

COMPREHENDING STEM EDUCATION FOR ENGLISH LANGUAGE LEARNERS FROM A LINGUISTIC PERSPECTIVE

Vanessa Mo

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Land Acknowledgement

I would like to begin by acknowledging that the land on which we gather is the traditional territory of the Niitsitapi (Blackfoot People)—comprising the Siksika, Piikani, and Kainai First Nations People.

My unit plan also demonstrates the Ojibwe calendar, and it originated from the Anishinaabe people, who are the second-largest First Nation group in Canada.

About me : A student teacher



My name is Vanessa Mo (Yixin Mo), and I am currently pursuing a Honours Bachelor of Education at the University of Calgary, where I am also completing my student teaching. I specialize in supporting elementary English language learners and hold a first degree in Applied Linguistics from the University of Victoria, providing me with a strong foundation in both linguistics and education. I am honored to have received the University of Calgary Undergraduate Continuing Students Award, a competitive award recognizing academic achievement. I also have relevant experience teaching ESL and Mandarin. I am passionate about exploring different cultures and learning new languages, and I am always eager to expand my knowledge and skills in these areas.



RESEARCH METHODOLOGY

The format of the research is a literature review, and it focuses on the teaching strategy for English language learners in STEM classes. The purpose of the research is to prove that the Cultural and Linguistics Responsiveness strategy (CLR) could help English Language Learners to improve understanding levels in STEM classrooms, as they can be relatable to various cultural components. At the end of my research paper I would create and implement a cross-curriculum lesson plan of science and mathematics that gathers cultural components such as the Ojibwe calendar, the Chinese farmer calendar, and the French Revolution calendar. ★

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7	87 Fr 钫 fāng	88 Ra 镭 léi	89~103 Ac-Lr 锕系	104 Rf 钚 lú	105 Db 铼 dù	106 Sg 𬬻 xì	107 Bh 𬬾 bō	108 Hs 𬬿 hēi	109 Mt 𬭎 mài	110 Ds 𬭏 dá	111 Rg 𬭐 lún	112 Cn 𬭑 gē	113 Uut	114 Fl 𬬻 fū	115 Uup	116 Lv 𬬼 lì	117 Uus	118 Uuo		

镧系	57 La 镧 lán	58 Ce 铈 shì	59 Pr 镨 pǔ	60 Nd 钕 nǚ	61 Pm 钷 pǒ	62 Sm 钐 shān	63 Eu 铕 yōu	64 Gd 钆 gá	65 Tb 铽 tè	66 Dy 镝 dí	67 Ho 铥 huǒ	68 Er 铒 ěr	69 Tm 铥 diū	70 Yb 镱 yì	71 Lu 镥 lǚ
锕系	89 Ac 锕 ā	90 Th 钍 tǔ	91 Pa 镤 pú	92 U 铀 yóu	93 Np 镎 ná	94 Pu 钚 bù	95 Am 镅 méi	96 Cm 锔 jū	97 Bk 锫 péi	98 Cf 锿 kāi	99 Es 镱 āi	100 Fm 镆 fèi	101 Md 镈 mén	102 No 镎 nuò	103 Lr 镥 láo

CHALLENGES THAT ELLS WILL FACE

- ★ Advanced disciplinary terminology (Hoeg, 2016)
- ★ Science and math has its own language
- ★ Different curriculum setting
- ★ Different assessment



Some types of calendar will be demonstrated

Calendar Type	Ojibwe Skywatcher Calendar	Ojibwe Turtle Calendar	Chinese Farmer Calendar	French Revolutionary Calendar	Gregorian Calendar
Learning outcome for mathematics	N/ A	turtle shell multiplication	solar term calculations : multiplication	multiplication Least Common Multiple	Multiplication
Learning outcomes for science	lunar cycle Solar Eclipse	What animals/ plants will be affected by lunar cycle.	Solar cycle and Moon cycle	Solar cycle	Solar Cycle

Time to criticize myself

Let's move on to the essential part: My unit plan



Lunar Cycle of Ojibwe Calendar

Name: _____

moon is originated from “-month”

1) Moon phase is _____. We have it because _____.

2) One full moon/ lunar cycle is around ____ days, and one solar year is around ____ days.

Introduction about Ojibwe People

“The Anishinaabe are a large First Nation group whose homelands cover a vast swath of territory in the Great Lakes and westward..... The Ojibwe, the Odawa, and the Potawatomi make up the collective Anishinaabe.”

You can even cut them into smaller pieces!

TIP 1



Let's circle the word that you do not know!

What Should we do After Circling?



Check dictionary/ translation app and write down all circling words into vocabulary notebooks.

Great tip to learn English faster:

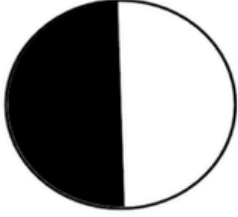
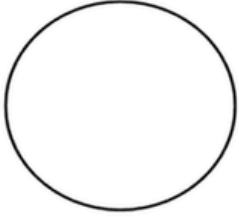
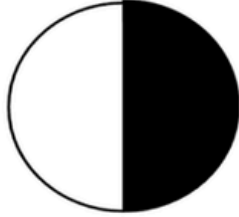
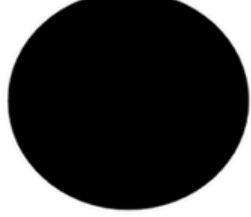
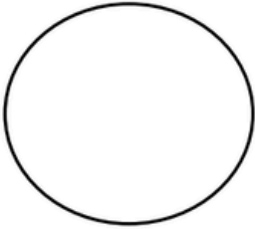
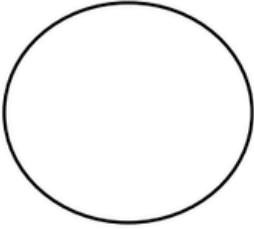
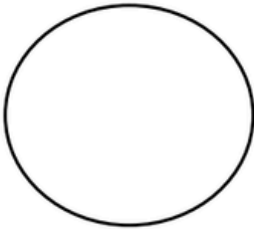
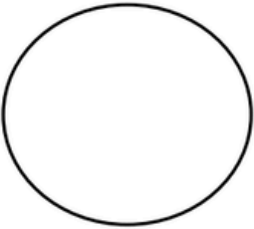
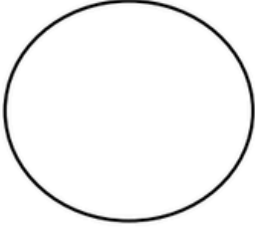
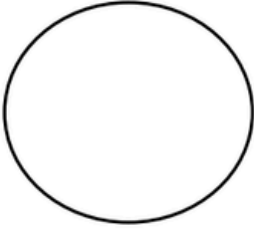
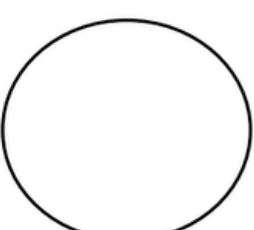
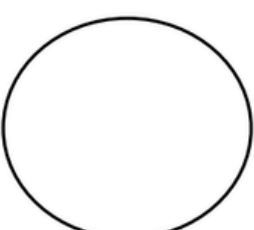
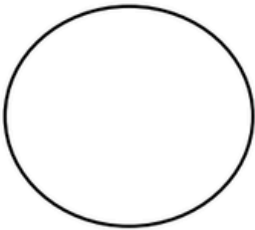
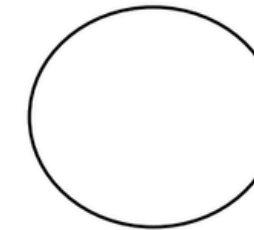
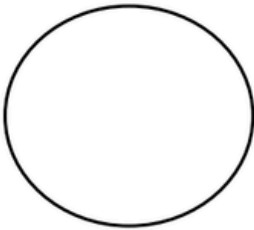
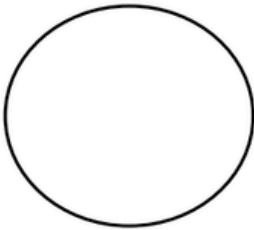
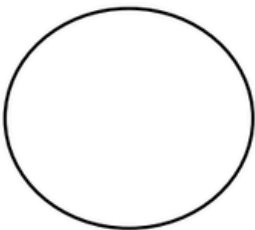
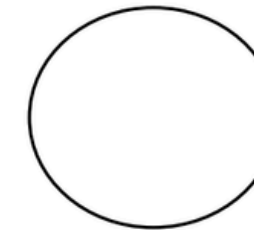
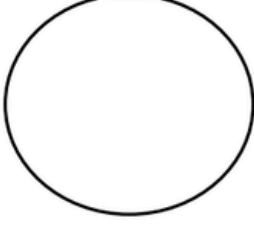
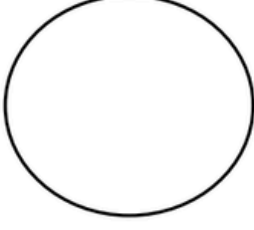
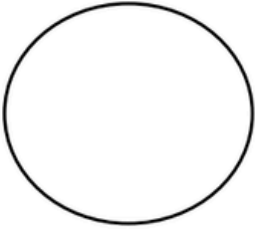
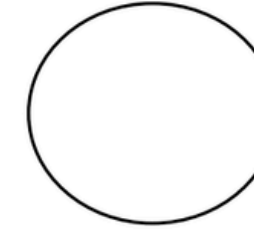
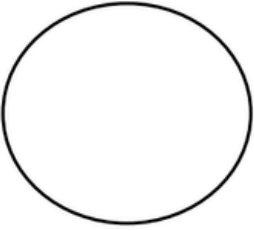
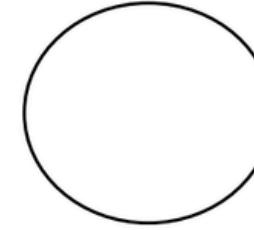
For every new word you learn, you have to make 1-2 new sentence(s) about it.

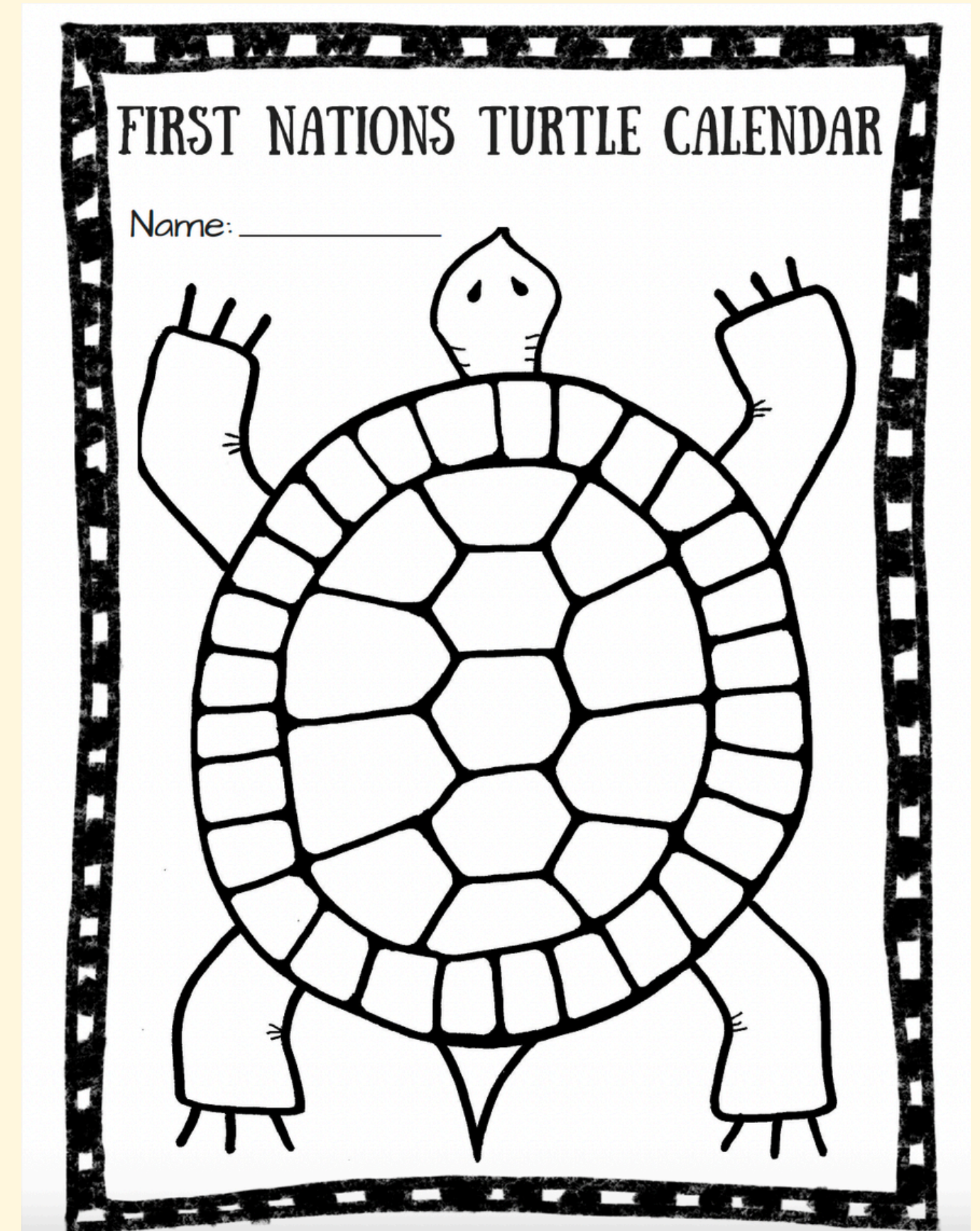
If worksheet is too easy for them, you will do this.....

“Moon” is from “month”; thus, the moon revolves around the earth for around one month.

"Eclipse" contains the meaning of "disappear" (Oxford English Dictionary, n.d.). Thus, “solar eclipse” can be perfectly used to define when the moon is blocking the sun from the earth, and it happens in the
new moon

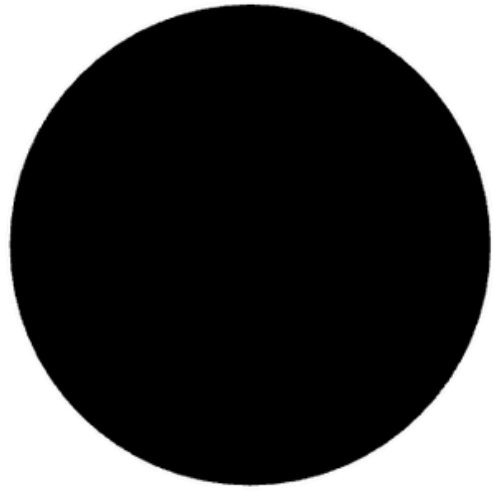
Tip 2: Cut everything into “bite-sized pieces” and focus on connection

				
	FQ	FM	TQ	NM
FEB				
MAR.				
APR				
MAY				
JUN				

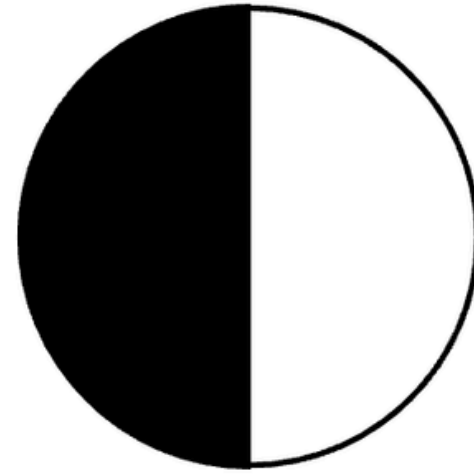


**They get confused
when contents are
too heavy and
complex!**

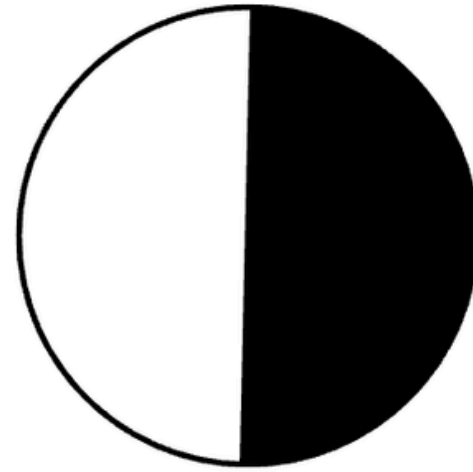




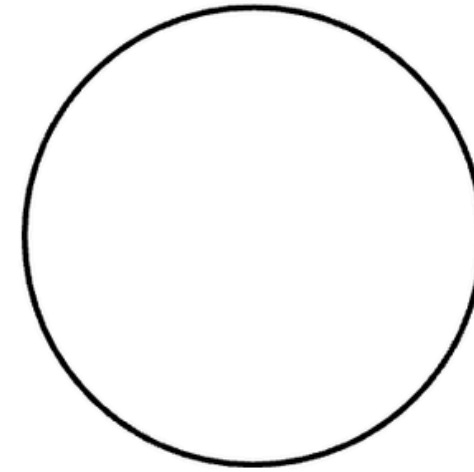
NM



FQ



TQ



FM

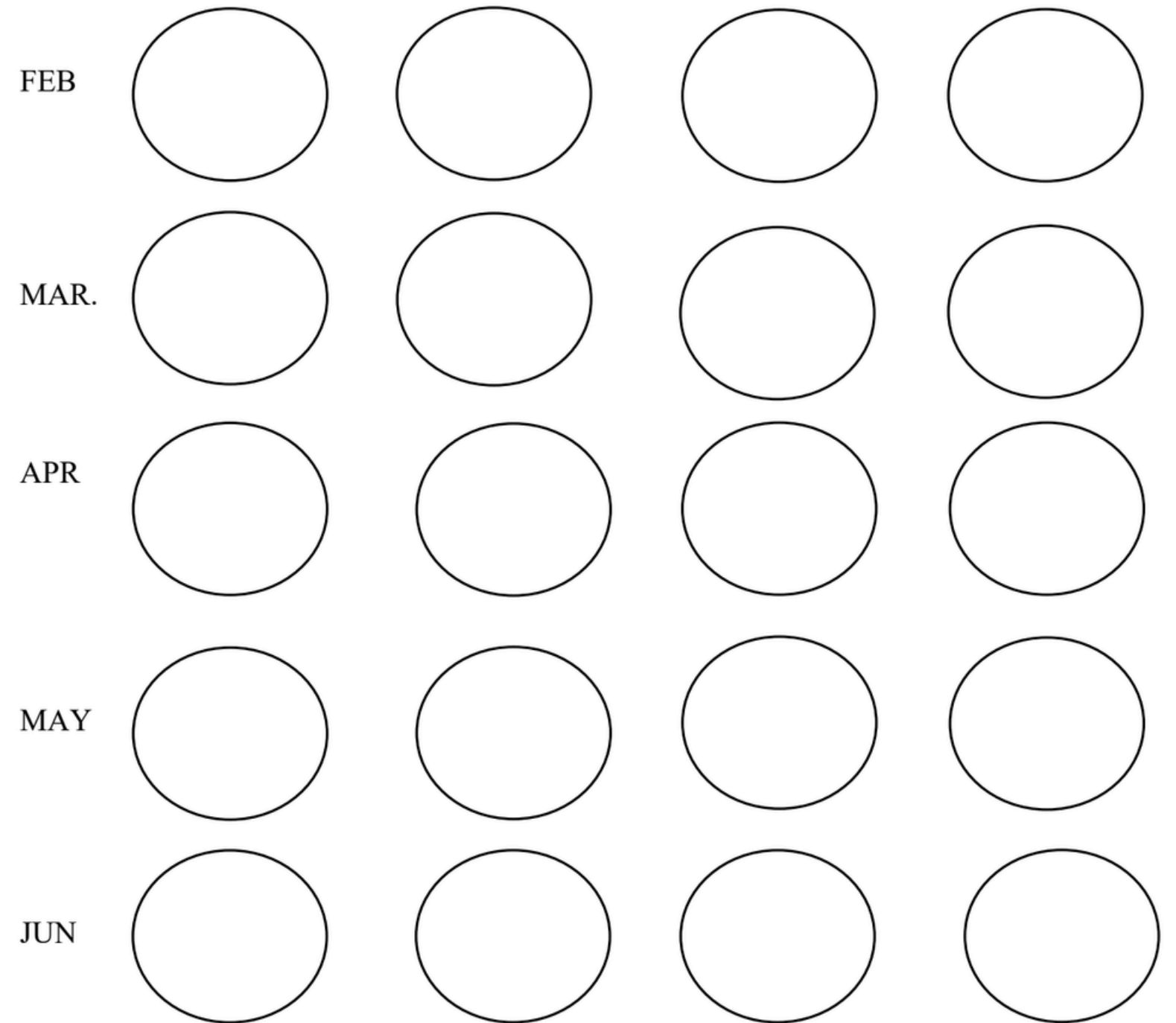
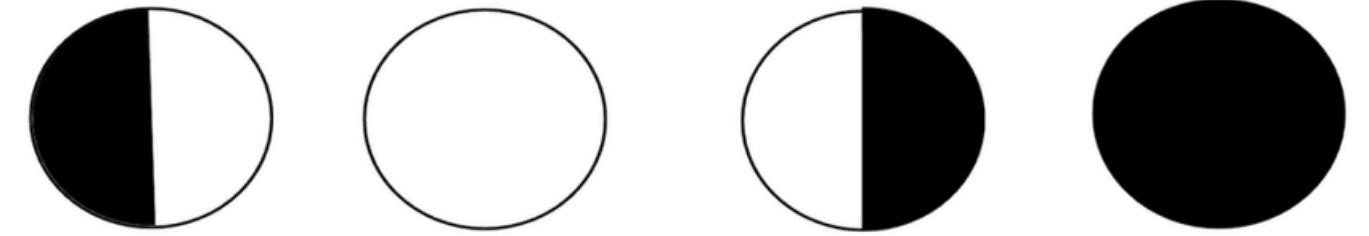
Then once at a time !



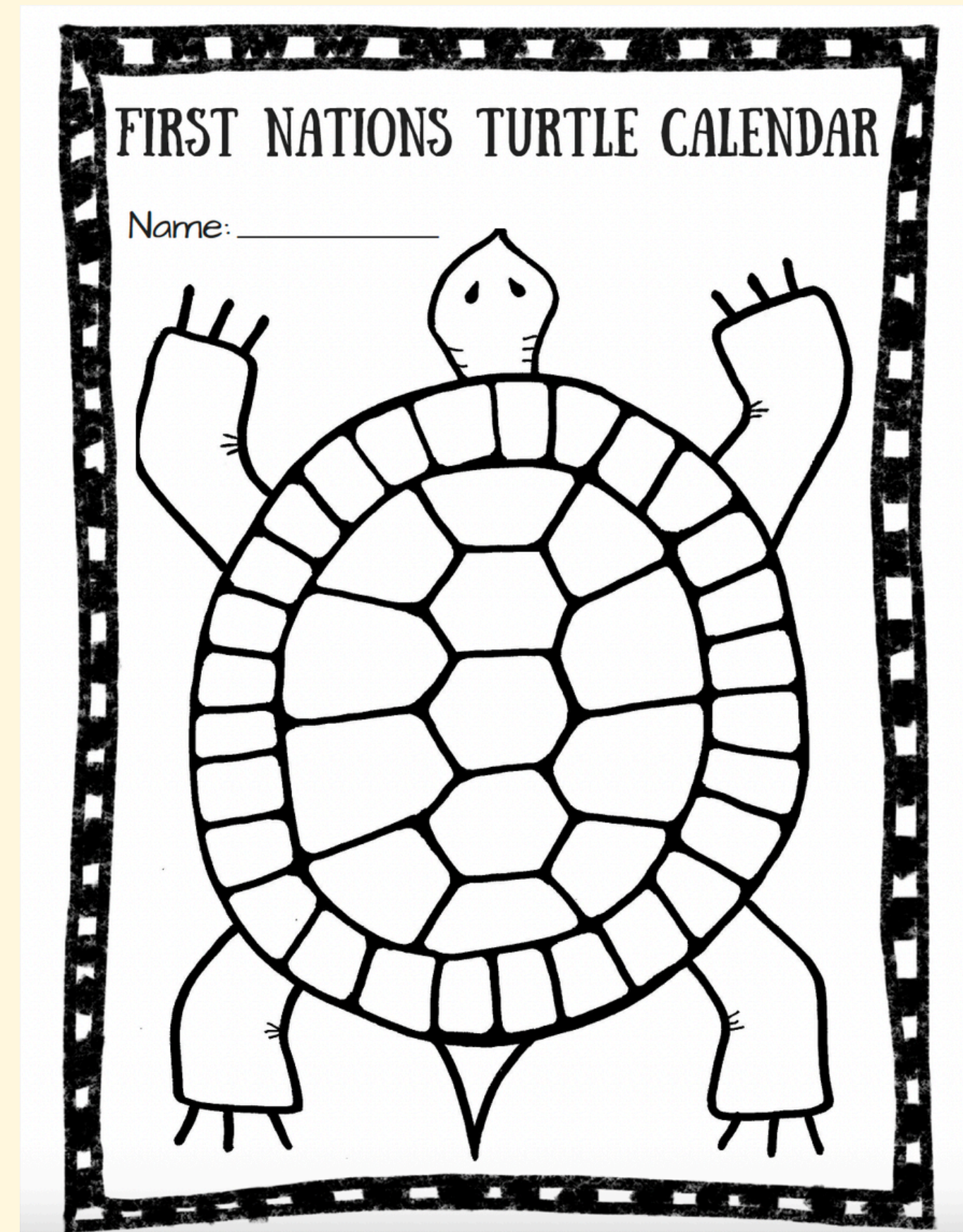
some ideas and examples for the unit design

1 What do you see in the Ojibwe Calendar?

2 Which moons are first quarter, full moon, third quarter, and new moon?



(Lee et al., 2019)



<https://ecampusontario.pressbooks.pub/indigstudies/chapter/13-grandmother-moons/>

(Miss Innovative Native, n.d.)



sucker fish lay eggs close to the Winter Solstice, shortly before the full moon .



Picture generated by Canva AI.

THE CHINESE FARMER'S CALENDAR: A VISUAL GUIDE TO THE 24 SOLAR TERMS

The 24 Solar Terms are a time system formed by the ancient Chinese observing the sun's annual motion. It accurately reflects seasonal changes and climate variations, guiding traditional agricultural production and daily life.

SPRING

UNDERSTANDING SPRING: SIX SOLAR TERMS

- 1. Start of Spring (Lichun)**
Marks the beginning of spring, all things revive.
Three Pentads:
- East wind thaws, hibernating insects awaken, fish swim up to ice.
Customs: "Biting Spring," whipping spring oxen.
- 2. Rain Water (Yushui)**
Temperatures rise, less snow, more rain.
Three Pentads:
- Otters sacrifice fish, wild geese arrive, trees sprout.
Rite: Position swapped with Jingche in Han Dynasty due to Emperor's name taboo.
- 3. Awakening of Insects**
Spring thunder, awakens hibernating insects.
Three Pentads:
- Peach blossoms, orioles sing, hawks become colubus.
Hong Kong Custom: "Beating the Villain."
- 4. Spring Equinox (Chunfen)**
Day and night are equal length worldwide.
Three Pentads:
- Swallows arrive, thunder begins, lightning strikes.
International: National Holiday in Japan.
- 5. Pure Brightness (Qingming)**
Clear weather, all things visible, also a traditional festival.
Three Pentads:
- Peonies blossom, voles become quails, rainbows appear.
Customs: Tomb sweeping, spring outings.
- 6. Grain Rain (Guyu)**
Rain gives birth to hundred grains, favorable for growth.
Three Pentads:
- Buckwheat grows, cuckoos preen, hoopoes land on mulberry.
Legend: Cangjie invented characters, Heaven rained grain as reward.

SUMMER

UNDERSTANDING SUMMER: SIX SOLAR TERMS

- 1. Start of Summer (Lixia)**
Summer begins, all things enter peak growth.
Three Pentads:
- Mole crickets chirp, earthworms emerge, melon vines grow.
Farming: Transplanting rice, sowing corn/beans in north.
- 2. Grain Buds (Xiaoman)**
Grain crops are full but not ripe.
Three Pentads:
- Bitter vegetables show, grass dies from sun, grain in autumnal.
Proverb: "Plant melons and beans now."
- 3. Grain in Ear (Mangzhong)**
Crops with awns (beards) mature, busy farming.
Three Pentads:
- Mantises appear, snakes crawl, mockingbirds cease.
Customs: Harvesting wheat, planting rice.
- 4. Summer Solstice (Xiazhi)**
Longest day in Northern Hemisphere, Yin grows.
Three Pentads:
- Beet and minters, cicadas sing, semi-aquatic herbs flourish.
Custom: Eating noodles, "Sanfu" days begin.
- 5. Minor Heat (Xiaoshu)**
Weather begins to be hot, but not the hottest.
Three Pentads:
- Warm wind arrives, crickets leave walls, young bats practice flying.
Mete: "Sanfu Tian" (Dog Days) starts, use acupuncture.
- 6. Major Heat (Dashu)**
The hottest time of the year, in "Middle Fu."
Three Pentads:
- Germinating grass becomes fireflies, earth is humid, great rain pours.
Climate: After this, Start of Autumn arrives.

AUTUMN

UNDERSTANDING AUTUMN: SIX SOLAR TERMS

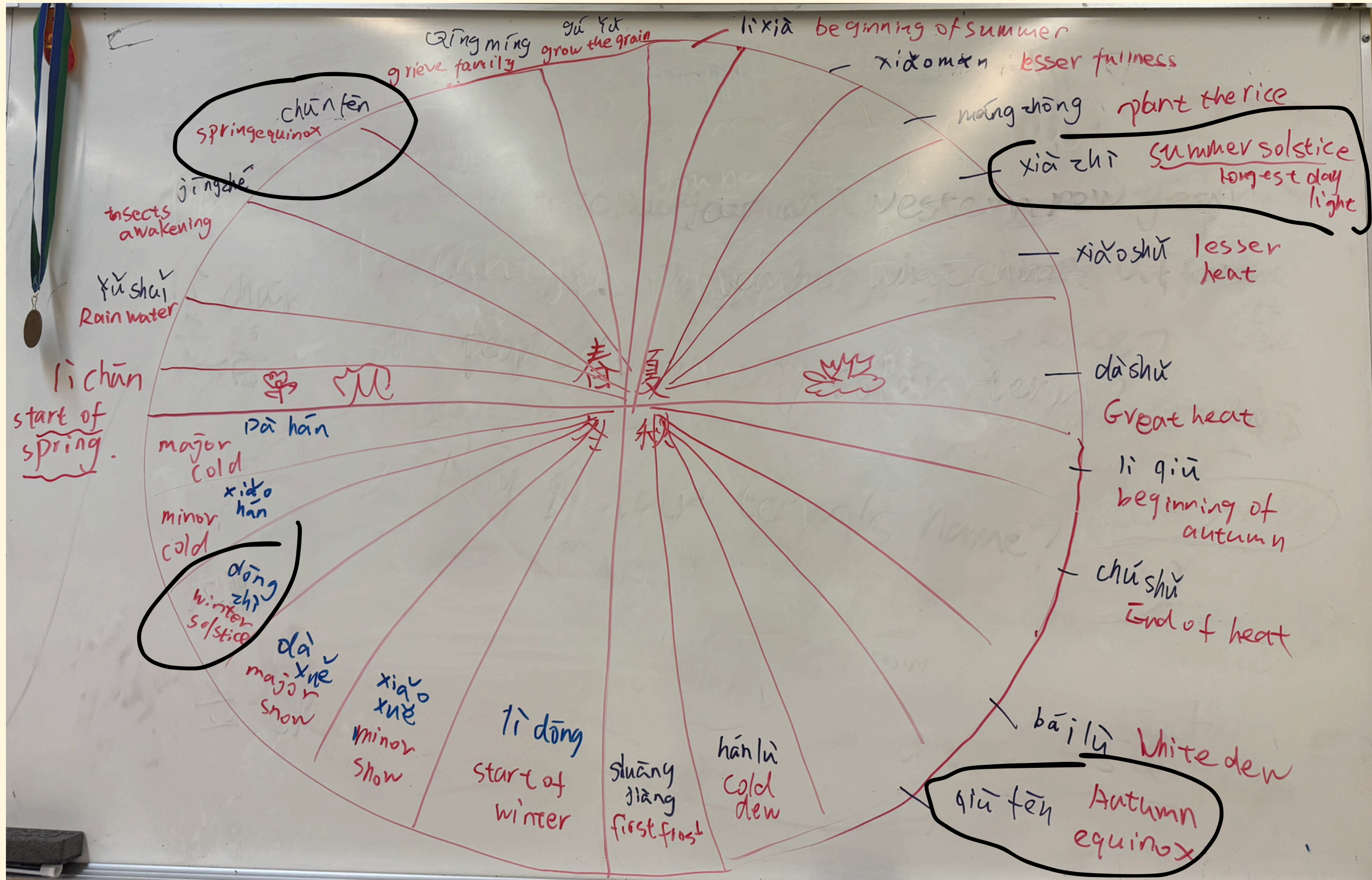
- 1. Start of Autumn (Liqiu)**
Aug 7-9. Signs that summer is passing, autumn arrives. "Qiu" means harvest.
Three Pentads: East wind arrives, white dew falls, winter cicadas sing.
- 2. Limit of Heat (Chushu)**
Aug 23. "Chu" means end, heat begins to fade.
Three Pentads: Hawks sacrifice birds, heaven and earth become solemn, grain is harvested.
- 3. White Dew (Bailu)**
Sep 8. Temperature drops, water vapor condenses into white dew.
Three Pentads: Wild geese come, swallows return, flock birds store food.
- 4. Autumn Equinox (Qiufen)**
Sep 23. Midpoint of autumn, day and night equal length globally.
Three Pentads: Thunder ceases, insects hibernate, water dries up.
- 5. Cold Dew (Hanlu)**
Oct 8. Colder than White Dew, dew is colder and about to freeze.
Three Pentads: Wild geese come as guests, sparrows dive into water, chrysanthemums bloom.
- 6. Frost's Descent (Shuangjiang)**
Oct 23. Weather becomes cold, water vapor condenses into frost, last term of autumn.
Three Pentads: Wolves sacrifice beasts, vegetation turns yellow and falls, hibernating insects sleep.

WINTER

UNDERSTANDING WINTER: SIX SOLAR TERMS

- 1. Start of Winter (Lidong)**
Nov 7-8. Winter begins, all things stored, crops harvested.
Three Pentads: Water begins to freeze, earth begins to rest to harden, pheasants enter water become clams.
Custom: "Supplementing Winter" with hearty food (dumplings, mutton).
- 2. Minor Snow (Xiaoxue)**
Nov 22-23. Temperature drops, precipitation turns to snow, but small amount.
Three Pentads: Rainbows are hidden, weather ascends, all is closed.
Climate: Snowfall begins.
- 3. Major Snow (Daxue)**
Dec 8-8. Weather is colder, snowfall range and intensity increase.
Three Pentads: Earthenware doesn't break, tigers mate, lychee spreads.
Scenes: Snowy landscape, frozen rivers.
- 4. Winter Solstice (Dongzhi)**
Dec 21-23. Shortest day in Northern Hemisphere, longest night, "Extreme of Winter."
Three Pentads: Earthworms kneel, deer shed antlers, sparrows roar.
Important Festival: Ancestor worship, eating dumplings.
- 5. Minor Cold (Xiaohan)**
Jan 5-6. Marks the coldest days of the year.
Three Pentads: Wild geese go north, magpies begin nesting, pheasants call.
Climate: Entering "Sanjiu" (Coldest Nine Days).
- 6. Major Cold (Dahan)**
Jan 20. The last solar term, extreme cold, end of the year.
Three Pentads: Chickens nod, birds behave strangely, waters become completely frozen.
Forecast: Spring is coming.

Interactive session

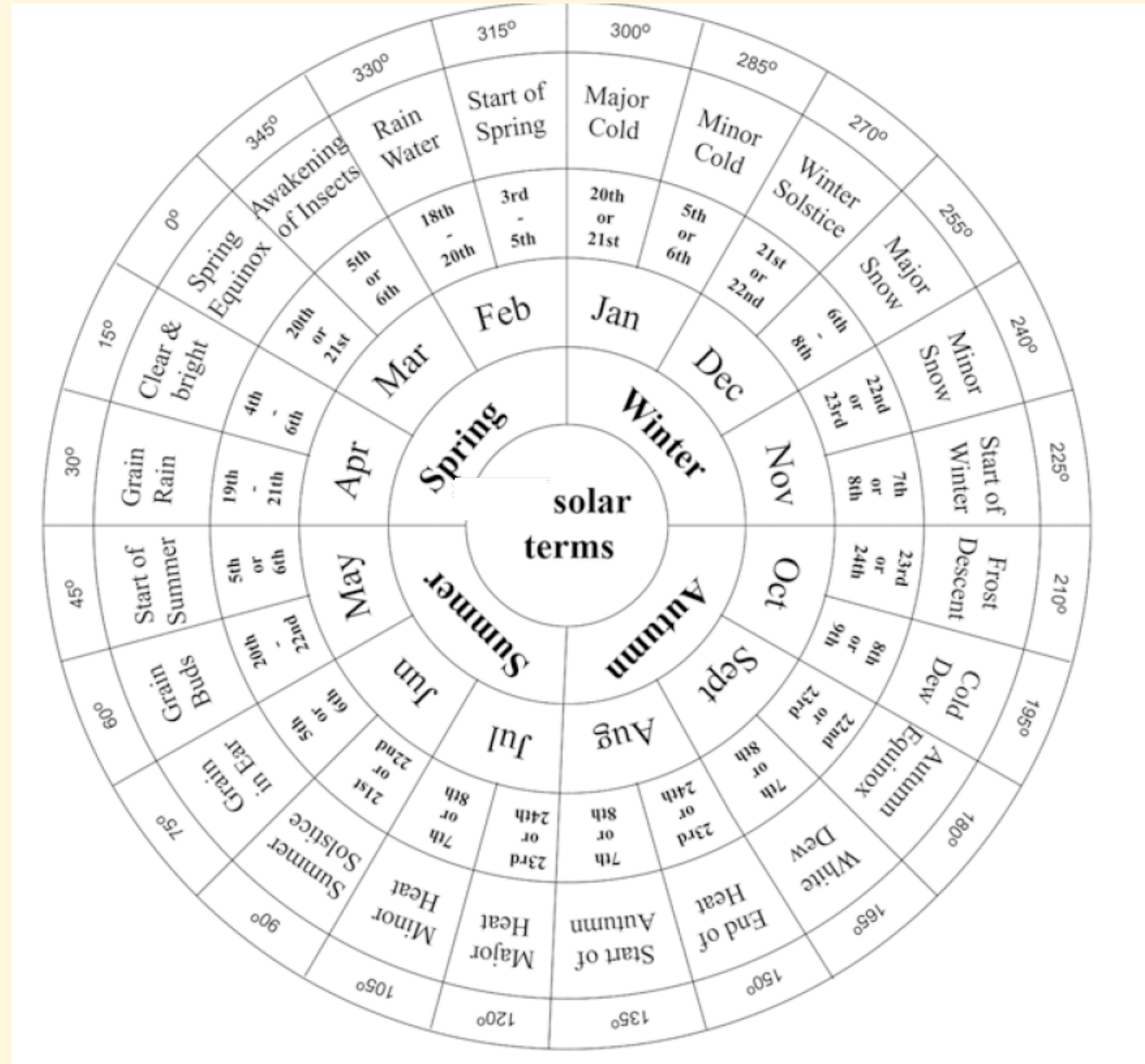




Interactive session

1) Fill in summer solstice, winter solstice, spring equinox, fall equinox (optional: try write down chinese pinyin :)

*2) Write down any mathematical expression to calculate how many solar terms there are.

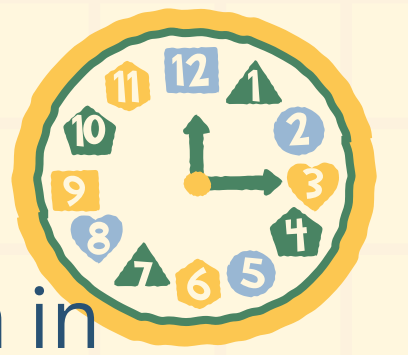


The Power of Translanguaging



Translanguaging fosters students to develop learning autonomy in classrooms (Cummins, 2019).

FRENCH REVOLUTION CALENDAR



The French revolutionary calendar was proposed after the French Revolution in 1789, which was fought against the privileged nobles (Richard, 1998). The new French revolutionary calendar had created its own name, and it later had its German and English translation versions, as table 5 shows below. With the week divided into 10 days, one month will be divided into three weeks, and one year will be divided into 12 months. In early 1793, the French revolutionary government developed a special decimal-based time system: 10 hours in a day, 100 minutes in an hour, and 100 seconds in a minute. After seven months, they abolished this system as the rationality was inappropriate. However, the French revolutionary calendar was kept until 1805, when the Gregorian calendar started to be popularized.



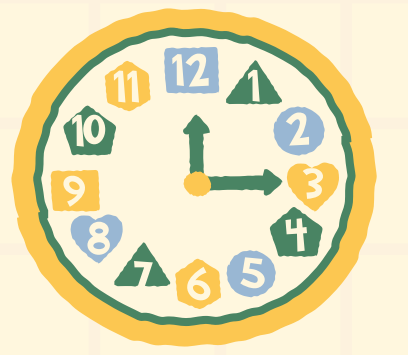
French revolutionary calendar

French	English
Vendémiaire (vendange)	Grape Harvest Month
Brumaire (brume)	Fog Month
Frimaire (frimas)	Frost Month
Nivose (nivosus)	Snow Month
Pluviose (pluie)	Rain Month
Ventose (vent)	Wind Month
Germinal (germer)	Seed Month
Floréal (fleur)	Flower Month
Prairial (prairie)	Meadow Month
Messidor (moisson)	Harvest Month
Thermidor (thermos)	Heat Month
Fructidor (fructus)	Fruit Month

students can analyze the
month from prefix such as
“brume”

(Richard, 1998, p.
262)

FRENCH REVOLUTION CALENDAR



- 1) In a day, we have 24 hours; one hour has () minutes, and one minute has () seconds.
- 2) The original French decimal system stated that there are 10 hours in a day, 100 minutes in an hour, and 100 seconds in a minute.
- 3) Talk to your group members. What are the differences between our system and the French decimal system?
- 4) Can you use mathematical ways to explain why French people will abolish the decimal system?



Summative Assessment

Summative assessment : inquiry-based research project

The Calendar I research is _____

The calendar is based on _____ (solar cycle/ lunar cycle/ solar and lunar cycle)

A/ some mathematics expression I can use to describe this calendar:

Some scientific phenomena such as _____ (Winter Solstice, Summer Solstice, Eclipse.....)

It will be represented through _____

The calendar was originated from _____ (country/ place/ ethnicity), they created this because _____.

! We have to learn this calendar because



Always provide them feedback there!

conclusion



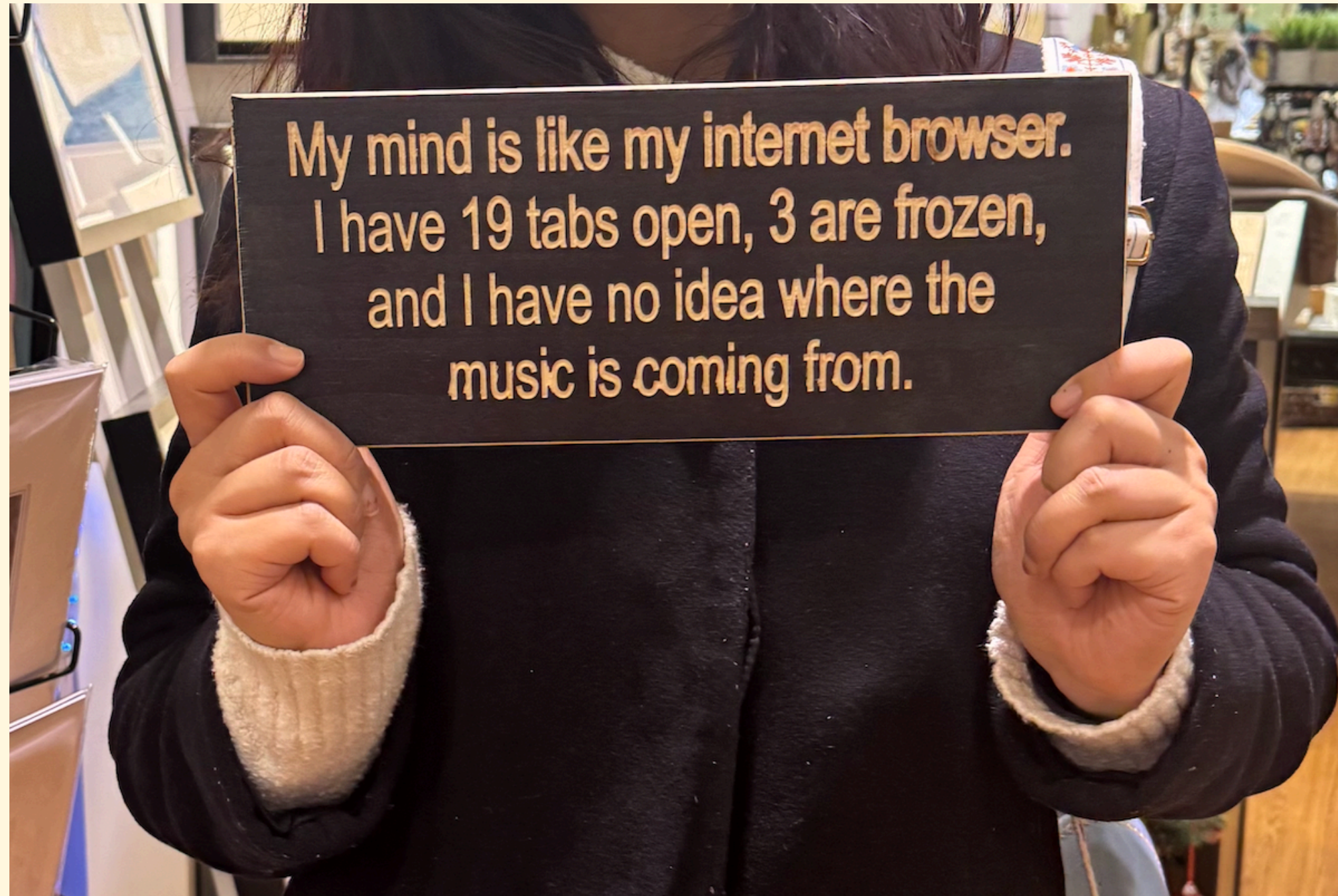
why we found it hard to use
CLR?

- Tokenism
- Hard to find connection to the curriculum.
- A great range of vocabulary could make students confused
- Time-consuming and Energy-consuming

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Q & A



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