digital technology goes beyond the mere gathering and presenting of information to support genuine inquiry through which students scrutinize, test and revise ideas in light of new learning.
How can we promote sustained inquiry?

When we create opportunities for sustained inquiry and allow children to explore great things happen. With a rich, generative question driving the lesson students are able to explore, test, revise and extend their thinking. Carol Dweck refers to this type of learning as “incremental learning” as compared to “entity learning” where the answers expected are fixed. Using the sustained inquiry approach helps the teachers to nurture a growth mindset in their students where they see challenges as something to be embraced and intelligence a product of their perseverance and new experiences.

Creating the conditions for sustained inquiry involves two distinct types of inquiry. *Mucking about inquiry* refers to the phase of inquiry where we first invite students to offer an initial speculation, conjecture, prediction or in the case of creating to sketch a prototype. Drawing inspiration from the popular game Angry Birds, this phase can be seen as launching the birds. In this phase teachers present an authentic and provocative challenge and invite students to record an initial response in their Thoughtbook (see below for a fuller discussion). As their learning deepens, students are invited to continually reflect on their response, extending, revising, or even re-starting if necessary. The meta-cognitive process supported by the Thoughtbook allows for learning to be an iterative journey as students reflect on what is working or not working and seeking new information and understandings allowing them to fail forward.

In order for inquiry not to become a fruitless and frustrating exercise for students it is essential that student explorations are supplemented by “guided inquiry” during which teachers carefully choreograph the development of the intellectual tools students need to be able to deepen and extend their learning. In a cascading approach to curriculum design teachers scaffold learning by carefully planning the Focus Inquiries and by teaching the intellectual that will become the enablers allowing students to arrive at thoughtful and often innovative solutions to the challenge presented.
Four Keys to Sustained Inquiry

1. *Cultivate a culture of inquiry*

- Invert the traditional approach so that the invitation to solve a problem is the driver for the learning rather than the culmination for learning.
- Use “design-down teaching” to help students understand the broad learning goals, the demonstrations of learning to be completed and the inquiry road map that will help them uncover the concepts and ideas needed to succeed.

2. *Problematize everything*

- Make critical thinking a routine part of learning by developing daily lessons that explore the Focus Inquiries by through manageable and focused critical challenges.

3. *Scaffold though cascading challenges*

- Introduce a “cascading challenge” framework for designing curriculum that embeds inquiry and builds in “failing forward” where setbacks or “failures” are embraced as opportunities for learning rather than viewed as evidence of shortcomings.

4. *Encourage meta-cognition*

- Encourage reflection and support failing forward (e.g., a “Thoughtbook” where students predict, speculate, hypothesize as they learn and then revise, edit, confirm after their learning).
Developing an Over-arching Inquiry
Developing a Cascading Unit of Inquiry

**Step One:** Identify desired understandings and competences to be developed and demonstrated by the learners.

**Step Two:** Frame learning around an *over-arching inquiry* that is generative in nature.

The *over-arching inquiry* is the driving question that sets out the enduring learning and competences to be developed. An over-arching inquiry is generative in nature when the core ideas are central to a subject area/discipline and consideration of the ideas have potentially rich explanatory and predictive powers that guide observations/questions and can help to enrich students' understanding of important concepts or issues.

Sample generative *Over-arching inquiries*:

Science: How important are the choices we make in contributing to a sustainable future?

History: For whom does a change in regime have the most and least impact?

English: Is justice or mercy more essential in sustaining an ordered and civilized society?

Math: Would it matter if the concept of fractions did not exist?

**Criteria for an effective over-arching inquiry:**
* invites students to explore an idea or issue
* the issue or idea explored has broad generative or predictive powers
* encourages exploration of important concepts and issues in the subject area
* supports nurturing of competences related to the subject area
Developing an Over-arching Inquiry Question:

Frame an important issue/idea/concept that students will take away from the unit as an invitation to inquire.

- identify the big ideas in the curriculum to be addressed through the inquiry
- consider how the big ideas from the curriculum relate to everyday life or issues that transcend the particular issues often addressed in the subject area
- frame the inquiry so as to establish relevance or interest for a range of students
- ensure that the inquiry is broad enough to allow multiple pathways for exploration

Criteria for an effective over-arching inquiry:
* invites students to explore an idea or issue
* the issue or idea explored has broad generative or predictive powers
* encourages exploration of important concepts and issues in the subject area
* supports nurturing of competences related to the subject area

Big ideas:

Connection to everyday life or transcendent issue:

Subject area competences required:

Over-arching Inquiry:
Cascading Challenge(s)

Sample Over-arching Inquiry
How can the classroom of the 21st century be re-imagined to create transformative learning in a digital world?

Launch:

Over-arching Critical Challenge/Demonstration of Understanding (DofL)

Focus Inquiry

Focus Inquiry 1:
- DofL:
- Launch:

Focus Inquiry 2:
- DofL:
- Launch:

Focus Inquiry 3:
- DofL:
- Launch:

Focus Inquiry 4:
- DofL:
- Launch:
Cascading Challenge(s)

Frame your over-arching inquiry

Over-arching Critical Challenge/Demonstration of Understanding (DofL)

Launch:

Focus Inquiry 1:
DofL:
Launch:

Focus Inquiry 2:
DofL:
Launch:

Focus Inquiry 3:
DofL:
Launch:

Focus Inquiry 4:
DofL:
Launch:
Developing an Over-arching Challenge
Step Three: Develop an over-arching challenge.

The over-arching challenge launches the learning and when completed by the students will provide rich evidence of achievement. The over-arching critical challenge is the driving task that is focused on developing the understanding of big idea and core competence set out in the overarching inquiry. Well designed the over-arching challenges should be authentic in nature, promote student engagement, and encourage entrepreneurial learning. The over-arching challenge acts as the hook and provide the performance demonstration that will yield evidence of student success at developing a sound understanding of key concepts and ideas and the application of the desired competences.

Sample over-arching challenges:

Science: Design a scale model of a environmentally friendly home that minimizes a families ecological footprint.

History: Write a short historical fiction that captures the impact of a regime change on a historical character, real or imagined.

English: Drawing on inspiration from King Lear, create a modern day one act play that illustrates the prime importance of justice or mercy in sustaining a civilized society.

Math: Write and illustrate a children’s story about “The Day Fractions Disappeared”

Criteria for an effective over-arching challenge:

* provides an engaging means for students to demonstrate learning
* draws together the big ideas addressed in the block
* demonstration focuses on desired understandings and competences
* allows for a range of learners to successfully demonstrate success
Over-arching Critical Challenge

Develop a critical challenge, using the 6 prompts as a guide, that will drive the learning for the unit and will provide ongoing evidence of student performance and understanding.

Six prompts for consideration:
• critique the piece
• judge the better or best
• re-work the piece
• decode the puzzle
• design to specs
• perform to specs

Developing the Over-arching challenge:
• frame the over-arching challenge so that a reasoned judgment is required
• clearly identify the what students will create or perform to demonstrate learning
• ensure the product or performance focuses on the key subject understandings and core competences for the subject area
• ensure the challenge will yield rich evidence of understanding and performance in the subject area

Criteria for an effective over-arching challenge:
* provides an engaging means for students to demonstrate learning
* draws together the big ideas addressed in the block
* demonstration focuses on desired understandings and competences
* allows for a range of learners to successfully demonstrate success

Key Understandings to be developed:

Core Competences to be nurtured:

Over-arching critical challenge:
How can the classroom of the 21st century be re-imagined to create transformative learning in a digital world?

Sample over-arching inquiry

Launch: Given *carte blanche* sketch or describe your dream classroom.

Sample over-arching critical challenge/demonstration of understanding

Design an ideal learning environment for the 21st century.
Over-arching Critical Challenge

Develop a critical challenge, using the 6 prompts as a guide, that will drive the learning for the unit and will provide ongoing evidence of student learning.

Provide a provocative launch for the inquiry:

Focus Inquiry 1:
DofL:
Launch:

Focus Inquiry 2:
DofL:
Launch:

Focus Inquiry 3:
DofL:
Launch:

Focus Inquiry 4:
DofL:
Launch:
Developing Focus Inquiries and Demonstrations of Learning
**Step Four**: Identify the *Focus Inquiries* and *Demonstrations of Learning (DofL)*.

The *focus inquiries* provide a focused structure for the delivery of lessons that will assist students in discovering the curriculum and will allow them to iteratively revise, extend and reflect on their response/design to the over-arching challenge. *Focus inquiries* are the prompts that establish in broad terms what we want students to learn about (content)/ and to be able to do (competence) - the reason for the learning. *Focus inquiries* are a series of sequenced focused challenges that lead to an understanding of a central concept, issue or idea needed complete the over-arching challenge. To develop a focus inquiry, first identify the topic, concept or issue to be addressed. Then frame the topic/issue/concept as a critical inquiry question or task.

At the same time identify corresponding *Demonstrations of learning or supporting challenges* that will provide evidence of student success at understanding and applying ideas and concepts and in demonstrating the desired competence in response to the over-arching challenge. The demonstrations of learning are the vehicles through which students will both learn and demonstrate understanding and competence. Students iteratively complete the *demonstration of learning* as they work through a variety of daily critical challenges. The DofL's should help students build the scaffolding necessary to be successful with the over-arching critical challenge.

Sample *focus inquiries* and *demonstrations of learning*:

**Science**

**Focus Inquiry**: What is the best energy sources for a home?

**Demonstration of Learning**: Write a short rationale defending the selection of either solar, geo-thermal, wind, or natural gas as the best energy source.

**History**

**Focus Inquiry**: Did the group you are investigating have a good quality of life before the regime change?

**Demonstration of Learning**: Using RAFTS capture the quality of life for the groups considered by depicting a day in their life.
English

Focus Inquiry: How similar or different was the Elizabethan concept of civilized society from our view of a civilized society?

Demonstration of Learning: Create a Venn diagram appropriately overlapped to illustrate the degree of similarity or difference between the Elizabethan and current view of a civilized society.

Math:

Focus Inquiry: What are the essential attributes of fractions?

Demonstration of Learning: Develop an accurate and easily understanding definition for fractions that identifies their essential attributes.
Focus Inquiries

Frame a series of 2-4 lines of inquiry that focus student inquiry on an examination of important concepts/ideas that relate to and support the over-arching inquiry/challenge. These smaller focused invitations to inquire should typically span 3-4 lessons.

Framing the lines of inquiry as focus inquiries:
• consider important subject related concepts/ideas that can will be the focus of the inquiry
• consider how the important subject area concepts/ideas will be used to help deepen student understanding related to the over-arching inquiry/challenge
• consider important subject competences to be nurtured that will help students respond to the over-arching challenge

Criteria for an effective set of focus inquiries:
* address the key understandings required to be able to respond to the over-arching inquiry and challenge
* invites students to inquire into issues/ideas that support the over-arching inquiry/challenge
* is focused enough to be manageable for students

Important subject area understandings:

Important subject area competences:

Lines of Inquiry:

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Draft
Demonstrations of Learning  
(DofL)

Develop a series of critical challenges that respond to each of the focus inquiries and supports the over-arching challenge. The demonstrations of learning (DofL’s) are smaller challenges that provide evidence of learning and act as building blocks for the larger over-arching challenge. A check points along the way, these smaller challenges allow students to test their understanding of related concepts and consider how these understandings can be used to build their understanding of the big ideas in the curriculum.

Developing demonstrations of learning (DofL’s)

• consider key understandings to be demonstrated  
• consider the various competences to be developed through the inquiries  
• consider various forms of communication to be assessed  
• ensure the demonstrations of learning focus on demonstrating understandings and competences important to the subject area

Criteria for an effective demonstration of learning:  
* illustrates understanding of an important issue or concept  
* supports the over-arching inquiry/challenge  
* focused so as to be manageable over several classes

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Developing Lesson Challenges
Step Five: Problematize daily instruction by creating *lesson challenges*.

Tweak lessons and tasks to create daily challenges that invite students to think about and work with the ideas. Through the *lesson challenges* students will discover the curriculum by building background knowledge required to revise and extend their thinking relating to the over-arching challenge and will develop an understanding of the criteria and critical thinking vocabulary necessary to respond to the challenge. Also through the lesson challenges students will broaden their repertoire of thinking that they can use independently when responding to critical thinking tasks. Finally, by making learning through inquiry routine, the habits of good thinkers will be nurtured.

Sample *lesson challenges*:

- **Science:** Complete an OCI (Opportunities/Challenges/I Wonder) chart as you learn about solar energy.
- **History:** Considering evidence from a variety of primary sources determine if the group you are investigating experience few or many hardships in meeting their basic needs (food, shelter, clothing).
- **English:** What does *King Lear* suggest about Shakespeare’s view of the basis of the authority of the monarchy to govern?
- **Math:** Identify the essential attributes of fractions by sorting yes and no examples of fractions.
C3i Thinking Lesson Plan

Grade: 

Subject: 

Topic: 

Issue: 

Learning Goals: 

Key Understandings: 

✓
✓
✓

Core Competencies: 

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Critical Challenge: 

Nature of the Inquiry: 

✓ Critique 
✓ Judge 
✓ Rework 
✓ Decode 
✓ Design 
✓ Perform
Intellectual Tools to Support Inquiry

Background Knowledge:

Criteria for :

Critical Thinking Vocabulary:

Thinking Strategies:

Habits of Mind:

Steps to Teaching to the Challenge:

1.
C3i  Lesson Plan

Grade: 2  Subject: Science

Strand: Understanding Life Systems  Issue: What do animals need to grow and stay healthy?

Learning Goals:

Curriculum Expectations:

Science

• investigate and compare the basic needs of humans and other living things, including the need for air, water, food, warmth, and space, using a variety of methods and resources
• identify environment as the area in which something or someone exists or lives
• describe the characteristics of a healthy environment, including clean air and water and nutritious food, and explain why it is important for all living things to have a healthy environment

Writing

• gather information to support ideas for writing in a variety of ways and/or from a variety of sources

Key Understandings:

✓ all living things need a safe and healthy environment to be able to grow and stay healthy
✓ to understand the needs of living things we need to gather important and relevant information
✓ the way we interact with animals can help to create safe and healthy environments for them to live in

Core Competencies:
Thinking about **ideas**

- How can people help to ensure animals have a safe and healthy environment to live and grow in?

Thinking about **representations**

- How can I best show what a safe and healthy environment for an animal would look like?

Thinking about **Actions**

- How can I interact with animals so that I can learn from them and keep them safe and healthy?

**Critical Challenge:**

Create a sketch of an enclosure in a zoo that would keep your animal safe and healthy.

**Nature of the Inquiry:**

- Judge (select the most important features needed for the animal’s safety and healthy)
- Design (create a safe and healthy enclosure)

**Intellectual Tools to Support Inquiry**

**Background Knowledge:**

- Various purposes zoos serve
- Factors that influence the safety and health of animals in captivity
- Basic needs of various animals including shelter/protection, climate,

**Criteria for an important feature:**

- Protects animal from possible harm
- Meets physical needs animal

**Criteria for a well-designed zoo enclosure:**

- Meets the needs of the animal it is designed for
- Allows people to see the animal in a natural habitat
- Keeps people and animals safe

**Critical Thinking Vocabulary:**

- inference
- evidence
- clues
Thinking Strategies:

- SSEE’s Chart
- Concept Formation
- Thought Journal

Habits of Mind:

- attention to detail
- empathy
- open minded

Steps to Teaching to the Challenge:

1. Using Concept Formation (students sort images and label the grouping they create) have students examine a set of images of animals. The set will include pets, farm animals, wild animals, mother with babies, birds, reptiles, mammals, fish, etc. Encourage students to sort then re-sort to see how many different ways they can group the images. As the grouping unfold, invite students to discuss which of the groupings you would likely see in a zoo. Draw out that zoos serve different purposes – for example a “Petting Zoo” may have common farm animals but a city zoo will not. Some zoos are created as a shelter for injured animals or abandoned animals. Use to examine what types of animals are in zoos and what it tells us about purposes for zoo

2. Summarize 4 possible purposes for zoos and invite students to rank order the purposes from the most to 4th most important (protect rare animals, study animals, let people see real animals, bring tourists to visit your city). The 2 criteria students are to use to consider importance are: keeps animals safe; keeps animals healthy.

3. Inform students they will be helping to design a zoo enclosure that will: provide a healthy and safe environment for the animals they are assigned

4. Assign each group of 3 students an animal for them to design a zoo enclosure (giraffes, elephants, monkeys, lions, polar bears, dolphins).

5. Explain to students that we will be using a Thought Journal to help us do our thinking about our zoo enclosure. Share with students a few examples of how others have used thought journals that show sketches, changes, notes made as the ideas unfolded. Provide students with a Thought Journal and invite them to draw a sketch of the enclosure they think would be best for their animal based on what they know so far. Remind them of the 2 criteria for the zoo enclosure and add a third: provide a healthy environment; keep the animal safe; keep people safe. (Design)

6. Show short clip for Old Dogs to engage students in thinking about why we need to design our zoos to keep both animals and people safe and encourage them to make any changes or additions to their initial sketch that would help make sure people are safe when visiting the zoo.

7. Inform students that you have been working on an enclosure for a special animal – a Duck-billed Platypus. Ask how many know about this animal?
8. Show the Perry the Platypus theme song and ask students to identify as many features of the animal as they can. Given its features where do you think a real platypus would live?

9. Show 4 images of a platypus in the wild. Using the SSEE’s chart on large chart paper invite students to determine what would be necessary for the platypus to have a healthy and safe environment in a zoo focusing observation, inference and drawing conclusions.

(decode)

10. Show students an initial sketch for the platypus and invite them to suggest changes/additions and to note what should be kept (critique).

11. For each of the 6 animals provide a set of visuals and have students use a SSEE’s to look for clues, form inferences and draw conclusions as to what is important for their animal to be safe and healthy – pictures should show animal in natural environment – should show possible dangers to animals – juxtapose the image against poor zoo enclosure – what is wrong with this? Or present two enclosures for each animal – which is better and why? (judge better or best) Using the SSEE’s chart as a data gathering sheet – invite students to consider what the clues and inferences tell us we need to do to make sure animals are safe and healthy?

12. Re-visit thought journal – what additions/changes would you like to make? Can you add a few notes explaining ideas you had and why they are good ideas? (re-work)
C3i Thinking Lesson Plan

Grade: 3                      Subject: Math

Topic: Whole number multiplication word problems

Learning Goals:

Indicators: Determine the unknown whole number in a multiplication or division equation relating three whole numbers. E.g. $8 \times ? = 48, 5 = ? \div 3, 6 \times 6 = ?$

Objective
Represent and solve word problems involving multiplication and division using whole numbers.

Key Understandings:

- Multiplication and division are inverse operations
- Numbers can be multiplied in any order
- Numbers can be multiplied in parts because multiplication is related to the addition of equal sets

Core Competencies:

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| • how to break down a set in a variety of ways for equal sharing  
  • how to represent solutions in a variety of ways | • ability to explain their mathematical reasoning | • are able to use multiplication and division to help solve everyday problems  
  • can select best strategy to match the problem being solved |
Critical Challenge:

Help Jean to determine how best to share 36 macaroons with 2 friends so that they are eaten while fresh but not too quickly so as to avoid getting a stomach ache.

Nature of the Inquiry:

- Critique
- Judge
- Rework
- Decode
- Design
- Perform

Intellectual Tools to Support Inquiry

Background Knowledge:

- multiplication is a means of adding equal sets of numbers
- multiplication and division are inverse operations
- multiplication problems can be represented in a variety ways

Criteria for the best way to share the macaroons:

- evenly divided (everyone gets the same number of macaroons)
- eaten in a timely manner to ensure freshness without getting a stomach ache

Thinking Strategies:

- visual representation
- Euler diagram

Habits of Mind:

- persistence
- attention to detail
Steps to Teaching to the Challenge:

1. Introduce the following word problem to students and inform them that this is the problem they will be working through the lesson:

   On a recent trip to Paris, Jean purchased 36 delicious macaroons to share with his 2 friends when he returned home. After buying the macaroons Jean learned that they are best enjoyed when they are fresh so they need to be eaten within 3 days (although they can be eaten in fewer days) and that, although delicious, eating too many all at once will make you sick. How can he best divide the macaroons with his friends so they all get the same number to enjoy while fresh without eating too many all at once? To help Jean understand your reasoning show your advice in more than one way.

2. Inform students that before trying to solve the problem there are a few important ideas to understand that will help them to solve this word problem.

3. Invite students to consider the following 4 representations that showing different ways of sharing items equally with others.

   **Word representation of a solution**

   Sunny has 12 rulers. His teacher asks him to distribute them equally to the 6 groups in the class. He gives each group 2 rulers.

   \[ 12 = 3 \times 4 \]

   **Numerical representation of a solution**

   \[ 12 = 3 \times 4 \]

   **Visual representations**

   ![Visual representation](image)
4. Challenge students to see how many similarities they can find?
5. Ask students if, considering the similarities, we should say they 4 representations are very similar, somewhat similar or very different. Invite students to slide a Venn diagram so that over-laps more (very similar) or less (very different). Be sure to encourage students to support their answer citing both similarities and differences.
6. Invite students to identify an important idea about multiplication that is shown by the similarities and differences they identified e.g. sets can be represented in different ways; different sets can be multiplied to arrive at the same total.
7. Return students to The Great Macaroon Dilemma. Review a more focused statement of the problem and invite students to identify what we know and what we want to figure out. Begin by focusing on how to make sure each friend gets the same amount.
8. Highlight the know and what we are looking for and create it as an equation for students to see the different representations.
9. Once the problem is clearly understood, ask how many macaroons each friend should receive overall. Have students show their reasoning both numerically and pictorially.
10. Remind students that eating all the macaroons at once will give them a stomach ache, so they should consider alternatives such as giving them out over 2 or 3 days.
11. Invite students to determine how many each friend would get if the macaroons were given out over 2 days. Have them show their reasoning numerically and pictorially; repeat for 3 days. When showing their reasoning with picture invite students to decide if they should pull out one macaroon at a time to check their answer or if they could use sets to show their reasoning, helping to re-inforce that multiplication is the addition of equal sets.
12. Invite students to discuss in groups of 3 which of the options would be best to ensure all get the same amount, they are eaten while freshest, and no one gets a stomach ache.
13. Encourage groups to share their advice using more than one way to show their reasoning.
C3i Lesson Plan

Grade: 5/6
Subject: Language

Strand: Media Literacy
Issue: Cyber-bullying

Learning Goals:

Curriculum Expectations:

- identify whose point of view is presented or reflected in a media text, ask questions to identify missing or alternative points of view, and, where appropriate, suggest how a more balanced view might be represented
- use a range of appropriate elements of effective presentation in the finished product, including print, script, different fonts, graphics, and layout
- use overt and implied messages to draw inferences and construct meaning in media texts
- identify an appropriate form to suit the specific purpose and audience for a media text they plan to create, and explain why it is an appropriate choice
- produce a variety of media texts for specific purposes and audiences, using appropriate forms, conventions, and techniques

Key Understandings:

- bullying and cyber-bullying can have tragic consequences for those affected
- stopping bullying is everyone’s concern
- carefully consideration for purpose and audience can help us to create a powerful message to encourage others to end bullying

Core Competencies:

<table>
<thead>
<tr>
<th>Thinking about ideas</th>
<th>Thinking about representations</th>
<th>Thinking about Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>what is bullying and what can be done to stop it?</td>
<td>how can a message be effectively crafted so as to best influence the intended audience?</td>
<td>* how can individuals help to make a difference in the battle to end bullying?</td>
</tr>
</tbody>
</table>
Critical Challenge:

Determine the most appropriate audience as a target for a legacy project to stop cyber bullying and select the most powerful medium to use to get the message across.

Nature of the Inquiry:

✓ Judge (select the audience for whom the legacy project would make the greatest difference)
✓ Judge (select the most powerful medium to use to help to reduce cyber-bullying)

Intellectual Tools to Support Inquiry

Background Knowledge:

- What bullying is and is not
- How social media contributes to bullying and how cyber-bullying differs from other bullying
- Current actions being taken to stop cyber-bullying
- Various audiences to consider when developing materials to reduce cyber-bullying
- Range of digital tools available to promote the message to the intended audience

Criteria for selecting audience to best target message:

✓ their actions are most likely to directly impact cyber-bullying
✓ they have the power/opportunity to make a difference
✓ they are likely to be willing to listen to the message and take action

Criteria for selecting most powerful medium:

✓ able to convey the urgency and seriousness of the problem
✓ likely to be seen by the intended audience
✓ likely to be successfully created by the group so as able to have the desired impact

Critical Thinking Vocabulary:

- perspective
- point of view
Thinking Strategies:

- Frayer Model
- 4 Pictures and a Word
- U-shaped discussion
- Common Senses

Habits of Mind:

- Risk taking
- Empathy
- Open minded

Steps to Teaching to the Challenge:

13. Invite students to co-construct a definition for bullying by suggesting words or phrases to include in a definition drawing on the Frayer model they have created.
14. Using a modified version of 4 Pictures and a Word ask students to generate new ideas, words and phrases that could be added to their definition.
15. Using a second set of images ask students how their definition of bullying changes when we use the term “cyber-bullying”.
16. Invite students to discuss in small groups if they believe cyber-bullying is a small part of the larger problem of bullying or if cyber-bullying is the more significant problem?
17. Using a U-shaped debate, invite students to discuss whether or not schools are doing too little or too much in response to cyber-bullying. Arrange the class in a U-shape
   - ask students with polar views (i.e., either strongly agreeing or strongly disagreeing with the proposition) to seat themselves at either tip of the U; ask students with mixed opinions to sit at appropriate spots along the rounded part
   - ask students at each tip of the U to state their position and offer a few reasons only (if there is an imbalance in strong support for one side or the other, locate yourself temporarily in a polar position to get the discussion going)
   - alternate from side to side, as students from all parts of the U offer their views
   - encourage students to physically move along the spectrum if they have heard reasons that cause them to want to shift their intellectual position on the issue.
18. Inform students that they will be creating a “Legacy Project” that they will leave as part of their Social Footprint. The Legacy Project is to encourage people to take a stand against cyber-bullying. To complete this project they will first have to make 2 key decisions – who should they target their Legacy Project at (younger children, peers, teens, parents, educators, government) and what medium should they use for their Legacy Project.
19. Inform students that to select the target audience for their Legacy Project they should consider how perspectives and point of view can differ. To help students understand how perspective differs from point of view, ask for 6 volunteers. Invite three to lay on the floor looking up and 3 to stand on chairs looking down. Ask students to describe what they see by shouting out as many things that they see as they can. Point out that “perspective” is the way we see the world. To illustrate, ask them how the teacher may see things
differently than they do. Do boys experience the world differently than girls? Do professional hockey players see the world differently than we do? Notice “perspectives” are shared with a group. Point of view is how each of use individually see the world shaped by the various perspective we share with others.

20. Invite students to share their thinking as to whom should be the target for their Legacy Project considering the criteria (see above). Use a ranking ladder for students to discuss which target would have potentially greatest impact.

21. Explain to students that we will be using a Thought Journal to help us do our thinking about a powerful Legacy Project. Share with students a few examples of how others have used thought journals that show sketches, changes, notes made as the ideas unfolded. Provide students with a Thought Journal and invite them to make some initial notes, sketches, or mapping of ideas as to who to focus on and what medium to use for their Legacy Project.

22. Present students with options for their Legacy Project (Glogster, Popplet, Video, Bitstrips, Graphic Novel). Invite them to determine which would be best to use considering criteria (see above) and an OCI chart. Model the use of the OCI chart then encourage students to use the chart to select the best option considering their intended audience.

23. Using “Common Sense” strategy begin to have students generate innovative ideas that they can use in their “Legacy Project”.

**OCI Chart**  
**Considering the Possibilities**

To complete the chart below, brainstorm all the possible *Opportunities*, *Challenges* and *Interesting* implications for the idea or proposal being considered. After having brainstormed reflect on the *Opportunities*, *Challenges* and *Interesting* Implications and decide whether or not the idea/proposal has enough merit to warrant moving forward.

<table>
<thead>
<tr>
<th>Opportunities</th>
<th>Challenges</th>
<th>I wonder…</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glog</td>
<td></td>
<td></td>
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<td>Popple</td>
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<tr>
<td>Video</td>
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<tr>
<td>Graphic Novel</td>
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<td></td>
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<tr>
<td>Cartoon</td>
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</tbody>
</table>

___________ would be best to get our message to our intended audience because…
Nurture Self-regulation through a learning road map and use of a Thoughtbook
Step Six: Provide a learning road map to students.

The learning road map allows students to see the relationship between the Over-Arching Inquiry/Over-Arching Challenge, the Focus Inquiries/Demonstrations of Learning, Lesson Challenges. Present the lesson road map in the form of a Cascading Challenge that flows from the Over-arching-Inquiry/Challenge through the Focus Inquiries/Demonstrations of Learning to the Lesson Challenges. Stress the iterative nature of learning by reminding students that they will have frequent opportunities to reflect on their learning to make connections, revisions, extensions to their initial response to the over-arching challenge. It is important students see the value in launching their learning with a speculation/hypothesis/conjecture or original idea that will revisited several times as they continue to explore and inquire.

Step Seven: Regularize assessment as and for learning and support “failing forward” through the use of a Thoughtbook.

Build assessment and evaluation practices that enable students to affirm and demonstrate what they understand, identify areas for further exploration and to revise, rethink, and extend their work as their understanding deepens. Using a “Thoughtbook” (explained below) allows students to initiate learning by responding to a challenge with a hypothesis, prediction, conjecture or trial idea and provides for on-going opportunities to revise, confirm or extend thinking as they uncover the curriculum. As well, the Thoughtbook provides a means for teachers to monitor learning, adjust teaching to address the intellectual tools and to clarify misconceptions or misunderstandings as the learning progresses.

Using Thoughtbooks to promote meta-cognition, innovation and perseverance

While the label may be new the concept of a Thoughtbook is certainly not new. For centuries many of history’s greatest minds have jotted down their ideas in notebooks, journals, scraps of paper and even on the walls of buildings! As a young man, Michelangelo scribbled charcoal etchings on the walls of a lunchroom in the basement of the Medici Chapel in Florence where he was working on sculptures to adorn the chapel. Years later, many of the ideas first roughly sketched on those lunchroom walls would
appear in the frescoes that transformed the Sistine Chapel. Like Michelangelo, great minds throughout history have used variations of Thoughtbooks as a place to initiate their thinking, make revisions, extend ideas, re-think and re-conceptualize ideas that have changed the world. Leonardo Da Vinci, Issace Newton, Charles Darwin, Albert Einstein, Stephen Spielberg, and J.K. Rowling are but of few of history’s notables who have used notebooks, journals, storyboards, and other variations of Thoughtbooks to initiate, extend and revise their thinking. The use of various forms of Thoughtbooks are not limited to those of exceptional fame. They are in fact common in many fields of work from graphic designers, car designers and fashion designers to architects and landscapers. Moving makers, choreographers, video game developers all employ some sort of Thoughtbook that allows them to capture an initial idea that is then shared, revised, and extend throughout the development process. Given the proclivity for use in many fields it is surprising how little the concept of Thoughtbooks is used in education. Although journaling has long been a part of the education landscape, journals have typically been used to have students reflect backwards on work completed. In fact, a Bachelor of Education student at an Ontario university recalled with dismay having to “reflect on the reflections they had completed during the year”! While there is value on reflecting backwards on work completed, the use of a Thoughtbook is intended to serve a very different purpose. The primary purpose for a Thoughtbook is to nurture and support innovation by allowing students to “fail forward” as they test ideas, deepen their understanding, and gather feedback on their ideas/designs.

Traditionally journaling has been used to encourage students to reflect on the learning they have completed and is often used at multiple intervals during a unit of study. Used in this way, journals provide a check for understanding and opportunities for assessment for learning. When reflective journals are used by teachers to check for understanding after the learning they do little to promote perseverance, risk taking or innovation. While traditional journals may encourage a degree of meta-cognition, the results are often disappointing because the reflections are not connected to revisions that may lead to a more successful end product. Instead they are often perceived by students to be a burdensome task to be completed to meet teacher requirements rather than a useful tool to
aid in learning and innovating.

The use of a Thoughtbook, as we envision it, is meant to is intended to provide students with the opportunity to deepen their understanding of important concepts and ideas by building upon a “launch of the learning”. During the learning launch students respond to a provocative prompt by capturing an initial idea, prediction, conjecture or hypothesis in words, picture, diagrams, numbers or other forms of notation in their Thoughtbook. As they inquire into the issue and new understandings develop they “fail forward” by constantly trying out new ideas, revising initial thoughts, extending their thinking and refining or refocusing their response to the challenge. The Thoughtbook allows educators to re-frame failure as a necessary part of learning that can act as a source of inspiration and opportunity for further learning rather than something to be feared. Our conception for the use of a Thoughtbook provides for multiple powerful supports for effective assessment. Firstly, the Thoughtbook supports as learning as students are continually reflecting forward as they apply new learning and their emergent understanding of concepts to help them refine their response to the challenge; secondly, it supports assessment for learning (allowing teachers to provide immediate and on-going feedback and guiding instructional decisions to as to be able to focus on the intellectual tools needed to improve student success), and; thirdly it supports the triangulation of assessment evidence, contributing to the body of evidence teachers gather through observation and conversation allowing for a focus on the quality of thinking demonstrated – even in product falls short of the ideal.

What might a Thoughtbook Look Like?

Thoughtbooks can take many forms including both traditional hard-copy approaches and virtual journals using various cloud-based applications. By definition, a Thought Journal is a means of recording the evolution of ideas from first conception/response through revisions, re-conceptualization and extension as students progress through their learning. Consequently, a Thoughtbook could take the form of a series of storyboard, sketches, audio recordings, video recordings, note, thinking maps, equations and so on. As they are intended for use with any subject or grade level teachers need to consider a few factors when implementing a Thoughtbook:
Age: Younger children need to have opportunities to work with both visual and written explanations of their thinking. A Thoughtbook in the primary grades should be designed to as to encourage children to capture ideas in pictures and words. While students may begin with a rough drawing of their idea, over time as they build their vocabulary they should be encouraged to add relevant labels and annotations within their Thoughtbook. Similarly, in cases where students are acquiring a new language, the Thoughtbook can be used as a place for students to assemble or create images to capture initial ideas that are labeled and annotated as comfort in the language develops.

Subject Matter: Thoughtbooks need to reflect the diversity of ways humans communicate ideas by recognizing and valuing multiple forms “language” including musical notation, mathematical literacy, science notations and so on. To encourage the use of communication within a domain, Thoughtbooks should be used to encourage students to explore communicating their ideas using multiple mediums and forms of notation. While they should be encouraged to use domain specific ways of communicating, the Thoughtbook should also be promoted as a natural vehicle for integration as students explore various ways to express and re-frame their thinking in a way that best supports their thinking about complex ideas and provocative issues.

Nature of the Task: The primary purpose of the Thoughtbook is to help students think deeply about important and provocative issues in the curriculum. The more authentic the task to which a Thoughtbook is attached the more likely students will see the relevance and therefore be engaged in the learning. By extension, if the Thoughtbook is to be seen as a useful vehicle through which students can explore and develop their ideas then it needs to have a clear connection to the task. Dance students choreographing a dance may want to create a series of short videos to help them think through their revisions, while music students may wish to create a series of audio recordings. When being asked to create a video or dramatic skit students might employ storyboards in their Thoughtbook while science students may include sketches, notations and still images from labs.
**Ease of Use:** If Thoughtbooks are to support students in their thinking and learning it is essential they be presented in a manner that is user friendly to the student. It is advisable that teachers present a variety of ways that students can capture their thinking and allow students to self-regulate by selecting the means that best advances their learning. If a classroom chooses to use an e-portfolio a vehicle for the Thoughtbook, students still need to be allowed to sketch by pencil, jot notes on paper or scribble drawing as needed. They can then be encouraged to digitize they thoughts captured on paper and add them to their e-portfolio. Similarly, if the Thoughtbook were to take the form of an artist’s Sketch book teachers need to be cognizant of size and portability so that carrying the journal with the student does not become a barrier to is use.