Why so Wormy? A Study of Student Retention.

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Abstract: Last year Jackson Heights Middle School developed a STEAM (Science, Technology, Engineering, Arts and Math) program of emphasis. There are multiple electives that constitute this program. The elective course I currently teach is our Bioscience class. This course existed prior to our new STEAM program of emphasis, however last year was its first year as a STEAM elective course. Our feeder high school has a Bioscience program for students and one of my goals is to attain the student's interest in science in the hopes that they will continue in their interest in science. This year my goal has changed. This action proposal will analyze the retention from the student's prior knowledge in genetics in a single Bioscience semester long elective course with 8th grade students. The lesson will take place during the second nine weeks of the 2016-2017 school year. The pretest will assess their prior knowledge of genetics that they acquired from 7th grade. Two posttest will be given to the students, one immediately after the lesson is completed and again 3 weeks later.

Rationale: Students in my district complete life science during their 7th grade year where they have completed a unit on genetics. I teach a Bioscience elective class where only 8th grade students are allowed in the course. Students who traditionally sign up for this class have a great interest in science and are intrigued by the bioscience course topic. I noticed last year due to this I didn't have to worry about gaining their interest but I did notice that they had some gaps in content, especially in the contents of cells and genetics to where I had to go back during the lesson to fill in the gaps. This idea lead me to the purpose of this study. It is not a new realization but students have not retained what they were taught in 7th grade which hindered their success in several lessons. This loss of retention can be due to several factors. The following article states "The potentially negative effects of prior knowledge on the accuracy of recall may become increasingly apparent with the passage of time, as the detail of a specific experience fade and the gaps are filled in, quite unconsciously, on the basis of knowledge and expectations" (Ornstein, et al, 1998). In order to measure this I will develop a pretest of the content that should have been successfully covered during their previous academic year related to genetics. This will assess their prior knowledge of the content. The lesson will follow different modalities, for example by using PowerPoints, notes taking, video clips and a hands on visual lab activity. I will then follow with a post test at the end immediately. This will test for immediate retention, however to test for long term retention, a posttest will be given again 3 later to compare the difference to see if there was any retention difference.

Intervention: I will be targeting my 8th grade Bioscience elective class for my data collection. I only have one bioscience class a semester so my data will be confined to just my one class. In order to study content retention students will be given a pretest, an immediate posttest once the lesson is complete and the same posttest 3 weeks later. I have always implemented rigorous, cooperative activities to where students are activity engaged in their learning. The following reiterates the importance of student engagement. The following article mentions that their study "observed high levels of retention for students actively involved in learning" (Semb & Ellis, 1994). To continue student engagement in the classroom I will be incorporating lessons from the "What can worms do for you?" in my Bioscience genetics unit. I will be focusing on genetic mutations in C. elegans hands on activity.

Changes to Action Research Intervention: The original intervention the students were going to take 3 assessments to test for content retention. My bioscience students completed the pre assessment and a post assessment, however due to the class being a semester long class getting to the content information in a timely manner was difficult. Another factor was that I wanted to save this activity for the end of a semester where the students build up to this lesson and where this was a goal for them to get to however our testing schedule was different than in the past and when I originally wanted to administer the third and final assessment I couldn't because I didn't see my students for several days and then this changed schedule wouldn't allow them the proper amount of time to take the final assessment. Next time I would allot more time and start prepping the student earlier in the semester.

Connections to Bench to Bedside summer institute: The C.elegan activity was presented to us during the 2 week UF Bench to Bedside Institute. The dissecting microscope with cool transmitted light will be provided by the Bench to Bedside program. The C.elegans kit will be purchased.

Data collection and analysis: The student's pre, post and delayed posttest scores will be compared and analyzed.

Changes to Data Collection and Analysis: The original data collection plan was changed due to my schools altering the usual testing schedule so unfortunately a third round of the assessment could not get administered. Due to this the students pretest and posttest was the only data that was

analyzed. Each student's tests were individually recorded to see individual growth. Also the class average was recorded to growth as a class. There was a class average increase between the pretest and the posttest. Individually 18 students out of 24 had an increase in score between assessments. I would like to have seen what the results would have been if another assessment was given, due to the amount of students who had a high increase in this lesson and the amount of students who had an increase in score I would predict that retention may have been high.

Student	Pretest	Posttest
1	55	73
2	55	64
3	28	55
4	82	82
5	46	55
6	46	73
7	82	82
8	28	18
9	46	64
10	37	91
11	10	73
12	46	73
13	37	73
14	64	73
15	55	37
16	37	82
17	37	55
18	28	100
19	28	91
20	37	91
21	28	91
22	37	100
Average	43.1	72.5

Literature cited:

Ornstein, P. A., Merritt, K. A., Baker-Ward, L., Furtado, E., Gordon, B. N., & Principe, G. (1998). Children's knowledge, expectation, and long-term retention. *Applied Cognitive Psychology Appl. Cognit. Psychol., 12*(4), 387-405. doi:10.1002/(sici)1099-0720(199808)12:43.0.co;2-5

Semb, G. B., & Ellis, J. A. (1994). Knowledge Taught in School: What Is Remembered? *Review of Educational Research, 64*(2), 253-286. doi:10.3102/00346543064002253

Permissions: No permission is needed for this study

LESSON PLAN Draft

TITLE: Why so Wormy?

KEY QUESTION(S): What are the key advantages of using model organisms? What is a genetic mutation and HOW does this occur?

SCIENCE SUBJECT: Bioscience

GRADE AND ABILITY LEVEL: 8th grade standard/advanced students

SCIENCE CONCEPTS: Cells and Genetics

OVERALL TIME ESTIMATE:
Day 1- pretest and start review of genetics lesson
Day 2- discussion continue with PowerPoints and video clips to expose students to what C. elegans are.
Day 3- Microscope protocol, C. elegans activity
Day 4- continue C. elegans activity
Day 5- Students in their teams will develop a chart or poster on the advantages of studying C. elegans Team present posters and discussion
Day 6- Posttest
3 weeks later- second posttest

LEARNING STYLES: Auditory, visual, hands on

VOCABULARY: genes, mutation, proteins, replication, amino acids, codon (more will be added once lesson is further developed)

LESSON SUMMARY: The lesson will cover genetic mutations and how it can occur spontaneously in DNA replication and how it can be passed on to its offspring. This lesson will be covered by lecture, note taking, team activities and a lab.

STUDENT LEARNING OBJECTIVES WITH STANDARDS: will elaborate once lesson is further developed
Standards
SC.912.L.16.3: Describe the basic process of DNA replication and how it relates to the transmission and conservation of the genetic information. (H)
SC.912.L.16.5: Explain the basic processes of transcription and translation, and how they result in the expression of genes. (H)
SC.912.L.16.9: Explain how and why the genetic code is universal and is common to almost all organisms.
SC.912.L.16.4: Explain how mutations in the DNA sequence may or may not result in phenotypic change. Explain how mutations in gametes may result in phenotypic changes in offspring. (H)
SC.912.L.15.15: Describe how mutation and genetic recombination increase genetic variation. (M)

Learning Objective

The student will be able to...

1. What are the key advantages of using model organisms like *C. elegans* to study genetics?

2. Observe the anatomical and physiological effects of a mutation in a gene that encodes a collagen protein in *C. elegans*.

MATERIALS: Student will be paired in 6 teams with 3-4 students or with shoulder partners, depending on class size.

1 dissecting microscope with cool transmitted light
1 small metal spatula
1 sharpie marker
1 plate of mixed stage N2 wildtype worms
1 plate of mixed stage *dpy-7(e88)* mutant worms
2 plates with 350 mM NaCl and OP50 bacteria
Copies of the procedure and worksheet

BACKGROUND INFORMATION: This is an overview-more details will be added once lesson in finalized. The C. elegans activity is based from Dr. Keith Choe. Some modification will need to be done for the middle school level. Times and lesson is subject to change once further developed.

Order and attain the materials from B2B program
Once materials are received
Day 1- pretest (10-15 minutes) and start review of genetics lesson and exit question of the day (remainder of class)
Day 2- discussion continue with PowerPoints (10 -15 minutes) and video clips (total of 10 minutes) to expose students to what C. elegans are. Team activity to review information of the day (remainder of class time)
Day 3- Microscope protocol (10 -15 minutes) C. elegans activity and worksheet (40 minutes)
Day 4- continue C. elegans activity (15 minutes) and discussion review (remainder of class)
Day 5- Students in their teams will develop a chart or poster on the advantages of studying C. elegans (20 minutes) Team present posters (10 minutes) and discussion
Day 6- Posttest (10- 15 minutes) then start next lesson
3 weeks later- second posttest

Key words: genes, mutation, proteins, replication, amino acids, codon

ADVANCE PREPARATION: Request and attain UF equipment locker from CPET. More details will be added later.

PROCEDURE AND DISCUSSION QUESTIONS WITH TIME ESTIMATES: The C. elegans activity is based from Dr. Keith Choe. Some modification will need to be done for the middle school level. More details to the lesson will be finalized later.

ASSESSMENT SUGGESTIONS:
Students will compare behavior of wildtype C. elegans and mutated C. elegan during lab

Students will develop a chart or poster on the advantages of studying C. elegans

EXTENSIONS:

ACTIVITIES: Are there other activities you know of from other resources that relate to this lesson? Yes I would like to incorporate the building a protein activity somehow as an extension of this activity.

LITERATURE: Are there trade books, novels, journal articles, or other print materials that focus on the same topic(s) as this lesson? Not that I know at this time, will further look into this once lesson is in further development

RESOURCES/REFERENCES: The C. elegans activity is based from Dr. Keith Choe. Some modification will need to be done for the middle school level. Will elaborate once lesson is further developed.