Plate Tectonics

Description of Concept

The activities in this lesson are designed to assist students to understand the physical evidence behind the theory of plate tectonics. Student should be able to describe the concept that the continents are continuously in motion and are not stationary.

The concept being taught in this unit is that the Earth is made up of multiple plates, that there is a cycle of heat that occurs within the Earth, causing these plates to move over long periods of time. The lessons aim to help students understand the evidence such as ocean basins, mountain ranges, islands, volcanoes and earthquakes the theory of plate tectonics. It includes activities and discussions to help students grasp the concept that the continents are not stationary. Activities will also permit students to understand how plate tectonic theory was developed and supported.

Rationale

The current lesson plan chosen has been selected from a number of plate tectonic lessons on the web. It can be located at:

http://www.teachersdomain.org/resource/ess05.sci.ess.earthsys.lp_platetectonics/.

This lesson was chosen for two reasons. The first reason for selection was that the lesson was built to accommodate students at the grade 6-8 level. It could also easily be adapted for a high school lesson in either BC Science 10 or Geography 12. Secondly the lesson incorporates a number of technology resources, in combination with kinesthetic activities to model concepts of plate tectonics and earthquake/volcano activity.

This plate tectonics lesson is designed to be implemented in a Earth Science unit. This lesson meets Science 7 learning outcomes:

- Analyse the dynamics of tectonic plate movement and landmass formation
- explain how the Earth's surface changes over time
By using technology tools, students will also meet a number of other learning outcomes for Information Technology and Language Arts. Students will be using online tools to complete research and to represent information in a different way. By using technology tools, students will also learn basic digital citizenship skills.

**Lesson Critique and Modification:**

**Lesson Breakdown**

The lesson has clearly stated objectives, which focuses on developing and understanding of the theory of plate tectonics. Information is complete regarding timing, grade level and resources for the lesson. There is a linear flow to the lesson, where activities build on each other. In this case the lesson’s two parts build on:

1. Evidence which supports Wegener used to develop his theory,
2. Wegner’s theory of continental drift was intuitive versus scientific
3. The development of plate tectonic theory.

In the two parts of the lesson there are a total of five activities per part. Activities include viewing online resources, questioning by the teacher, model creation and a summative assessment at the end of part 2.

There does not seem to be a hook for this lesson. However, there is a KWL type of activity at the beginning of the lesson to ascertain the understanding of students with respect to plate tectonics. As mentioned, assessment occurs throughout the two days of the lesson. In this plan the assessments are summative in nature, enquiring as the level of student understanding following each activity. There is not rubric for formative assessment in this lesson plan.
At first this lesson looked like it might be a bit further advanced from a traditional lesson, or behaviourist approach (Standridge, 2002). Two aspects lead to this observation, the first being that computer and online technologies were being used and the second the inclusion of hands-on activities. One of the activities also was designed for students to develop a model to demonstrate seafloor spreading.

Upon further reflection, on the overall lesson, a more behaviourist approach seems to be taken (Mergel, 1989). This includes breaking down the lesson into measurable tasks. Following each section of the lesson a number of questions are to be asked to the students. Interestingly there is no recording of answers is suggested throughout the lesson.

The use of websites in this case does not really go beyond that of similar use of a textbook. Students are simply asked to review the material on the websites so that they can answer questions by the teacher. However, in part seven and nine of the lesson there is a digression from behaviourism, as the students are required to take the information they have gained from a video as background information for a modeling activity.

Summative assessment at the end of the two part lesson also suggests a behaviourist approach (Mergel, 1989). Again, this is simply a discussion between students and teacher. There is no suggestion of assessment that would demonstrate the understanding of the concepts by each student.

Lastly, there is no mention of the actual time budgeted for each lesson. For the analysis here, each lesson will be considered to be sixty minutes. If this is the case the number of activities seems a bit much for two classes. For one thing, there does not seem to be any time allotted to technology problems. This lesson assumes that all technology and access to listed websites will work without a problem. Students should be provided with a fair amount of time to develop their models for sharing in part 7. A more appropriate timeframe for this lesson might be
three to four days. Thus, the timing shall remain the same, but fewer activities might permit students time to better interact and support each others’ learning (John-Steiner and Mahn, 1996).

*Adaptations to the lesson:*

The goal for the adaptation of this lesson, given a two day time frame, would be a shift along the learning spectrum to a more cognitivist/constructivist approach, building on previous schema and developing a student-centred approach (Mergel, 1989 and BC Education Plan, 2011). The first alteration would be to reduce the number of activities. In this case the classroom activities have been reduced from 11 to 9 with a comprehensive assessment activity at the end of the lesson. The second approach would be to focus on provided students with the opportunity to create their own learning material and to demonstrate their knowledge of plate tectonic theory with their peers; this could be achieved via a wiki following the completion of all activities. This would shift the lesson to a Vygotskian style of learning which is dependent on the influence of those surrounding a child such as advanced peers and adults, combined with the use of scaffolding to influence cognitive development (John-Steiner and Mahn, 1996).

It is also proposed that the lesson incorporate the use of Google Docs and Blogger. The combination of Google Docs and Blogger would permit the collection of student feedback following activities as well as permit students to reflect on their learning. There is an early KWL activity at the beginning of the lesson. Instead of using the whiteboard, the teacher could create a KWL chart in Google Docs. This chart could be filled in by each student to create a classroom chart of students’ background knowledge (Brown, Collins, and Duguid, 1989). Introduction of the chart would follow the introduction of links to recent localized geological events. Students could use Blogger to reflect on what they have learned following each activity. Existing lesson questions could be used to guide the students’ entries. Students could include text, images or other online activities they have found. In doing so, students would have the opportunity to express their learning in different ways.
As this adapted lesson will be used with students from Vancouver Island, a situational approach could be used whereby students could be introduced to the lesson by using links to footage of local earthquakes and volcanoes (Brown, Collins and Duguid, 1989). Most recent activity would be the best (Queen Charlotte Quake, 2012). Links would also include news footage of Mt. St. Helens 1984 eruption.

A culminating activity, the production of a wiki page has been added. Students would be given class time as well as a couple of days following the activities to add to their wikis. Wikis would ultimately be used throughout the unit as culminating project. Students could be given the opportunity to present their wiki to their teacher or parents as a final assessment for the unit. This final activity using a wiki would result in the distributed cognition of the students (Hutchins, 2000). Information in the wikis could be used to prepare for a final exam or to assist students in future classes.

Summary

This lesson was quite dense to begin with. There are a number of activities to get through and very little assessment or whether students are meeting the learning outcomes. Moreover, the lesson does not really have hook for the students, something to peek their desire to learn about plate tectonics. Suggested revisions include: local plate tectonic activity (hook), the use of modeling and hands-on activities as well as the use of technology enabling students to develop their digital citizenship skills and their ability to share what they have learned with peers, parents and teachers. The goal has been to modify the lesson shifting from behavioural/congnitivist to a cognitivist/constructivist approach, whereby student-centred learning takes place (Von Glasersfeld, 2008). The added use of Google Docs, Blogger and wikis should accommodate this shift. Lastly, by utilizing these technologies in a more cognitivist/constructivist approach, the lesson will better accommodate various learning styles, which neuroscience and other research support (John-Steiner and Mahn, 1996 and Willis, 2012).
References:


http://www.bcedplan.ca/theplan.php


http://eclectic.ss.uci.edu/~drwhite/Anthro179a/DistributedCognition.pdf


http://www.usask.ca/education/coursework/802papers/mergel/brenda.htm#The Basics of Constructivism


Appendix:

Lesson plans:

Original Lesson Plan

Updated Lesson Plan