Action Research Proposal
The effect of conceptual change and literacy strategies on students in high school science classes,

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Introduction

One area of concern I have comes from what I have observed in the past two years of my teaching. A majority of students do not have the ability to access content. Specifically, the weakness I have observed is literacy in the form of readings and textbooks. Students not only do not know how to investigate through a book, but they do not know how to decipher good information from irrelevant information. I have often observed a student reading a sentence, yet even though they understood all of the words in the sentence they have no idea what they are reading. An aspect of my pedagogical context knowledge I am curious about exploring is the notion of conceptual change. I am intrigued by the phenomena of how students who are repeatedly exposed to a concept, yet still do not understand. How does conceptual change that incorporates literacy strategies affect students' achievement in a science classroom? What changes do students have in their reading ability as they use conceptual change and various literacy strategies? What changes will students observe in their own academic achievement?

Purpose Statement

The purpose of this paper is to determine how conceptual change that uses literacy strategies affects students' achievement in a science class. The specific research questions are how conceptual change will affect my students. And more specifically how can the use of literacy strategies that promote conceptual change affect students achievement in a science classroom. Which strategies help students access the content in a biology class or integrated coordinated science class? Can conceptual change affect students' success in a biology class? Which literacy strategies in conjunction with conceptual change affect students' prior knowledge?

Importance of the Study

This study will be important to me as a teacher because it is what I find to be the biggest obstacle for my students in my biology class. Biology is often said to be a very demanding class with respect to the sheer volume of vocabulary. As a result there is good reason that creating literacy strategies for conceptual change and observing their affect on students achievement might prove to be useful to me, and other teachers with similar teaching situations. Biology textbooks are not like texts from other disciplines. There is an enormous amount of de-contextualized text for students to sift through. Many students do not have the skills necessary to deal with such a demanding text, so my research might prove to be invaluable to teachers of struggling readers in their science or more specifically biology classes.

Definition of Terms

Conceptual change is a teaching strategy that requires students to reorganize the conceptual framework in order to learn something. Humans construct meaning from experiences in their everyday lives and many times those concepts are not in harmony with scientific phenomena. This requires for the reorganization of concepts by students in order for them to completely learn and understand a concept (Mason and Boscolo, 2000). Decontextualized texts are terms that have no reference before, after, or within the sentence they are found in. Decontextualized texts are very common in biology textbooks. The vocabulary is conceptually dense and as a result the text is also decontextualized in order to make sense to a science reader; however, the problem with this is that it leaves no clues for students to infer meaning of any vocabulary they are not familiar with.

Review of Literature

Conceptual change

There are many ways to get humans to learn, but a deep understanding of concepts is not always achieved when teaching students. Students often memorize through rote memorization, but do not conceptually understand because humans interpret their world based on the concepts that make up their own understanding of the world also known as their "conceptual framework". This unique lens is a byproduct of the sum of all of an individual's experiences. We interpret the world based on what we know and often if these preconceptions are not reorganized in their minds. As a result, humans do not learn the true nature of scientific phenomena. Conceptual change is based on the work of Piaget (Macbeth, 2000). There are several versions of conceptual change. In order for students to release their concrete preconceptions they must find a more satisfying concept. This can be achieved through the conceptual change model. Students must exchange or adjust their own central concept, also known as accommodation (Venville and Treagust, 1996). The other form of conceptual change is when students use their existing concepts to interpret a new phenomenon which is called assimilation (Venville et al., 1996).

Conceptual change can only happen when students become dissatisfied with old conceptions because of some new phenomena they have encountered (Venville et al., 1996). In science it is very difficult for a teacher to get students to abandon their preconceptions for more accurate concepts of scientific phenomena. Mason (2000) cites that there is prominent research that demonstrates what is important "to engage students' interests, attitudes and beliefs; activate their existing mental models or representation systems; encourage them to pose their own questions and doubts, generate hypothesis, explore alternative solutions; stimulate them to think metacognitively reflecting on their won and others' ideas and beliefs" (Mason, 2000, p.201).

Weaver (1996) found that students desire “hands on” activities such as laboratory exercises. In order for them to be effective the activities must provide opportunities for “developing hypothesis, designing experiments, and analyzing data” (1996, p.469). Conceptual change was also possible when teachers included relevant examples of the scientific concepts that were real-world examples much like Science Technology and Society instruction (Mason, 1996).

Research on conceptual change

As for literacy and conceptual change Mason et al. (2000) referred to Rivard & Straw (1996). They argued that the way literacy is involved in conceptual change has yet to receive much attention. It is my intention to determine if this is currently still the case because my research primarily deals with that very question. Rivard (2000) goes on to cite Bereiter who proposed that students should use their own writing to clarify preconceptions and reflect on their prior knowledge in order to make their thoughts more accurate. Mason et al. (2000) investigated fourth graders who could use writing as a way of conceptual change in their scientific knowledge. They found that writing let the children express their current conceptions and provided a way for students to look and think about what they knew. It also gave the students a chance to reflect on what their pre conceptions were. Their analysis demonstrated that writing did give significantly better understanding of photosynthesis.

Mason’s (2001) work with an ecology unit in a high school biology class found that students who wrote and discussed were able to clarify, express, communicate, and reason their conceptions and explanations. This provided a significant conceptual change as a result of those practices. Mason states that not all students met the same level of scientific understanding.

Methodology

Participants

My study will potentially observe three biology classes and two integrated coordinated classes. The biology classes will consist of 38 10th grade students whereas the integrated coordinated science (ICS) classes will be 40 9th grade students each. Currently, I am unaware of what my schedule will be for the next year. I might teach AP Bio and AP Environmental Science in addition to or instead of the classes mention above. I most certainly will be teaching a biology class. The students involved in the research come from mixed socioeconomic status, race, and gender. Students will also range in a wide variety of abilities. Some students will have IEPs and be English Learners. The school is located in an upper middle class community with 60% of the student body coming from lower middle class community. The school is on a block schedule. Periods 1, 3, and 5 meet on Mondays, Tuesdays, and Thursdays. Periods 2, 4, 6 meet Tuesdays, Wednesdays and Fridays. The blocks are one hour and fifty minutes long with the exception of Tuesdays where all classes meet for fifty-two minutes.

Materials

The students in the Biology classes will be using the Holt Biology book by Rinehart and the ICS students will be using It's about Time's ICS Book. I will be using a variety of literacy strategies throughout the study. I will be using Cmaps, a free graphic organizer software program to generate graphic organizers in class for the students. The students may use this in class on the science department's laptop cart or the school library. This program is a simpler version of Inspiration, which is a more popular graphic organizer program. Quizzes in biology will be standards based questions generated by Holt Chapter Quiz generator software that comes with the Holt Biology book. The ICS quizzes will be standards based questions that I develop.

Procedures

The study will be a 16 week study beginning in the fall of 2007. The data collection will be scaffold depending on the data. Students will be given a pre and post test for each unit studied. The pre and post test will measure students understanding of the concepts that they will be taught. Quizzes will be collected once a week. The Quizzes will be from the California state content standards for science. The questions will be a in a variety of levels of Bloom's taxonomy. The questions will sometimes be true/false, multiple choice, and free response; where as, surveys will be collected biweekly. Surveys will include both open and closed ended questions. Writing prompts will be collected every three weeks.

Analysis

The data collected in my study will be analyzed depending on the type of data collected. First the pre- and post- test will be analyzed to test whether students that participate in conceptual change with literacy strategies learn better than the students without the strategies. Students' grades will be analyzed to verify the validity of whether conceptual change and literacy strategies have a significant impact on students' conceptual understanding of the content. Students' results on surveys will be coded to check for factors that I am interested in investigating, such as whether conceptual change is facilitated by literacy strategies in a science class or what students thoughts are on using conceptual change. The study will also measure whether literacy strategies will help students become mindful of what changes are taking place in their conceptual framework. Inferential statistics will need to be used if my class schedule for next semester changes, if I only have one biology, ICS, AP Bio, and AP Environmental science class. Inferential statistics is used to make predictions when the researcher only has a sample size (Johnson, 2008). I will also use data coding for my field notes.

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