

EDCP 342A Unit planning: Rationale and overview for planning a unit of work in secondary school mathematics

Your name: Sally Yu

School, grade & course: MacNeill Grade9 Math

Topic of unit: Chapter5 Linear Relations

Preplanning questions:

(1) Why do we teach this unit to secondary school students? Research and talk about the following: Why is this topic included in the curriculum? Why is it important that students learn it? What learning do you hope they will take with them from this? What is intrinsically interesting, useful, beautiful about this topic? (150 words)

For a number of strong reasons, the Math 9 unit on linear relations is essential. First of all, it acts as a cornerstone for more complex mathematical ideas. Proficiency in linear relations and patterns is essential for exploring advanced mathematics, such as algebra and calculus. Second, there are a lot of practical uses for these subjects. Through graphs and patterns, students are taught to interpret and analyze real-world data—a critical skill in a variety of fields, including engineering, economics, and the sciences. Moreover, tackling these topics improves one's capacity for critical analysis and problem-solving. The logical reasoning and analytical skills developed are not just academically beneficial but also invaluable in everyday decision-making and various professional contexts. In addition, the symmetry of tessellations and the predictability of linear patterns frequently reveal an underlying beauty and satisfaction found in mathematics. Students may develop a greater appreciation for and love of mathematics as a result of this feature.

(2) A mathematics project connected to this unit: Plan and describe a student mathematics project that will form part of this unit. Describe the topic, aims, process and timing, and what the students will be asked to produce, and how you will assess the project. (250 words)

Topic: Students will create proposals for urban development projects in the fictional city of Metroville, using a fixed budget to address issues of equity and sustainability.

Aims: The project aims to apply linear functions and graphs to model and analyze urban development scenarios, encouraging students to think critically about resource allocation, social equity, and environmental impact.

Process and Timing: Over a period of two weeks, students will work in groups to research, plan, and develop their proposals (lesson 5 to lesson 10). The first week involves brainstorming and selecting a project focus, such as public transportation, green spaces, or educational facilities. Students hand in their ideas about the project in groups, they will be asked to use function relations as well as linear equations and graphs to analyze the cost, impact, and feasibility of their proposals. The second week is dedicated to preparing a presentation that includes their mathematical analysis and a persuasive argument for their project.

Student Output: Each group will produce a detailed project proposal and a presentation that includes linear graphs and mathematical reasoning to support their ideas.

Assessment: The project will be assessed based on the clarity and feasibility of the proposal, the accuracy and application of linear functions and graphs, the quality of the presentation, and the consideration of social and environmental factors. Additional points will be awarded for creativity, teamwork, and the ability to effectively communicate complex ideas. This project not only reinforces mathematical concepts but also encourages students to consider the broader implications of mathematics in societal development and policy-making.

(3) Assessment and evaluation: How will you build a fair and well-rounded assessment and evaluation plan for this unit? Include formative and summative, informal/ observational and more formal assessment modes. (100 words)

Formative Assessment:

Observational Assessments: Regularly observe students during the Tessellation Art project and the Metroville Revitalization Challenge, noting their engagement, problem-solving approaches, and collaboration skills.

Peer Feedback: Encourage peer reviews during project development stages, allowing students to give and receive constructive feedback.

Check-ins: Conduct brief, informal discussions with students to gauge their understanding and provide immediate guidance.

Summative Assessment:

Tessellation Art Project: Assess the final artwork and the Desmos representation for mathematical accuracy, creativity, and reflection of cultural understanding.

Metroville Revitalization Challenge: Evaluate the final project proposals and presentations based on their mathematical analysis, feasibility, creativity, and presentation skills.

Self-Assessment: Encourage students to assess their own work using provided rubrics, fostering self-reflection and responsibility for their learning.

Elements of your unit plan:

a) Give a numbered list of the topics of the 10-12 lessons in this unit in the order you would teach them.

Lesson	Topic
1	Representing Patterns (examples: different graphs with patterns),(activities: moving tables)
2	Art Project (Tessellation Art: Introduction, materials, discussions)
3	Interpreting Graphs (Introducing graphs, leave 30 mins for working on project)

4	Introduction Linear Relations (Introducing linear relations, presenting the art project to the class)
5	Graphing Linear Relations (Introducing graphing linear relations on paper)
6	Desmos (Introducing using Desmos to graph linear functions, Desmos project: using Desmos to graph the tessellation art they just made)
7	Another Form of the Equations (Introducing horizontal, vertical, and oblique lines, introduce the social justice project and let students form groups, share ideas)
8	Equations of Linear Relations (Introducing to linear equations, 30 mins work on the project)
9	Matching Equations and Graphs (Introducing matching, 40 mins work on the project)
10	Using Graphs to Estimate Values (Most of the class time: presenting projects and debating. Brief introducing the way to estimate values (this topic is advanced content can be eliminated))

b) Write a detailed lesson plan for *three* of the lessons which will *not* be in a traditional lecture/ exercise/ homework format. These three lessons should include at least three of the following six elements related to your mathematical topic. (And of course, you could include more than three!)

These elements should be thoroughly integrated into the lessons (i.e. not an add-on that the teacher just tells!)

- a) History of this mathematics
- b) Arts and mathematics
- c) Indigenous perspectives and cultures
- d) Social/environmental justice
- e) Open-ended problem solving in groups at vertical erasable surfaces (“thinking classroom”)
- f) Telling only what is arbitrary, and having students work on what is logically ‘necessary’

Be sure to include your pedagogical goals, topic of the lesson, preparation and materials, approximate timings, an account of what the students and teacher will be doing throughout the lesson, and ways that you will assess students’ background knowledge, student learning and the overall effectiveness of the lesson. Please use a template that you find helpful, and that includes all these elements.

Lesson1

Subject: Math	Grade: 9	Topic: Representing Patterns	Duration: 75mins
Curriculum Learning Standards - Continuous linear relationships can be identified and represented in many connected ways to identify regularities and make generalizations. - Similar shapes have proportional relationships that can be described, measured, and compared. - Use logic and patterns to solve puzzles and play games. - Use tools or technology to explore and create patterns and relationships, and test conjectures. - two-variable linear relations, using graphing.			
Lesson Content Objectives <i>What the students will KNOW.</i> By the end of the lesson, students should be able to: - Identify and describe patterns found in real-life scenarios. - Understand the concept of function as a special kind of pattern.			
Materials and Equipment Needed for this Lesson. <i>Printed handouts, Whiteboard and markers, Exercise worksheets, Name card.</i>			

Lesson Progression / Stage:

1. Warm-up <i>Get students' attention, connect to previous knowledge, and explain why the topic is important to learn.</i>		Time Allotted: 5-7 mins
Learning Activities Set up the seating chart before class. Create study groups and have students sit at the table with their name cards. Engagement Activity: Introduce the concept of patterns in mathematics, using real-world examples like weather cycles or traffic flow. Engage in a brief discussion about patterns they observe in daily life.	Language Adaptations for ELs - Project the screen - Encourage group discussion by asking questions. - Allow time for translation if students still have trouble understanding gesture/visual explanations. - Encourage peer support (same language group)/ support / guide.	
Assessment/Evaluation of Students' Learning during This Stage: Observation of classroom engagement.		

2. Presentation		Time Allotted: 30mins
<i>Introducing ways that we can use to translate patterns into data in tables and then in functions.</i>		
Learning Activities Hold an activity: Let students move their tables to form longer tables to sit. And record the people numbers and table numbers. Try to find a pattern. Record the numbers in the table provided. Using the worksheets examples to introduce the ways we can do to understand functions.		Language Adaptations for ELs - Be aware of voice, adjust pacing. - When using complex words, make sure students understand the meanings.
Assessment/Evaluation of Students' Learning during This Stage - In-the-moment comprehension check - Sit / stand to re-state the idea / ask a question.		

3. Practice and Production		Time Allotted: 30mins
<i>Let students try out the practice questions and work on them on the whiteboard in groups.</i>		
Learning Activities Encourage students to work in groups and come back together. Share their answers in groups and help with their peers who have no idea what to do or how to do the questions.		Language Adaptations for ELs - Circulate and do frequent check-ins for ELs while they work. - Strategic pairings / groupings for peer translation.
Assessment/Evaluation of Students' Learning during This Stage: Circulate while students are discussing the questions. Ask questions to encourage explanation and deeper thinking. Assessment/Evaluation Adaptations for ELs during This Stage: Offer options to accommodate language: time extensions. Allow them to use the translator to better understand the articles and the questions.		

4. Closure		Time Allotted: 5-7mins
- reflection gestures (Thumbs up/down to show their understanding/happiness of today's lesson) - ask if there's any question about the lesson.		

- Suggest students to find some patterned pictures that resonate to them.	
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Lesson2

Subject: Math	Grade: 9	Topic: Art project part1. (Tessellation graphing)	Duration: 75mins
Curriculum Learning Standards - Continuous linear relationships can be identified and represented in many connected ways to identify regularities and make generalizations. - Similar shapes have proportional relationships that can be described, measured, and compared. - Use logic and patterns to solve puzzles and play games. - Use tools or technology to explore and create patterns and relationships, and test conjectures. - two-variable linear relations, using graphing.			
Lesson Content Objectives <i>What the students will KNOW.</i> By the end of the lesson, students should be able to: - Identify and describe patterns found in real-life scenarios. - Understand the concept of function as a special kind of pattern. - Engage in problem-solving experiences that are connected to story, cultural practices, and perspectives relevant to local First Peoples communities, the local community, and other cultures. - Incorporate First Peoples worldviews and perspectives to make connections to mathematical concepts.			
Materials and Equipment Needed for this Lesson. <i>Slides with stories about indigenous weaving, Printed handouts, Whiteboard and markers, Paper and pens, color pens, Name card.</i>			

Lesson Progression / Stage:

1. Warm-up <i>Get students' attention, connect to previous knowledge, and explain why the topic is important to learn.</i>		Time Allotted: 5-7 mins
Learning Activities Set up the seating chart before class. Engagement Activity: Review the way I introduced last class for constructing functions based on patterned data sets. Let students discuss in groups to share the patterns from their own cultural backgrounds.	Language Adaptations for ELs - Project the screen to show last class examples. - Encourage group discussion by asking questions. - Allow time for translation if students still have trouble understanding gesture/visual explanations. - Encourage peer support (same language group)/ support / guide.	

Assessment/Evaluation of Students' Learning during This Stage:

Observation of classroom engagement.

2. Presentation**Time Allotted:**
20mins

*Introducing the weaving patterns/ blankets patterns from indigenous people.
Show examples of the patterns. Handing out activity materials.*

Learning Activities

Introducing the different patterns indigenous people did for blankets, scarves, the Salish weaving and so on.

Handing out the activities to the students with articles about different persons' experiences, related pictures and reflection questions.

Language Adaptations for ELs

- Be aware of voice, adjust pacing.
- When using complex words, make sure students understand the meanings.

Assessment/Evaluation of Students' Learning during This Stage

- In-the-moment comprehension check
- Sit / stand to re-state the idea / ask a question.

3. Practice and Production**Time Allotted:**
40mins

Activity discussion. Lead students to share their feelings or answers for the reflection questions. Offering time to students to think about the tessellation arts they would like to create and share that is meaningful to them.

Learning Activities

Encourage students to work in groups to share, discuss, and come back together.

Share their findings and understandings from the activity.

Introducing the tessellation art project. Lead students to think about possible tessellation art they would like to create that has the shape resonates to them. Answer questions about the project.

Language Adaptations for ELs

- Circulate and do frequent check-ins for ELs while they work.
- Strategic pairings / groupings for peer translation.

Assessment/Evaluation of Students' Learning during This Stage:

Circulate while students are discussing the questions. Ask questions to encourage explanation and deeper thinking.

Assessment/Evaluation Adaptations for ELs during This Stage:

Offer options to accommodate language: time extensions. Allow them to use the translator to better understand the articles and the questions.

4. Closure

- reflection gestures (Thumbs up/down to show their understanding/happiness of today's lesson)
- ask if there's any question about the lesson/project.

**Time Allotted:
5-7mins**

Lesson7

Subject: Math	Grade: 9	Topic: Another Form of the Equations + Social justice project	Duration: 75mins
Curriculum Learning Standards - Continuous linear relationships can be identified and represented in many connected ways to identify regularities and make generalizations. - Similar shapes have proportional relationships that can be described, measured, and compared. - Use logic and patterns to solve puzzles and play games. - Use tools or technology to explore and create patterns and relationships, and test conjectures.			
Lesson Content Objectives <i>What the students will KNOW.</i> By the end of the lesson, students should be able to: - Identify and describe patterns found in real-life scenarios. - Understand the concept of function as a special kind of pattern. - Visualize to explore mathematical concepts. - two-variable linear relations, using graphing, interpolation, and extrapolation			
Materials and Equipment Needed for this Lesson. <i>Slides with stories about indigenous weaving, Printed handouts, Whiteboard and markers, Paper and pens, color pens, Name card.</i>			

Lesson Progression / Stage:

1. Warm-up <i>Get students' attention, connect to previous knowledge.</i>		Time Allotted: 5-7 mins
Learning Activities Set up the seating chart before class. Engagement Activity: Check-in with the whole class and ask how they like their Tessellation Desmos project. Pull out one example/practice question and let students work on that in groups to review previous knowledge.	Language Adaptations for ELs - Project the screen to show the Tessellation Desmos project. - Encourage group discussion by asking questions. - Allow time for translation if students still have trouble understanding gesture/visual explanations. - Encourage peer support (same language group)/ support / guide.	
Assessment/Evaluation of Students' Learning during This Stage: Observation of classroom engagement.		

2. Presentation <i>Introducing the horizontal, vertical, and oblique lines.</i>		Time Allotted: 20mins
Learning Activities Introducing the special linear functions by using examples in the worksheet. Modeling how to solve the questions. Handing out the worksheets to the students with practice questions. Let students work in groups.	Language Adaptations for ELs - Be aware of voice, adjust pacing. - When using complex words, make sure students understand the meanings.	
Assessment/Evaluation of Students' Learning during This Stage - In-the-moment comprehension check - Sit / stand to re-state the idea / ask a question.		
3. Introducing Social Justice Project		Time Allotted: 40mins
Learning Activities Introducing the project, let students understand the importance of social justice in constructing a city. Let students form groups (anonymous voting) and choose their interest roles and share ideas about how they would like to present the project.	Language Adaptations for ELs - Circulate and do frequent check-ins for ELs while they work. - Strategic pairings / groupings for peer translation.	
Assessment/Evaluation of Students' Learning during This Stage: Circulate while students discussing on the project. Ask questions to encourage deeper thinking of the project. Assessment/Evaluation Adaptations for ELs during This Stage: Allow students to use the translator to better understand the project and discuss with their peers.		
4. Closure - reflection gestures (Thumbs up/down to show their understanding/happiness of today's lesson and the project) - ask if there's any question about the lesson/project.		Time Allotted: 5-7mins