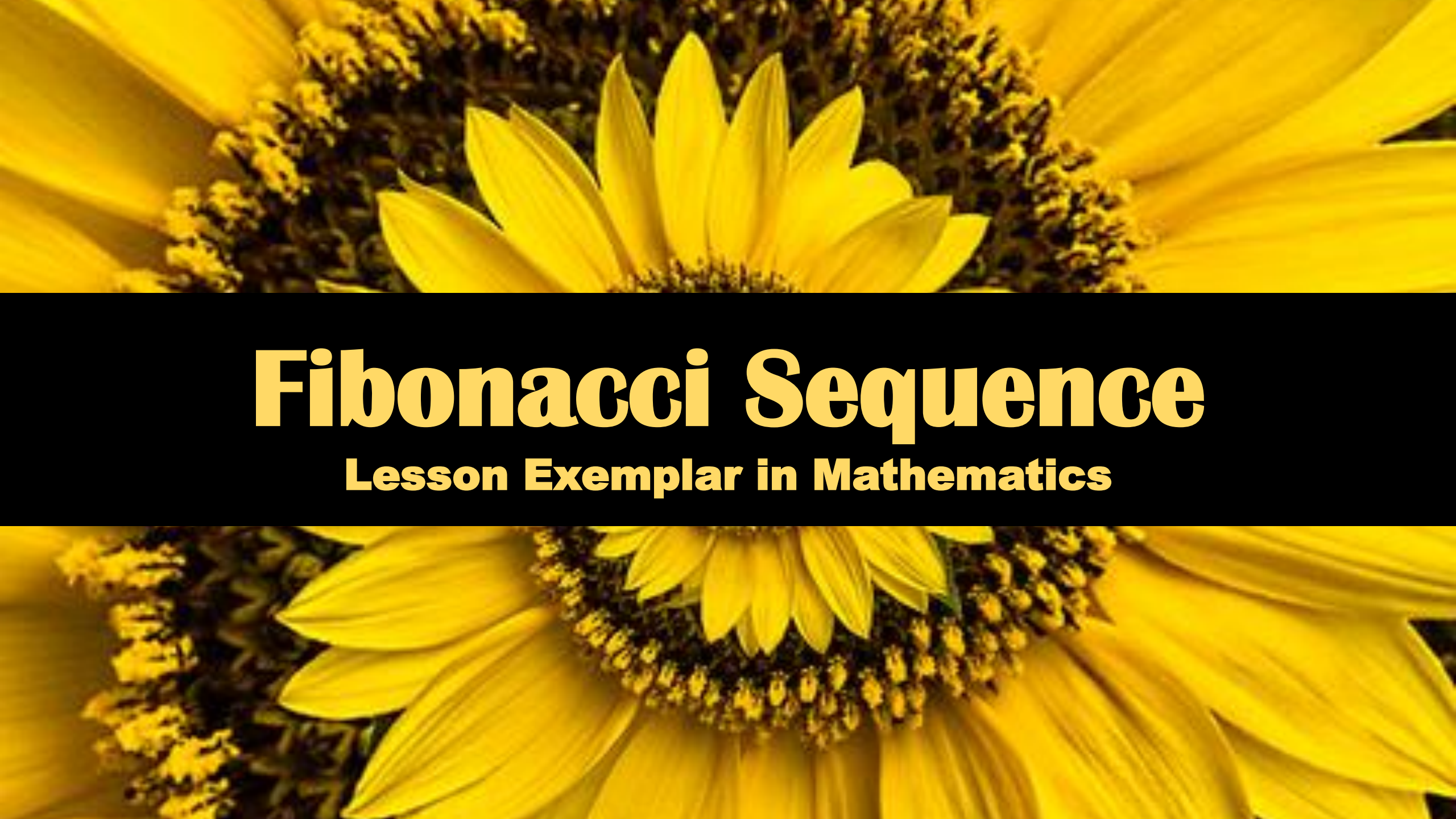


Fibonacci Sequence

Lesson Exemplar in Mathematics

Subject/Course:	*Math in the Modern World*
Topic:	*Mathematics in Nature*
Lesson Title:	*Fibonacci Sequence*
Level:	*First Year College*
Lesson duration:	*1.5 hours*

Learning Outcome(s)

At the end of the lesson, students will

1. recognize Fibonacci sequence;
2. determine the nth term in the Fibonacci sequence;
3. identify Fibonacci sequence in nature;
4. express appreciation of Fibonacci sequence in nature.

Target Audience

- First year college students in all programs
- Students from different high school backgrounds
- Students with different learning styles
- Heterogenous class

Pedagogies

MOTIVATION

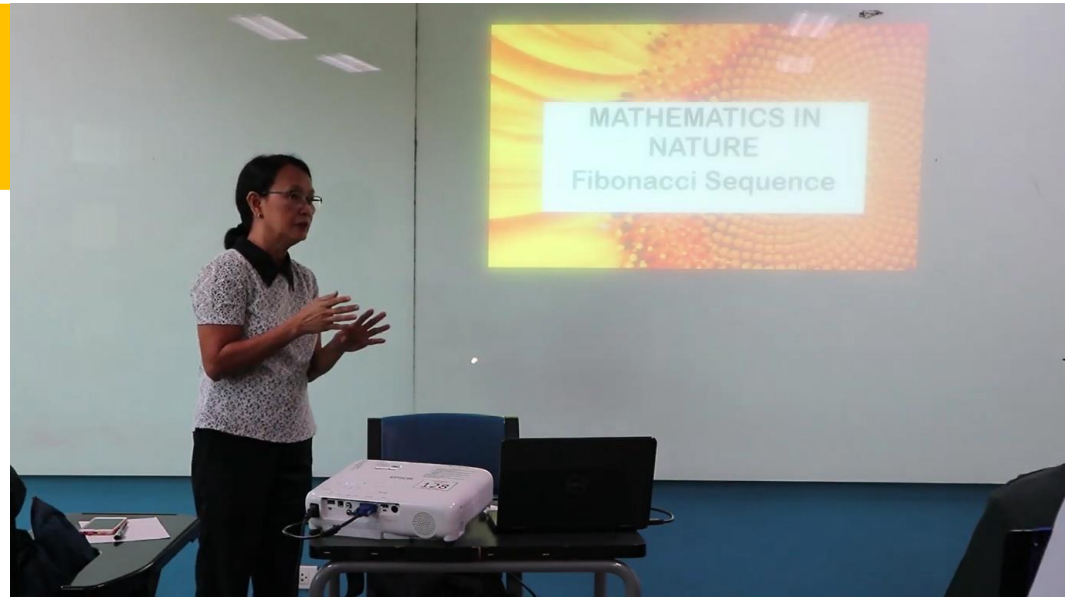
1. The class starts with a game.
2. The game will be participated in by two groups of 5 students each. The first direction for each group will be to arrange themselves according to their height. The second direction for each group will be to arrange themselves according to birthdate.
3. The activity will be processed as an example of a pattern or a sequence.

Pedagogies

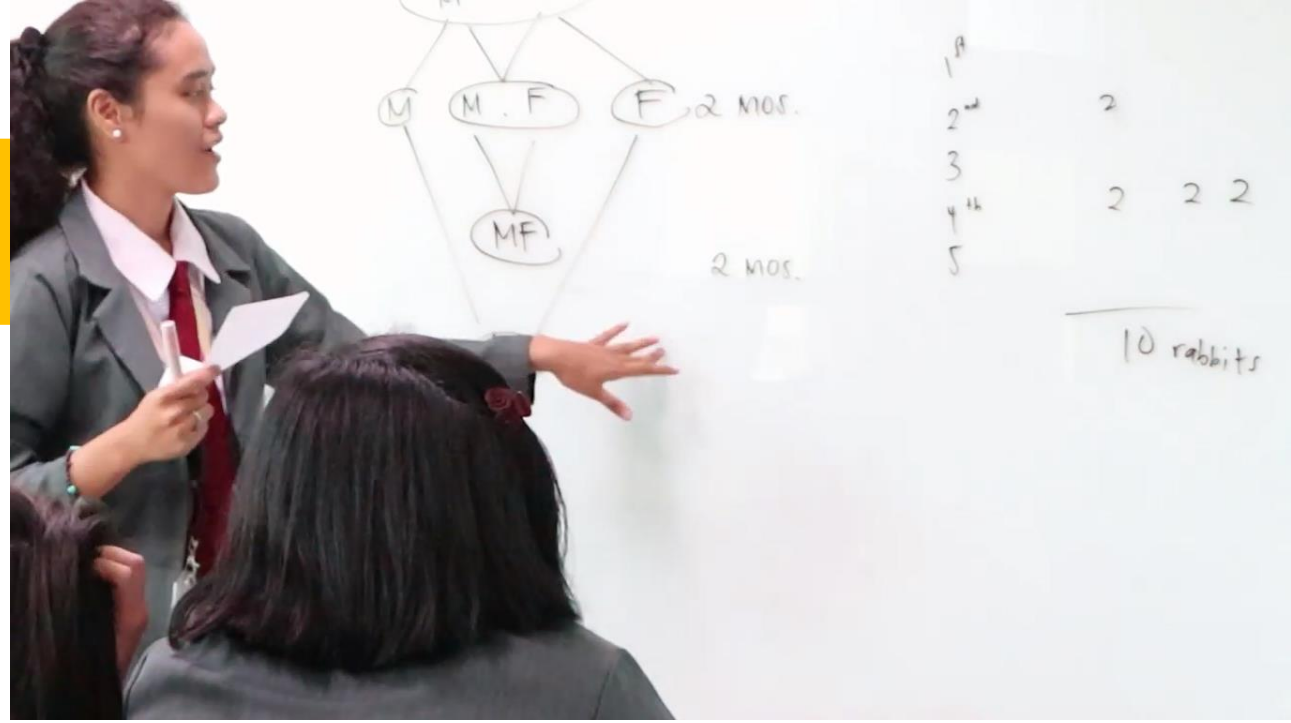
LESSON INTRODUCTION

1. The lesson will be introduced to the class through a power point presentation.

2. Students will be recalled about their lessons on sequences that they have encountered during their high school.



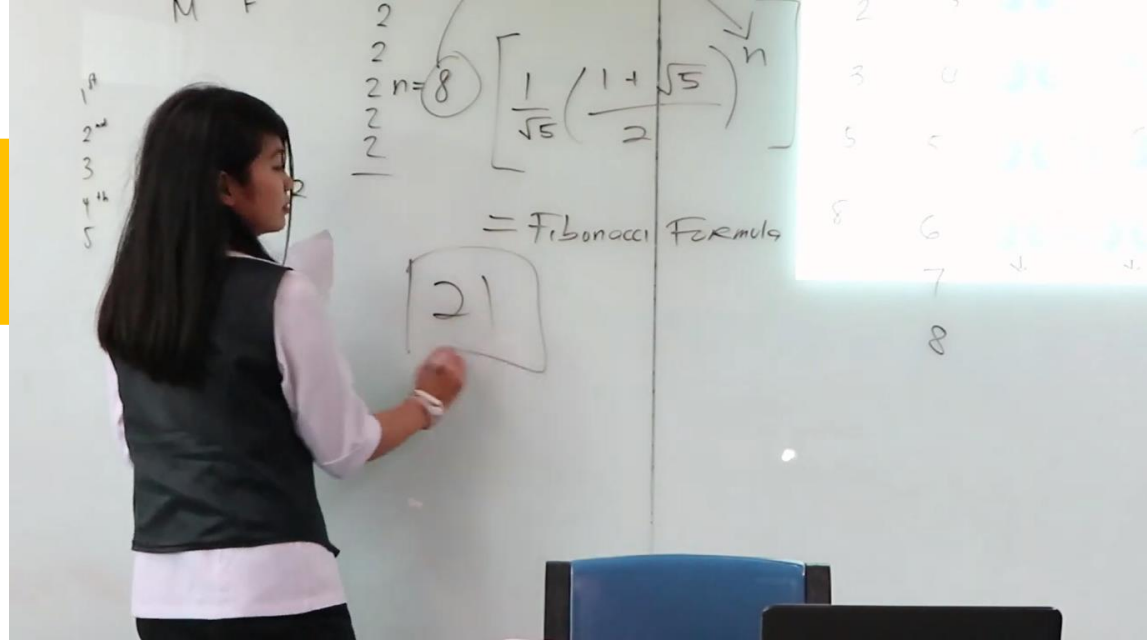
Pedagogies



LESSON ACTIVITY

1. Students will be given a situational problem (The Rabbit Problem) shown through PPT presentation.
2. Students will discuss among themselves the solution to the problem.
3. Students can use their scientific calculators or cellphone calculators so they can work efficiently.
4. Selected students will be asked to present their solution and explain in class how the answer was arrived at.

Pedagogies



LESSON ACTIVITY

5. The lesson proper will be introduced after the students had given their answers.
6. The correct sequence will be taught to the students and how the pattern is calculated using two methods: simple addition and the use of the formula by Binet.
7. To determine their understanding of the Fibonacci sequence, a board exercise will be given. The exercise involves filling in the Fibonacci sequence with the missing number.

Pedagogies

LESSON ACTIVITY

8. The use of the formula will be tested.
9. Students can use the calculator or cellphone to find the nth number in the Fibonacci sequence.
10. Students will be assisted on the use of the functions and keys in the calculator to calculate the required values.

Pedagogies

LESSON ACTIVITY

11. To allow students to recognize patterns in nature, pictures of objects found in nature will be shown.
12. A video “Nature by Numbers” by Cristobal Vila (https://www.youtube.com/watch?v=tnkLDFpgix4) will be shown to further understand the concept of the Fibonacci sequence and the different objects in nature where the sequence can be found.
13. Students will be asked to write their insights about the video. This will show the student’s appreciation of the Fibonacci sequence as expressed in nature.

Pedagogies

ASSIGNMENT

1. Students were previously asked to answer a questionnaire to determine their intelligence type *(https://personalitymax.com)*
2. Considering their intelligence type, the following tasks will be assigned:

linguistic intelligence: Write a poem about Mathematics in Nature

musical intelligence: Write a song about Mathematics in Nature

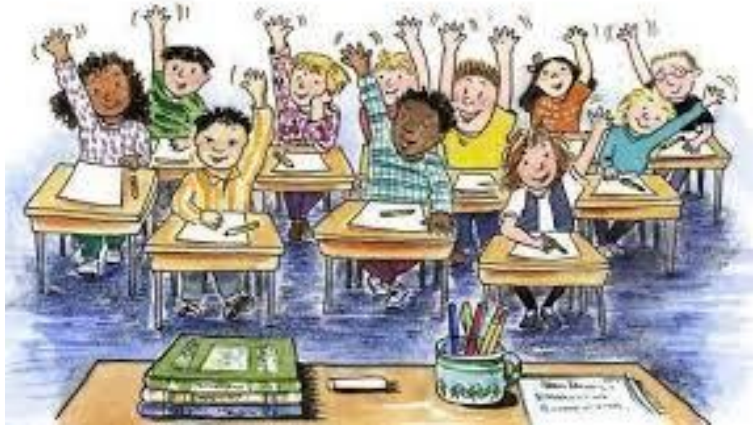
visual and naturalistic intelligence: Take pictures of objects in nature that exhibits the Fibonacci numbers.

Pedagogies

ASSIGNMENT

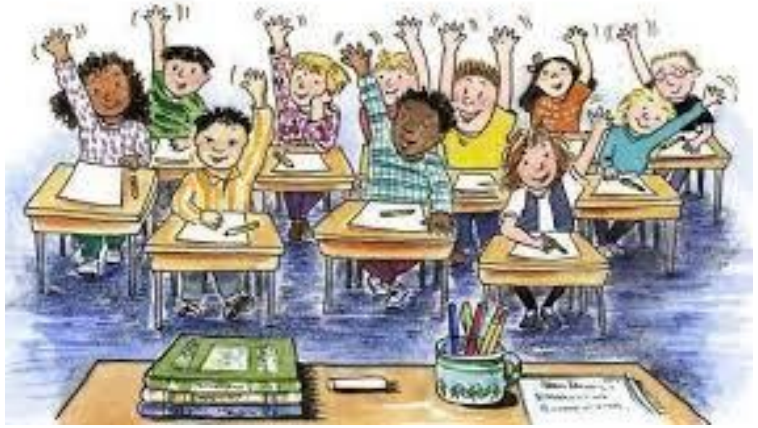
3. Students will be required to bring a picture of their face which will be measured to illustrate the Golden Ratio. This will provide realization on the application of the Fibonacci number as a golden ratio in the human body.

Efficient classroom management



1. A positive learning environment will be established to ensure a pleasant, friendly and a non-threatening learning environment.
2. Classroom rules, procedures and instructions will be given at the start of the class and implemented throughout the session.
3. Individual differences will be addressed by one-on-one coaching when calculations are being done.

Efficient classroom management



4. Learning activities will be done in pairs or groups to encourage cooperative learning and provide a supportive learning environment.
5. Student attention will be maintained by encouraging student participation and making them do the activities.
6. Student responses will be monitored and immediate corrective feedback will be provided.

Misconceptions to address

1. Student's misconception that Mathematics is a difficult subject shall be addressed by allowing them to see the different applications of Mathematics in their lives.

2. Possible students' difficulty in the proper use of calculator for computation of the nth number in the Fibonacci sequence can be addressed by whole class discussion, peer mentoring, and guided inquiry.

Integrating technology

1. Powerpoint slides presented using the laptop and the LCD projector will allow the students to view the lesson and have better understanding of the lesson.
2. Calculator and cellphone calculators will make calculations easy for the students.
3. The video downloaded from the internet will be presented using the laptop, LCD and a speaker.
4. The identification of the type of intelligence will be done using an online questionnaire.

Lesson Strategies

- In the Rabbit Problem, the students will be able to discuss among themselves possible solutions to the problem by scaffolding: think-pair-share or group work.
- The proper use of the calculator will be done by demonstration.
- Understanding of the Fibonacci sequence will be enhanced utilizing an illustration (for visuals) of the rabbit problem in the powerpoint.

Technology Being Used

By students

- computers/ laptops
- cellphones
- scientific calculators

Reason for use

- Utilizing these technologies will allow students to demonstrate independence making it easier to accomplish the objectives.
- Said technologies will also respond to the different demands of learners, task, purpose and program.

Technology Being Used

By teachers

- computers/ laptops
- cellphones
- scientific calculators
- LCD projector
- speaker
- internet

Reason for use

- The video clip, Nature by Numbers by Cristóbal Vila will provide a vivid illustration of how the Fibonacci numbers were derived and where they can be found.

Technology Being Used

Reason for use

- Utilization of these technologies differentiates for needs of students with varying learning styles.
  - The creative student can use art and music.
  - Those who love words can write.
  - Visual learners can use a combination of color and images.
- Use of video clip for teaching will allow students to pause the video clip, rewind and learn at their own pace.
- Technology helps ensure full participation of students during discussion.

Limitations of Technology

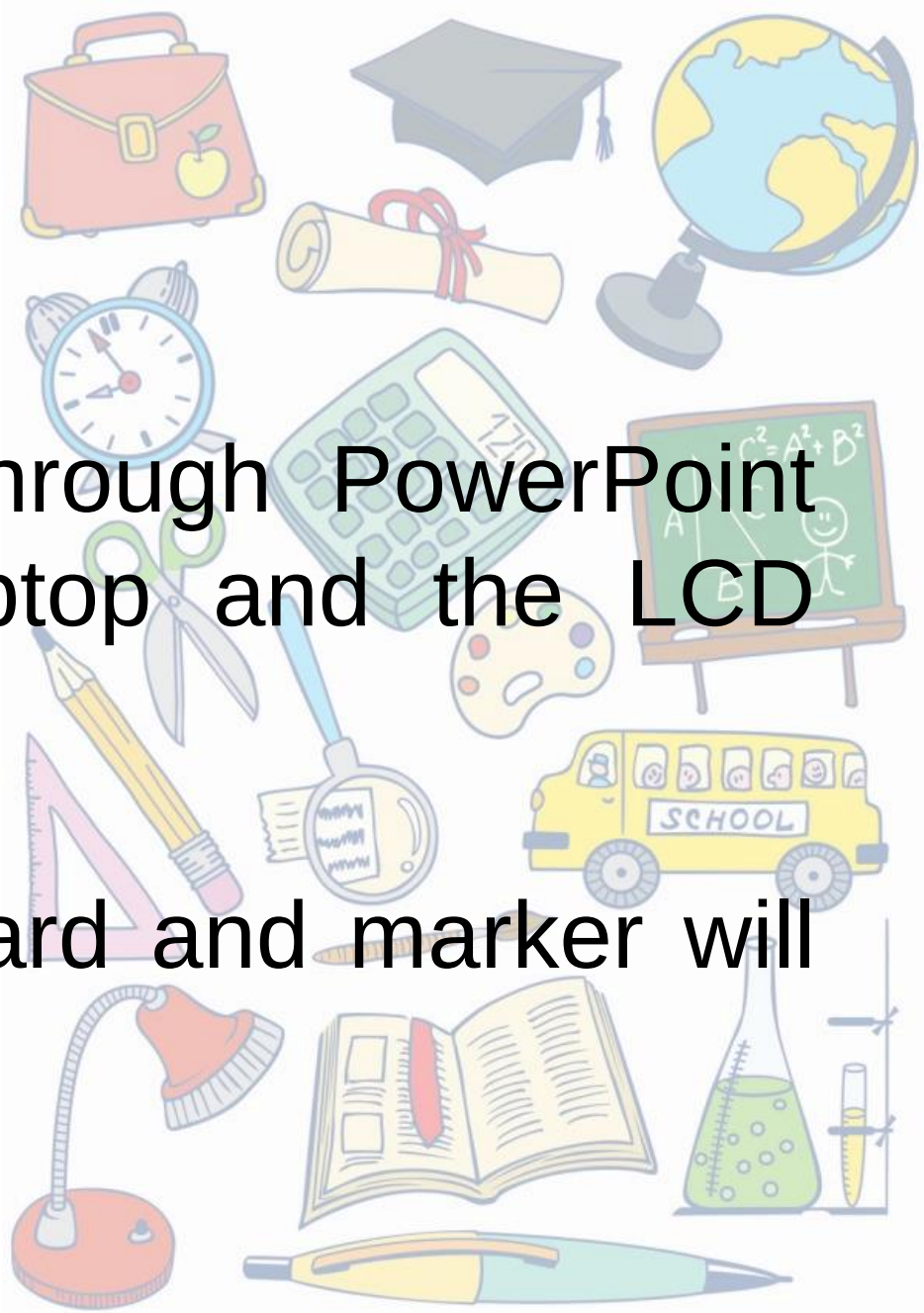
- In case power is not available, students can be brought outside and see or themselves the different objects in nature that exhibit the Fibonacci numbers.

- Possible students' difficulty in the proper use of calculator for computation of the nth number in the Fibonacci sequence

Required Materials

- The lesson will be delivered through PowerPoint presentation using computer/laptop and the LCD projector.

- To illustrate the solution, the board and marker will be utilized.



Required Materials

- The calculator will be used to provide alternative solution in finding the nth number in the Fibonacci sequence.

- The video clip (Nature by Numbers by Cristobal Vila) will be shown using the laptop, speaker and LCD projector.

Assessment strategy

- Students will be called randomly to fill in a series of numbers with the missing Fibonacci number
- Problem exercise in finding the nth term in the Fibonacci sequence.
- Students will be randomly asked to give examples of things they see in the environment that exhibits Fibonacci number.
- The students will be called randomly and share their reflection on the video presented about Fibonacci sequence

Feedback strategy

- Possible students' misconceptions that Math is difficult will be addressed by illustrating examples of math in nature.
- Possible students' difficulty in the proper use of calculator for computation of the nth number in the Fibonacci sequence can be addressed by whole class discussion, peer mentoring, and guided inquiry.

Assessment

Technology integrated in the assessment

- computers/ laptops
- cellphones
- scientific calculators

Technology integrated in the feedback

- computers/ laptops
- cellphones
- scientific calculators
- LCD projector
- speaker
- internet (for online multiple intelligence test)

Assessment of Learning

- Performance task given as an assignment specific to each of the multiple intelligences of the students (linguistic, naturalistic, spatial, and more).
- Students will be tasked to take pictures of objects found in nature that exhibits Fibonacci numbers. The work will be presented in class and will be grade using a rubric.

Assessment of Learning

- Students will be required to bring a picture of their face which will be measured to illustrate the Golden Ratio. This will provide realization on the application of the Fibonacci number as a golden ratio in the human body.

Reflection

- Identify appropriate strategies suited to the needs of the 21st century learners.
- Be able to handle/overcome technical problems/issues due to limitations in technology use.

Modifications/Enrichments

- Modify teaching strategies


Thank you !

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