109th South Dakota Academy of Science

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Which is the best : Technology, Resources or Active Learning Activities?

04/19/2024 - Friday

Online, face to face or hybrid education

- **Online education** is a flexible instructional environment in which learning takes place via internet.

- **Face to Face** is an instructional environment in which learning takes place in-person.

- **Hybrid** is an instructional environment in which learning takes place via internet and face to face.

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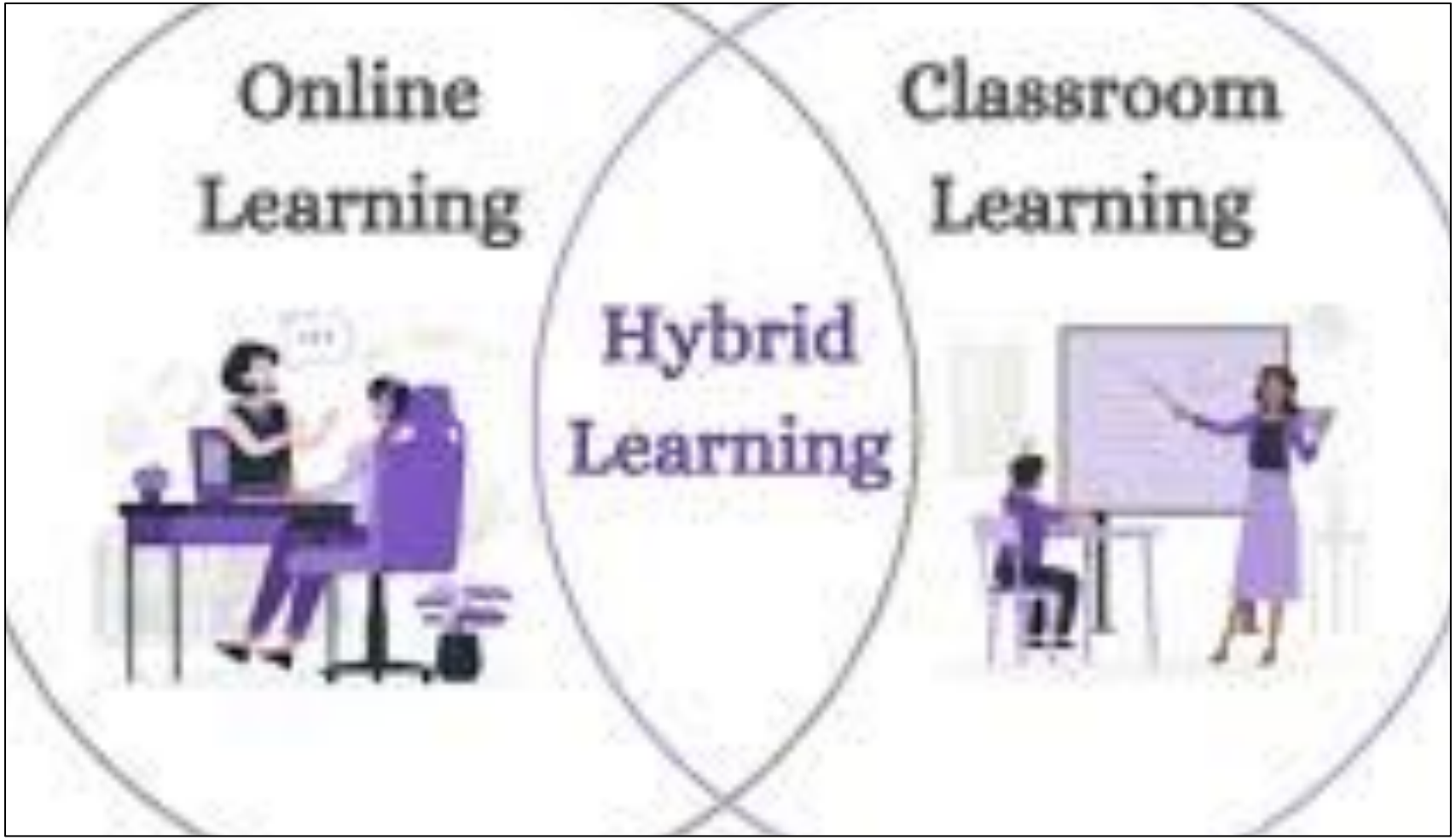
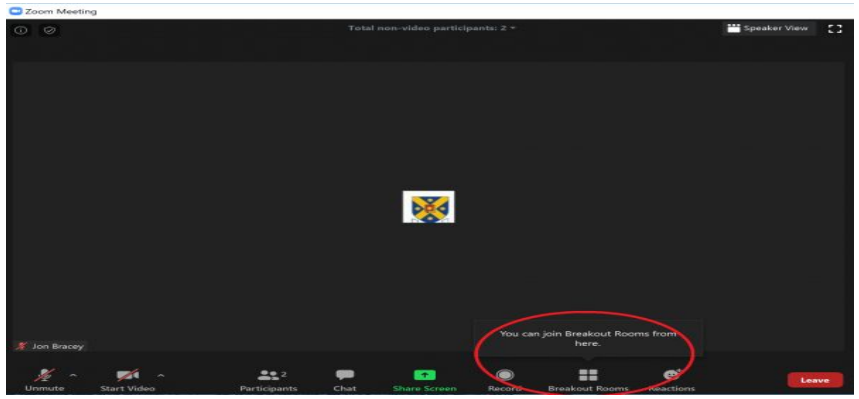


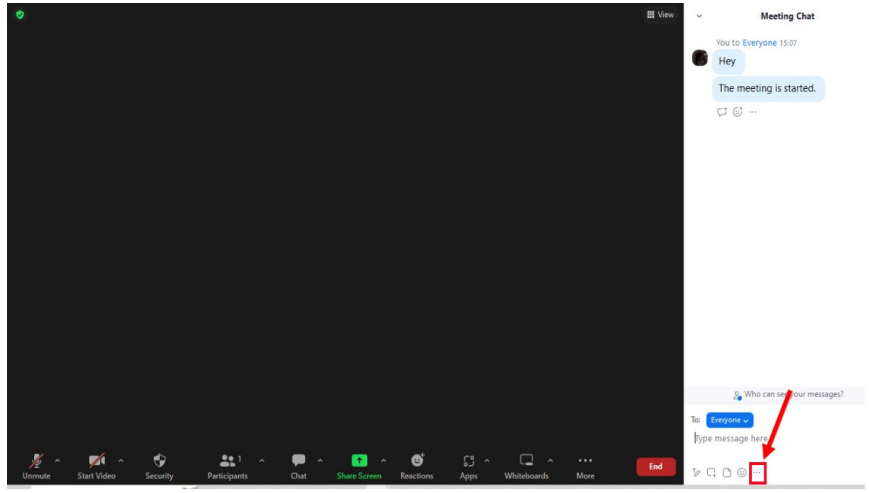
Learning Spaces

Learning spaces where interaction takes place between students-professors and students-students.

Face to Face Learning Spaces

Online Learning Spaces





Breakout rooms

Hybrid Learning Spaces

Major Learning Spaces - Learning spaces where interaction takes place between students-professors and students-students

Minor Learning Spaces - Learning spaces where interaction takes place between students-professors.

Online Education : Asynchronous & Synchronous

- **Asynchronous learning** - Interaction between students-students and students-professor without live instructions.

- **Learning Spaces** in asynchronous environment - discussion forum, learning journal assignment, quizes and written assignment.

Discussion Forum

- **Major Learning Space**
- **Minor Learning Space**

Messages

Minor Learning Space

Quiz

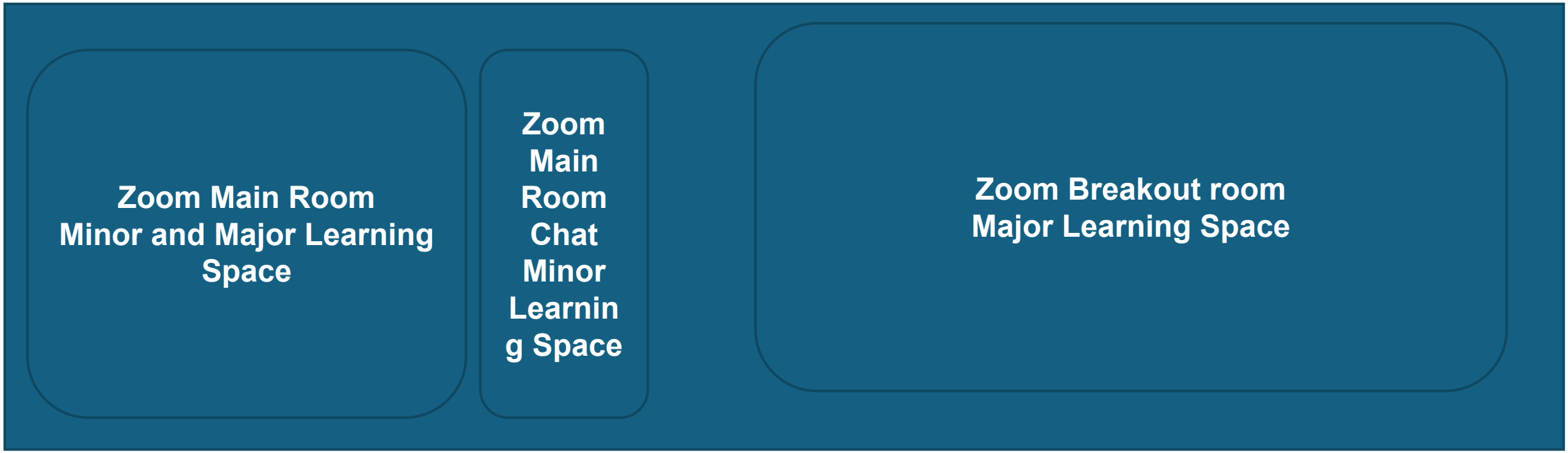
Assignment : Learning Journal & Written Assignment

Minor Learning Space

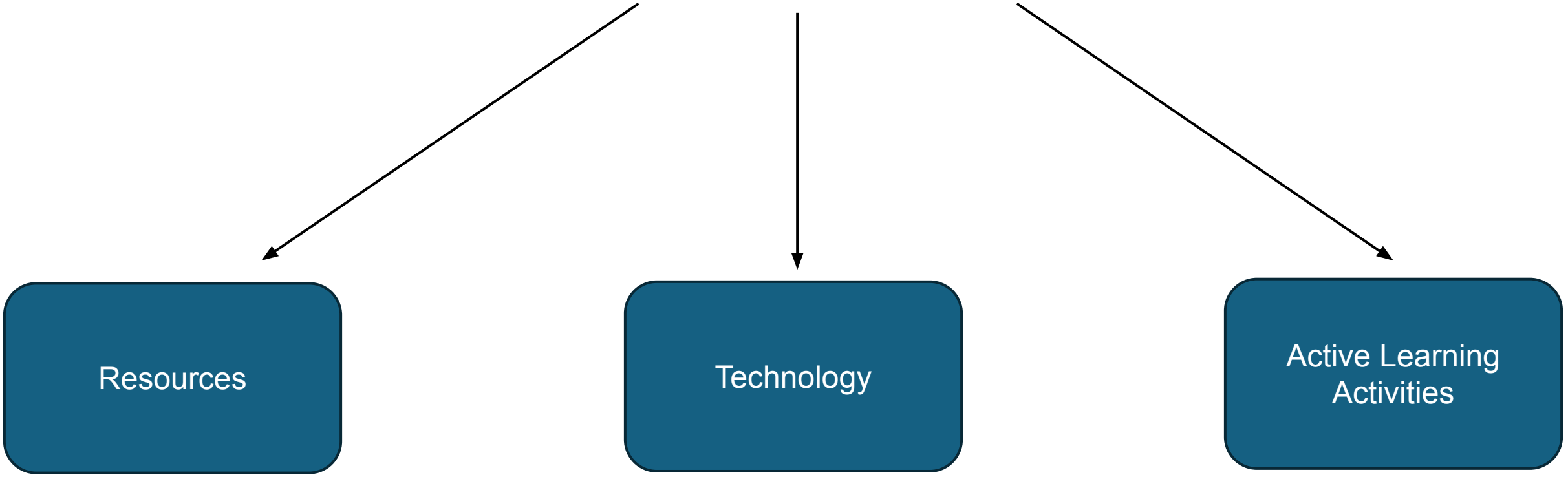
Synchronous learning

- **Synchronous learning** - Interaction between students-students and students-professor with live instructions.

- **Learning Spaces** in synchronous environment - Zoom main room, zoom chat and breakout room.



Learning



Projector - Power Point slides
White Board
Sideboard.

Simulation, Google Doc, Google Sheet, Jamboard and Google Power Point.

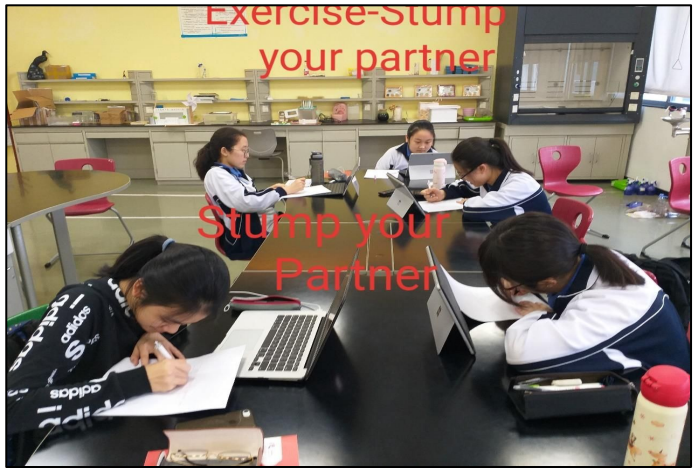
Individual, group and collective learning.

Active Learning Activities in Science Learning Spaces (SLS)

Individual, group and collective learning activities

Peer Learning enhances Learning in Major Learning Spaces

Stump your partner



Write-Pair-Share

Catch-Up

Think-Pair-Share

Individual Learning activities enhances learning in Major Learning Space

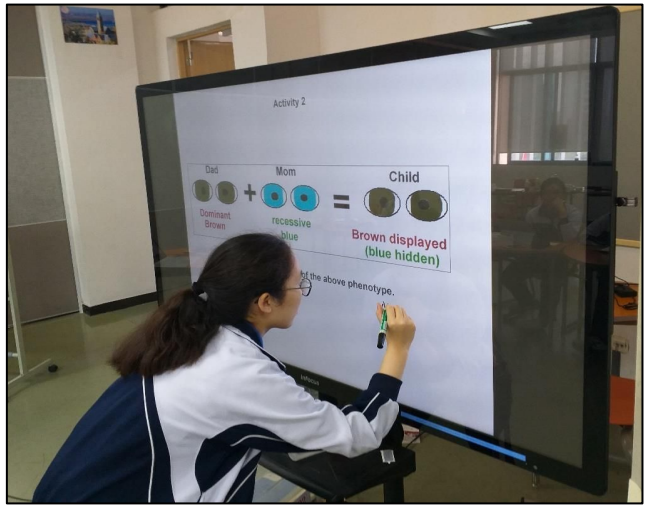
One Sentence Summary

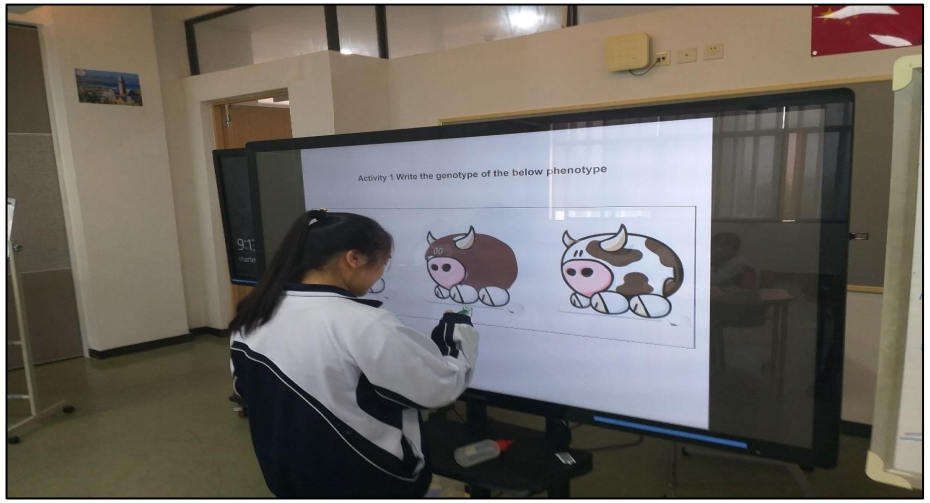
Muddiest Point

Multiple Choice Questions

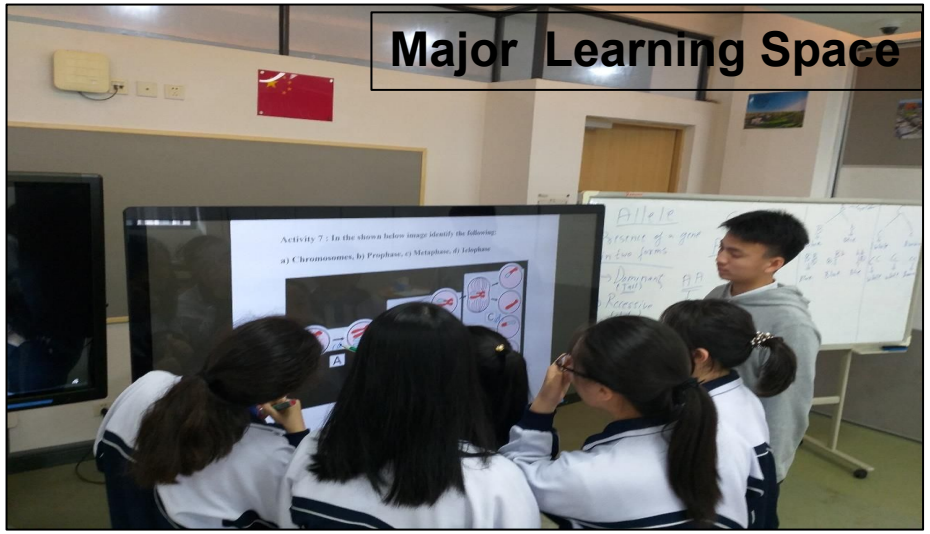
Group Learning activities enhances learning in Major Learning Space

Individual learning and Group learning activities enhances learning in Minor Learning Space





Identify and Interpret - Individual



Identify and Interpret - Group

Summary

Integration of learning activities in Major Learning Spaces are more important for advancement science learning outcomes in-person courses.

Synchronous Learning Environment

Zoom Main Room

Discussion, Dialogue and Debate

Zoom Chat

Independent Learning Activities – One sentence summary, one word story, think-write-share, muddiest point and Clicker questions.

Zoom Breakout Room

Peer Learning and Collaborative Learning Activities.

Asynchronous Learning Environment

Discussion Forum

Peer Learning and Collective Learning

Discussion Forum

Peer Learning and Collective Learning

Discussion Forum

Peer Learning and Collective Learning

Integration of learning activities in Major Learning Spaces and Minor Learning Spaces are dependent upon type of learning activity as they differentially enhances science learning outcomes in synchronous learning environment.

Site of integration of learning activity is more important in asynchronous learning outcome regardless of major learning space and minor learning space.

Resources in Science Learning Spaces (SLS)

White board, any educational material, research article, textbook and worksheet.

Major and Minor Learning Space - Outside Lecture Room

National Geographic Society - BIO BLITZ- Observe, Measure, Record and Identify

Individual work

Peer work

Group work

External Resource enhances student learning outcomes

Team Based Learning - Student observe, measure, record, calculate and discuss - STEM

Educational Material

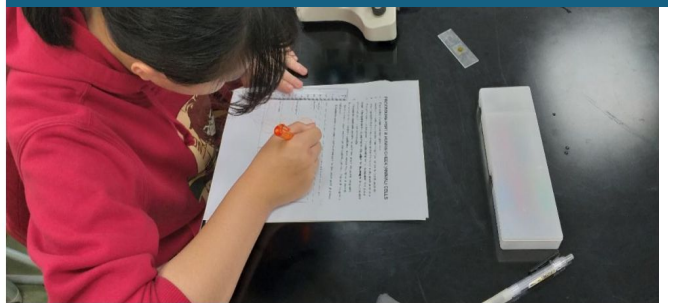
Standing Board

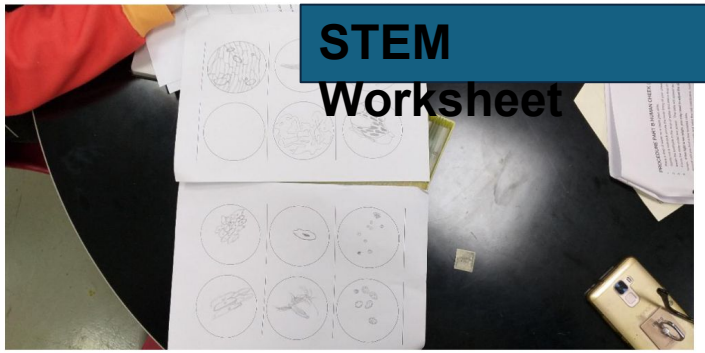
Educational material

Educational material

Laboratory Educational material

STEM Worksheet





STEM Worksheet

Laboratory Educational material

The integration of type of resource elicits differential engagement (better student group formation and long term engagement) which enhances science learning outcomes in-person learning environment

Synchronous Learning Environment

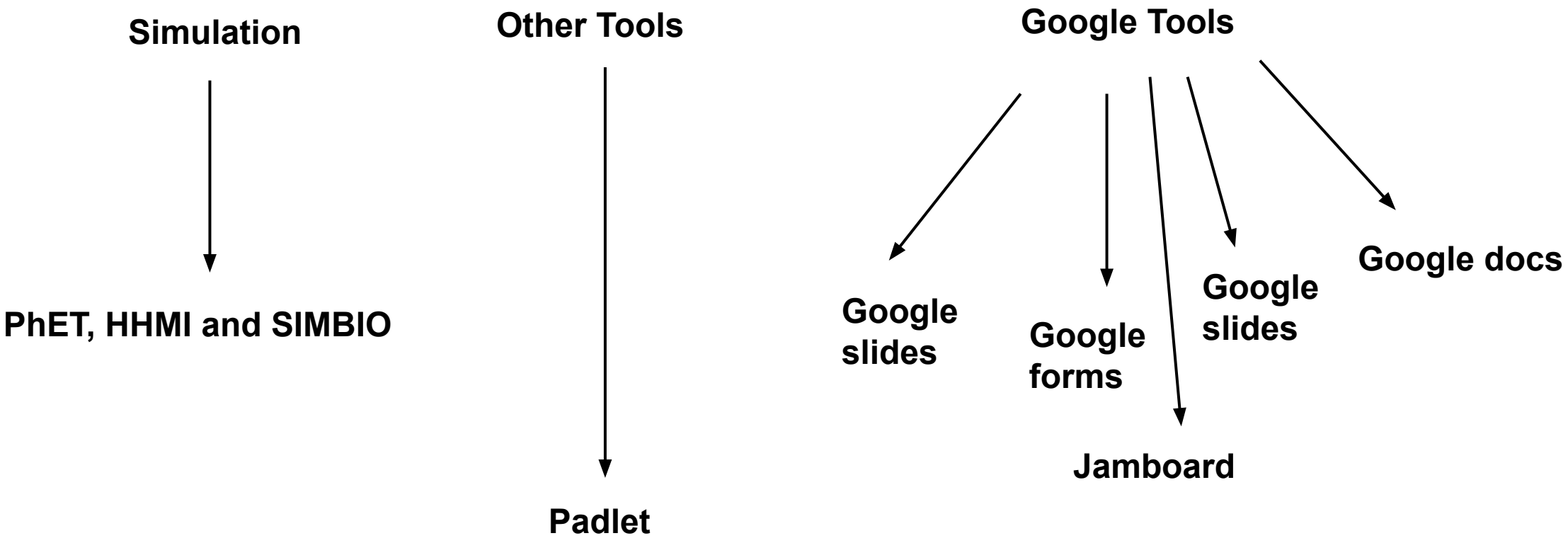
Zoom Main Room	Zoom Chat	Zoom Breakout Room
Share screen and show the textbook, research article, click and learn type animation, worksheet or any other educational material.	Share links to textbook, videos, simulations and animations.	Students and Students discuss the resources shared and write on worksheet.

Asynchronous Learning Environment

Discussion Forum	Announcement Forum	Moodle Messages
Textbook, research articles and video	Textbook, resources, video, click and learn type	Textbook, research articles, discussion with instructor.

The integration of type of resource at different location of major learning space and minor learning spaces enhances science learning outcomes.

Technology in Science Learning Spaces (SLS)



Simulation-Based Learning enhances learning outcomes in Major and Minor Learning Outcomes

Group work to individual work

Technology Based Learning (TBL) enhances science learning outcomes by exploration and discussions with students and professors both in major learning spaces and minor learning spaces.

Synchronous Learning Environment

Zoom Main Room

Share screen and show the google tools like google doc, google sheet, google power point slides and Jamboard for individual work.

Zoom Chat

Share the links of google tools and padlet

Zoom Breakout Room

Students-students and students-professors discuss the google doc, google sheet, google power point slides and jamboard for individual (fewer times like reflection and mostly for collaborative work.

Asynchronous Learning Environment

Discussion Forum

Google doc and padlet for asynchronous interaction.

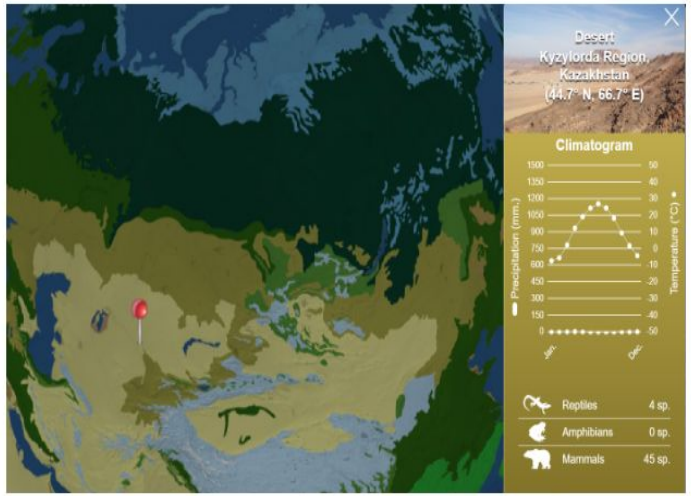
Announcement Forum

Google tools and padlet for additional information purposes. And sometime PhET simulations for purpose of scientific experiments.

Moodle Messages

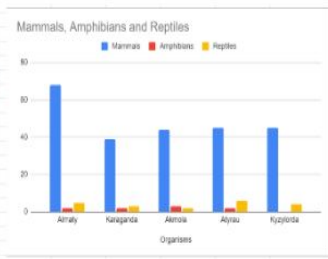
Discussion with instructor using padlet ang google tools.

Google doc enhances science learning outcomes by advancement of student scientific writing and creativity.



Reptiles - 4 sp - Even-fingered Gecko (Alsophylax pipiens), Sunwatcher (Phrynocephalus helioscopus), Tessellated Water Snake (Natrix tessellata)
Amphibians - 0 sp
Mammals - 45 sp - Argali (Ovis ammon), Asian Badger (Meles leucurus), Bobrinski's Serotine (Eptesicus bobrinskoi)

Organisms	Almaty	Karaganda	Akmola	Akyrau	Kyzylorda
Mammals	68	39	44	45	45
Amphibians	2	2	3	2	0
Reptiles	5	3	2	6	4



It can be clearly seen that the numberof mammals is bigger in every region. The one

Almaty

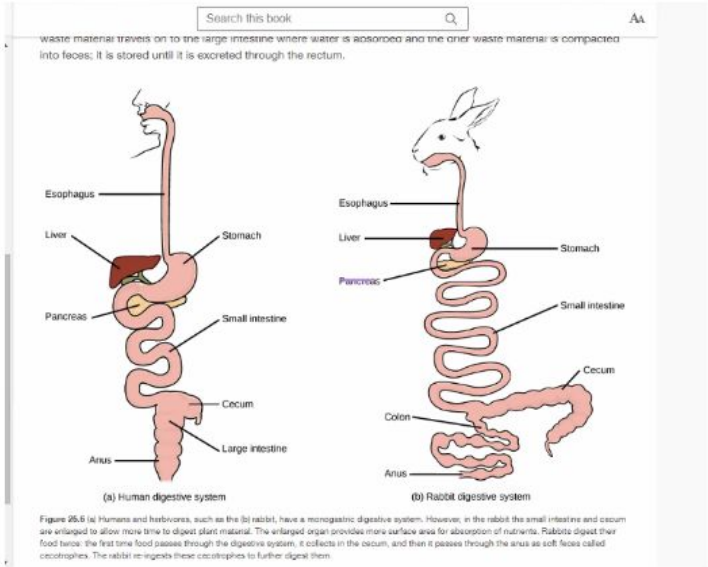


Figure 25.6 (a) Humans and herbivores, such as the (b) rabbit, have a monogastric digestive system. However, in the rabbit the small intestine and cecum are enlarged to allow more time to digest plant material. The enlarged organ provides more surface area for absorption of nutrients. Rabbits digest their food twice: the first time food passes through the digestive system, it collects in the cecum, and then it passes through the anus as soft feces called cecotrophes. The rabbit re-ingests these cecotrophes to further digest them.

It is noticeable that the rabbit's digestive system seems a little more complicated. However, we know that a rabbit is much smaller than a human. Rabbit's digestive system has a lot more curves of small intestine. The liver and Pancreas of humans are bigger. On the other hand, the cecum of rabbits is much longer.

Mouth: pH 6.5-7.5, slightly acidic to neutral. Saliva contains enzymes for carbohydrate digestion.

Stomach: pH 1.5-3.5, highly acidic for protein digestion and killing bacteria.

Small Intestine: pH 7.0-8.5, slightly alkaline for enzyme activity and nutrient absorption.

Large Intestine: pH 5.5-7.0, slightly acidic, bacteria ferment carbohydrates, maintaining pH.

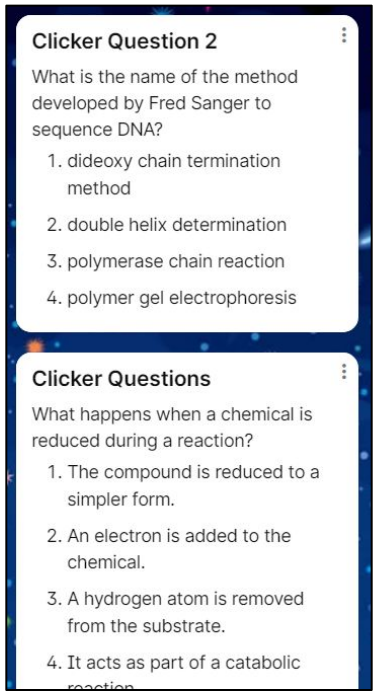
Almaty

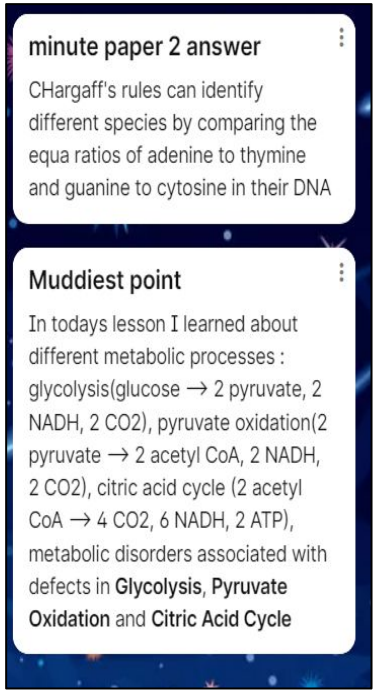
- Phylum: Chordata
- Class: Mammalia
- Order: Rodentia
- Family: Castoridae
- Genus: Castor
- Species: Castor canadensis

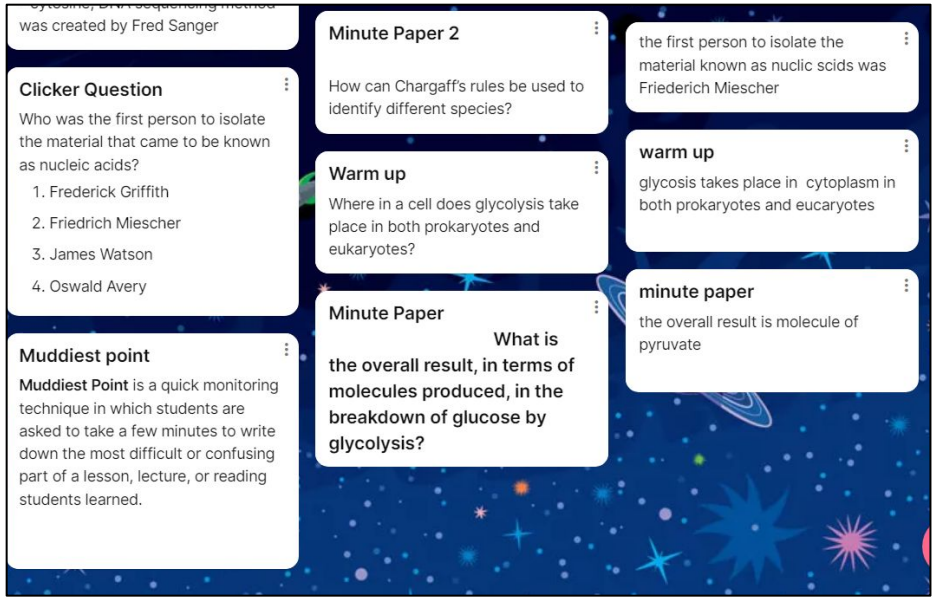
N	Common Name	Scientific name
1	American Beaver	Castor canadensis
2	American Mink	Neovison vison
3	American Water Shrew	Sorex palustris
4	Big Brown Bat	Eptesicus fuscus
5	Bobcat	Lynx rufus

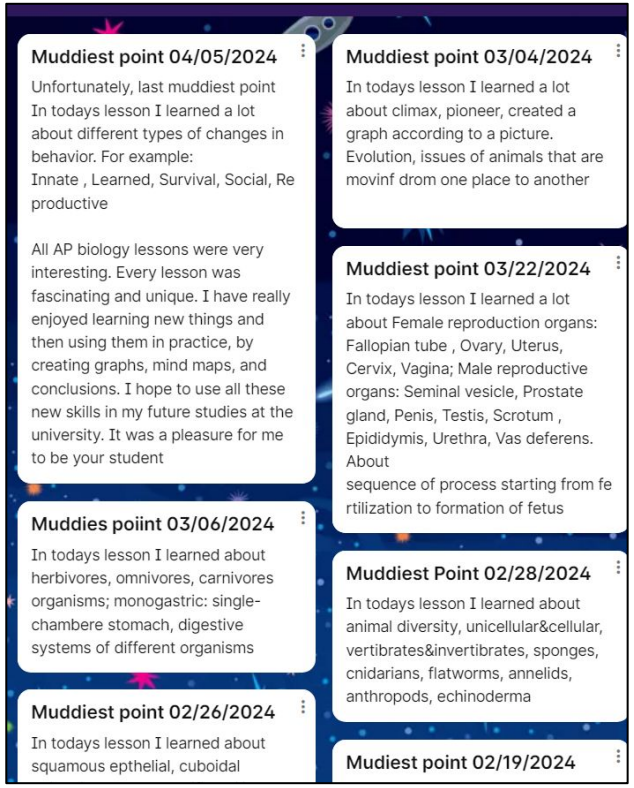
https://evolution-outreach.biomedcentral.com/articles/10.1007/s12052-008-0080-5

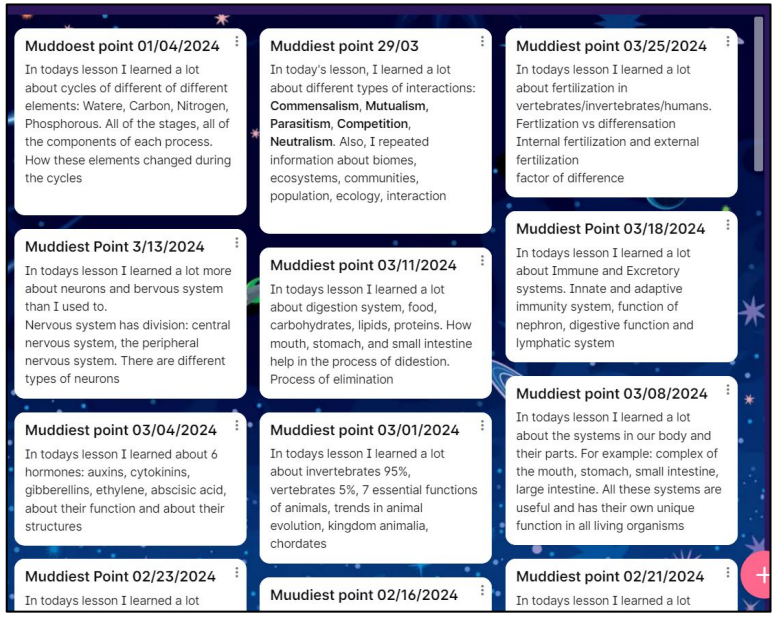
Padlet improves Science Learning outcomes by providing opportunity to students to express learning by thinking and writing critically.

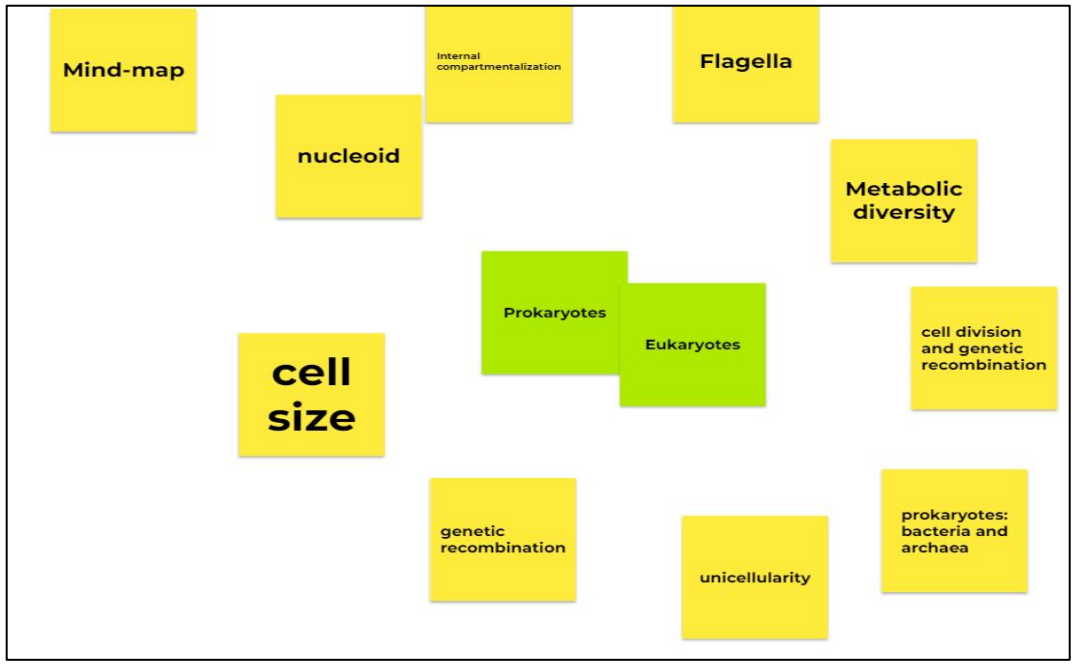




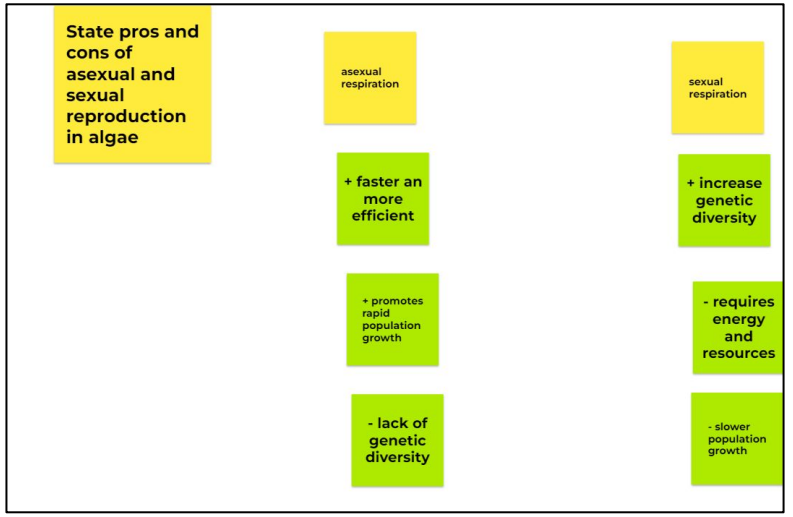


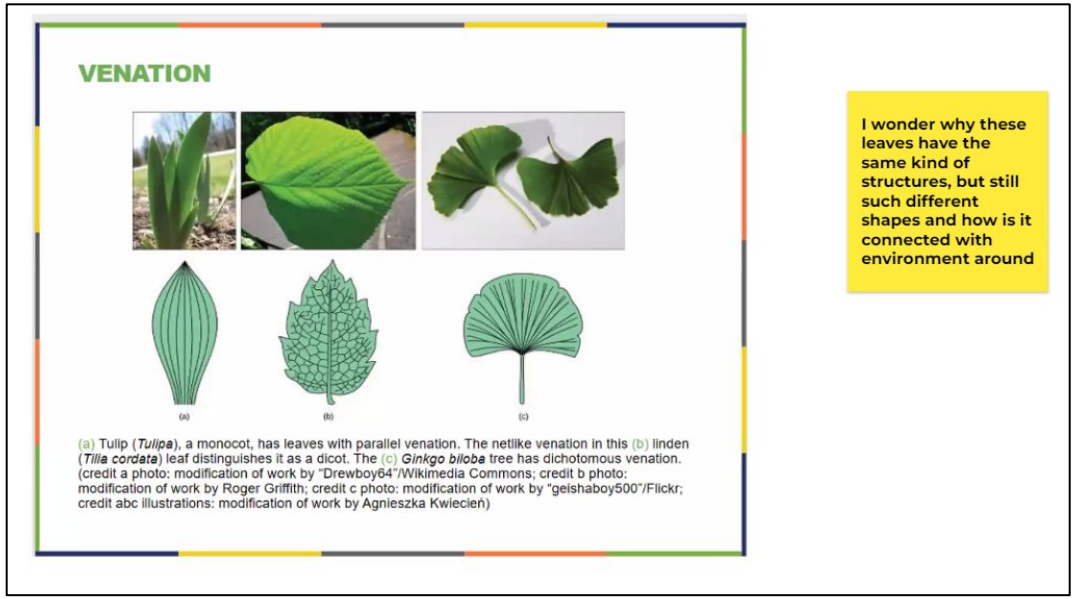


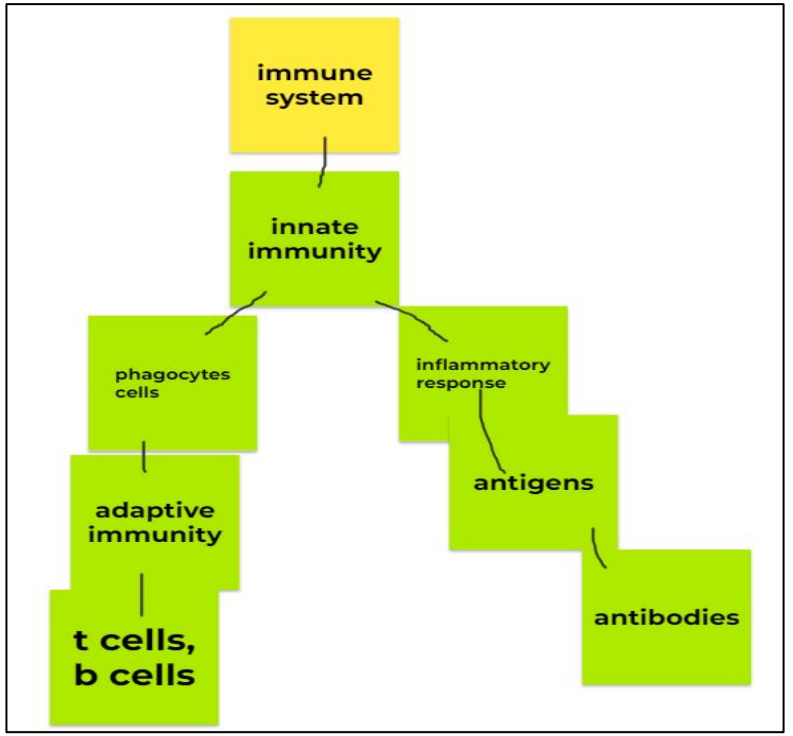




Jamboard enhances critical thinking and vocabulary



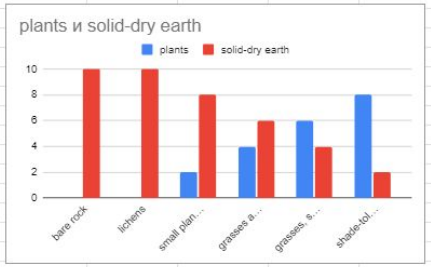




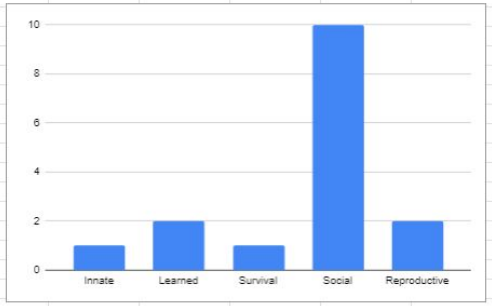
Google sheet enhances science learning outcomes by data organization, data representation and analysis

Observe this image and convert the data into quantitative data on google sheet

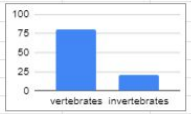
	plants	solid-dry earth
bare rock	0	10
lichens	0	10
small plants and lichens	2	8
grasses and perennials	4	6
grasses, shrubs	6	4
shade-tolerant	8	2



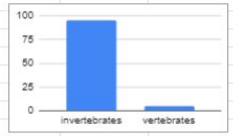
Innate	1
Learned	2
Survival	1
Social	10
Reproductive	2



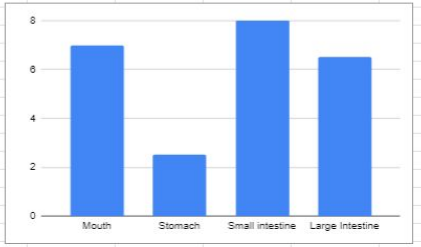
Pennsylvania	vertebrates	56
	invertebrates	42
Colarado	vertebrates	81
	invertebrates	21



invertebrates	95
vertebrates	5



Mouth	7
Stomach	2.5
Small intestine	8
Large Intestine	6.5



Location – Zoom main room

Organisms	Almaty	Karaganda	Akmola	Atyrau	Kyzylorda
Mammals	68	39	44	45	45
Amphibians	2	2	3	2	0
Reptiles	5	3	2	6	4

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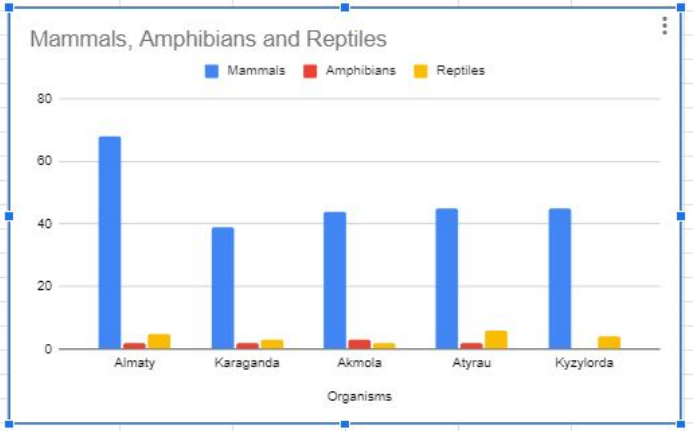

Technology Based Learning (TBL) enhances science learning outcomes by increasing scientific writing, critical thinking and vocabulary in asynchronous and synchronous learning outcomes .

Technology and types of technology may play important role in enhancement of learning outcome however multidisplinary approaches of integration of technology, resources and learning activities may be required to utilize the major learning spaces and minor learning spaces to advance the science learning outcomes.

Questions/ Suggestions and Feedback