

**USING FOSSIL EXPLORATION TO ACTIVELY ENGAGE UNDERGRADUATE STUDENTS IN SCIENTIFIC DISCOVERY****Belkasim Khameiss\*, Richard Fluegeman**

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**KEYWORDS:** Oxygen Isotopes, engaged learners, environmental conditions.**ABSTRACT**

Using fossils as data is a unique way to engage students in scientific discovery to uncover the age and environmental conditions of the planet when the fossils were formed. As part of the Ball State University Scientific Teaching Program, I used the backward design to build objectives, assessments, and an activity to engage students in synthesizing isotopic and environmental data to evaluate fossil age and characteristics.

I implemented this activity in an undergraduate geology course where students used oxygen isotopes data and temperature records to predict the environmental conditions, and to make predictions about the timeframe of fossil formation. Pre and post-test results indicated an increase from 15-75% in students' ability to describe fossil formation after completing the activity. Summative assessment results indicated that by actively engaging students in the processes of science, 79% of the class was able to use information learned during the activity to solve a new problem.

The goal of this project is to engage undergraduate students (major and non-major) in the Earth Sciences Courses to be active or thinking carefully about the problems, rather than passively listening and taking notes during the class. We engaged the students by different ways in the classroom activities that complements the lecture material by supplementing. We engaged the students by covering the material individually or by facilitating small group discussions. Classroom discussion brings the assignments to a close and help students create their own ideas and to from community of active and engaged learners. The data presented came from 25 undergraduate student's Introduction of Historical Geology course at Ball State. The topic selected was Scientific Teaching Writing Paleontology before and during the activities, and makes them in small Groups each group talk and discuss about the assignments.

**INTRODUCTION****THE OBJECTIVES AND GOALS**

The objective and the goals of this research are: The first assignment was general question describes the kind or type or organisms that formed that fossils, and answer this question. Then explain why important study was the paleontology (what is the benefit from it)? Second assignment was Brain storm, which was matched or predicate the Fossils on the Geologic Time Scale GTS, then the students Work as a group or by yourself please. Explain the reasons for the study fossils and match them in GTS, and the second part was at the previous question has a blanket that is related to the Oxygen Isotopes and temperature ,and match them on the Geologic Time Scale. Also, the students work as a group or by yourself. Reasons for studying the Oxygen Isotopes and temperature match them in GTS. Finally and third assignment was short quiz about the whole assignment and the mini lecture to see how the students in class were able to use information learned during the activity to solve a new problem.

**DATA AND RESULTS**

The first pretest was about describing the kind or type or organisms that formed that fossils. This question was multiple choice answers with an example copied below.

**Which is most likely to become a fossil?**

- A skeleton in a large lake
- A jellyfish in the ocean
- An earthworm in a damp forest
- A skeleton in a riverbed that is drying up



The results of this pretest showed from the 25 students, 18 students got the incorrect answers which means 72% of them as shown the blue color based on the evidence from the pie chart which means the majority of the student, they did not get the correct answer. Also, 7 students got the correct answers which means 28% as shown in the Figure 1.

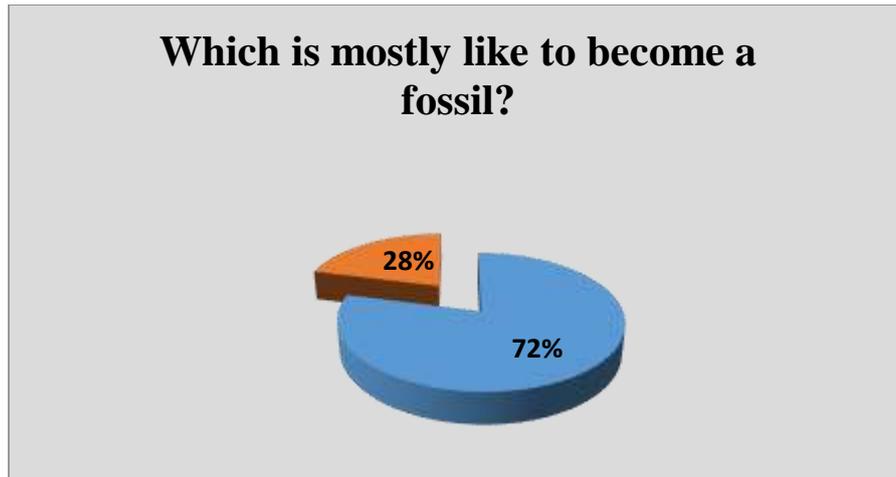


Figure 1. The pie chart shows the percentage results of the first pretest, 72% of the students showed the incorrect (blue color), and 28% got the correct answer (red color).

After the poor results of the first pretest, I gave the students a mini lecture about paleontology is essential for working out the history of the earth. The age of the rocks in turn is vital to determining where the oil. Studying the environment of deposition of sedimentary rocks. Indicate either a dramatic change in climate. Indicates not only that these continents. Much of the evidence used to refine the various theories of evolution is derived from the study of fossils. Presents us with the facts about how life has changed

The second pretestes questions were about A- match or predicate the Fossils on the Geologic Time Scale GTS, giving other reasons to study the fossils and match them in GTS, as shown in the Figure 2.

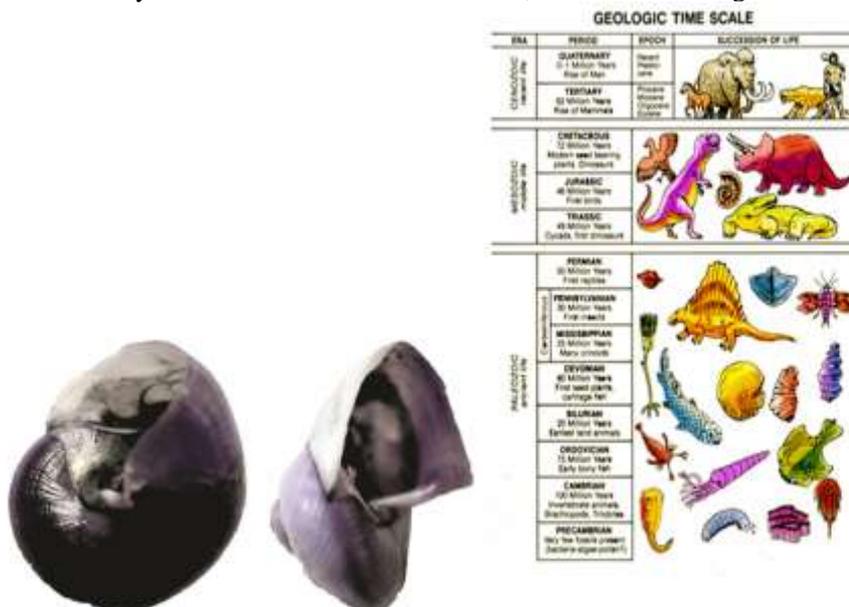


Figure2 .Shows one photo from the pretest, and the geologic time scale. Ahmed M. Muftah and Belkasim Khameiss, 7, Issue 3, March 2016 Edition, and <http://geology.com/time.htm>



From the 25 students, 14 students got the incorrect answer which means 56% of them as shown the blue color in the pie chart. Also, 11 students got the correct answers which means 44% as shown in the Figure 32 in the red color, based on the evidence from the pie chart.

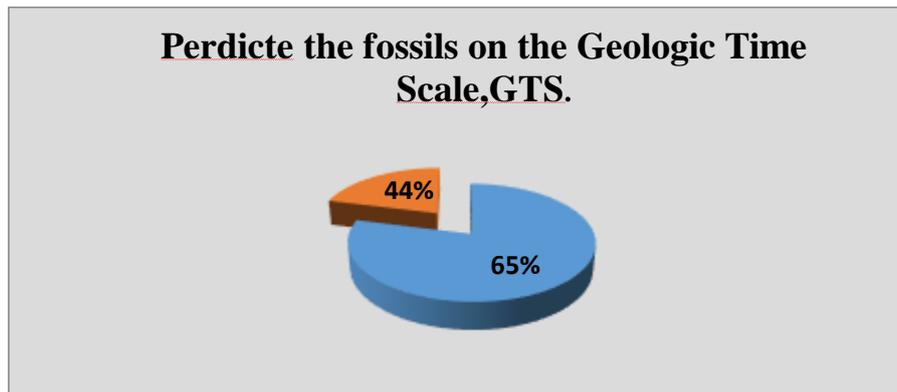


Figure 3. The pie chart Shows the percentage results of the first pretest, 65% of the students showed the incorrect (blue color), and 44% got the correct answer (red color).

After that gave them the reasons to study the fossils and match them in the GTS. Fossils can be used to recognize rocks of the same or different ages. The kinds of fossils found in rocks of different ages differ because life on Earth has changed through time.

B- At the previous question has a blanket that is related to the Oxygen Isotopes and temperature match them on the Geologic Time Scale.

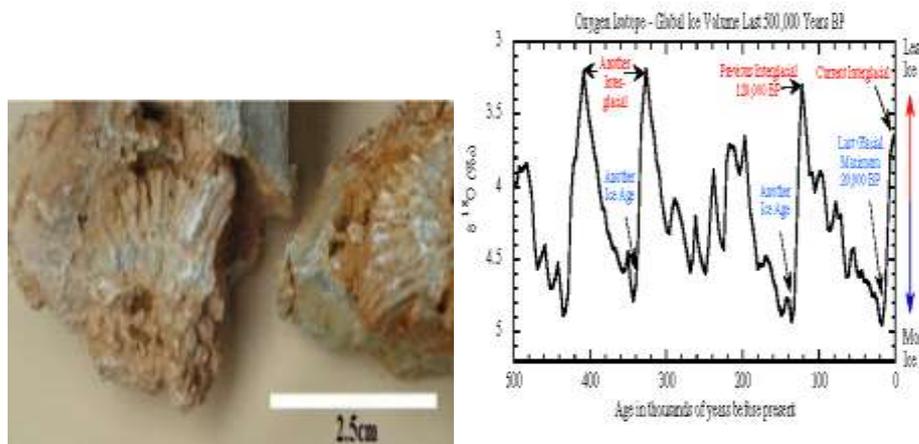
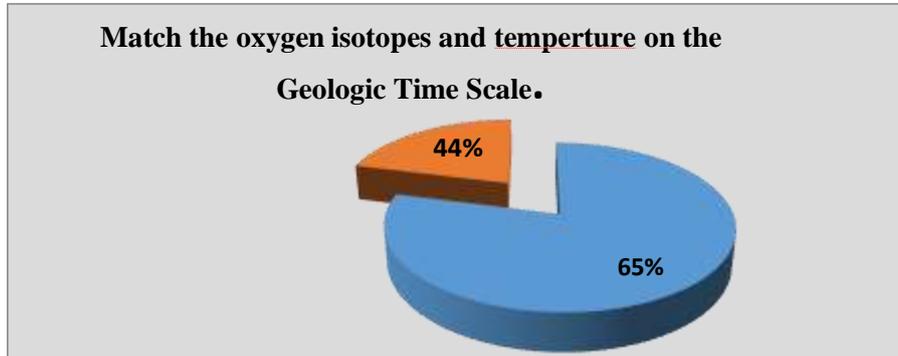


Figure 4. shows us the coral reef and oxygen isotopes results. Belkasim Khameiss and others, 2016, 7, Issue 3, March 2016 Edition. <http://www.exo.net/~pauld/workshops/Paleoclimate/paleotemperature.html>

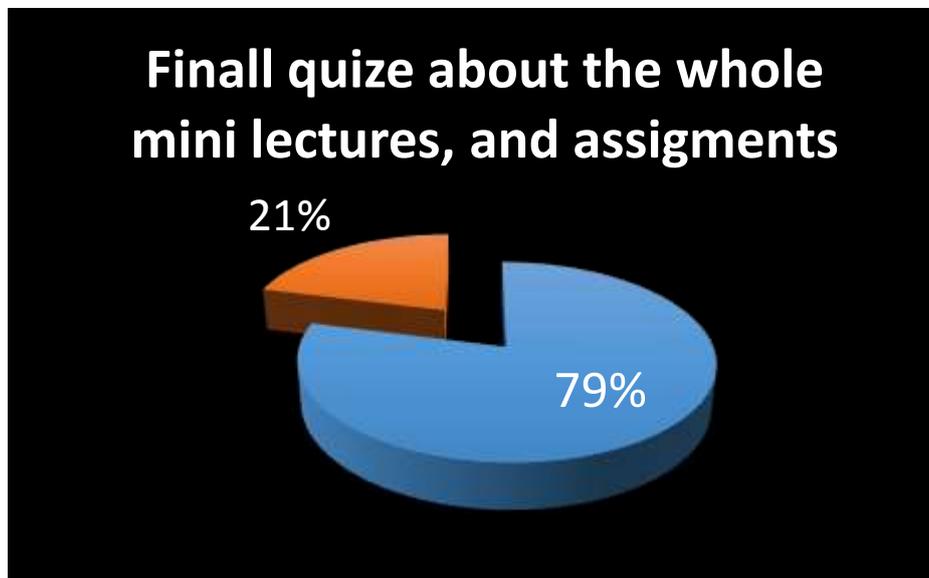
From the 25 students, 14 students got the incorrect answer which means 56% of them as shown the blue color in the pie chart. Also, 13 students got the correct answers which means 44% as shown in the figure (3) in the red color, based on the evidence from the pie chart.



*Figure.5. The pie chart Shows the percentage results of the first pretest, 65% of the students showed the incorrect (blue color), and 44% got the correct answer (red color).*

Reasons for studying the Oxygen Isotopes and temperature match them in GTS. Important for paleoclimatology and paleoecology. Ocean waters rich in heavy oxygen: During ice ages, cooler temperatures extend toward the equator, so the water vapor containing heavy oxygen rains out of the atmosphere at even lower latitudes than it does under milder conditions.

Finally, the short quiz about the whole lecture and the assignment, it was posttest. From the 25 students, 20 students got the correct answer which means 79% of them as shown in the blue color in the pie chart. Also, 5 students got the incorrect answers which means 21% as shown in the figure (3) in the blue color, based on the evidence from the pie chart. So 79% of the class was able to use information learned during the activity to solve a new problem.



*Figure 6. The pie chart Shows the percentage results of the first pretest, 79% of the students showed the correct (blue color), and 21% got the incorrect answer (red color).*

## CONCLUSION

Summative assessment results indicated that by actively engaging students in the processes of science as shown in the previous graphs/ (chart). To engage students by thinking carefully and resolve critical problems depends on the teachers and the materials, they are given in the class to improve the skills of the students.



### ACKNOWLEDGMENTS

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