8th Grade Science at Alaska Virtual Academy

Ramya Ramnath

Hamilton College

Date of Submission: 05/11/2012

8th Grade Earth Science at Alaska Virtual Academy

Alaska Virtual Academy is a virtual learning school that serves students across the country with a focus on remote students in Alaska. It is part of the public school system and receives government funding (www.k12.com/akva/home). Most of the students enrolled at this school choose to complete an online program instead of homeschooling because their primary caregivers either do not have the time or the resources to design a curriculum for them. The mission of the Alaska Virtual Academy is to "ignite the minds of children like yours to bring learning and innate possibility alive" (www.k12.com/akva/home). Currently, their curriculum leaves little room for social interactions among peers and instructors. This curriculum focuses on innovative use of technology to overcome this weakness and ensure that students are given an opportunity to not only learn content but also develop social skills. Currently, the curriculum is also disjointed with little flow maintained between courses. I will introduce a new method of instruction and assessment that allows students to see a logical progression to their learning rather than distinct, unrelated units. Lastly, parents are currently considered responsible for creating accountability in the students. This new curricular model also allows for peer involvement in assessment that creates accountability and self-reflective tendencies in students. Lastly, this curriculum model provides students with the necessary skill sets for work and higher education as it is important for education to provide students with the skill sets to pursue both work and higher education so students have the options to choose their path (Ramnath, 2012). I will begin by explaining a

new tool of interactive podcasts that will serve as the medium of instruction. Complementary with these podcasts are two "spaces" for peer-interaction and instructor-student interaction: video conferencing and a 3D virtual environment. I will then explain the two kinds of assessment in my curriculum. The first is content testing completed through the interactive podcasts, regular in-class tests, and other activities completed during video-conferencing. In addition, students will also complete an individual project and a group portfolio that reflect their interests and their strengths by offering a variety of media to express their research in a specific field.

This curriculum model will focus on Solar System and the Universe as a unit of 8th Grade Earth Science. This unit introduces students to the study of the earth in the context of the solar system. As our understanding of the solar system is rapidly changing, it is important for students to not only understand the structure of the solar system but also the methodologies used to explore the solar system. Since the students are from remote communities, they are exposed to a clear view of the night sky and it is important for them to gain a better understanding of how their view of a starry night relates to our scientific understanding of the structure of the solar system and the universe. In relation to the state content standards in Alaska, this unit provides students with the resources to develop an understanding of Earth's origins, current processes that shape the structure, composition, and physical history of Earth, and the theories regarding the origin and evolution of the universe (eed.alaska.gov). Within the unit of Solar System and the Universe, I will be focusing

on teaching students to model the universe, whereby students should be able to model the size, location, composition, moons/rings, and conditions of the planets in the solar system (eed.alaska.gov). Students should also have a grasp on Earth's relationship to the sun and it's moon and how these relationships affect seasons, tide, day/night, etc. (eed.alaska.gov) The unit on the Solar System and the Universe would span 2 weeks with a focus on the unit of modeling the Solar System for 1 of those weeks. With this in mind, this course will cover:

- The reason for seasons
- Seasons and Ecliptic simulator
- Modeling the solar system
- Planet "Geo"pardy
- What's all the buzz about light years?
- How far is that star?
- Viewing sunspots
- Star Light Star Bright, Really Big Star I See Tonight
- Reflecting Light
- Aurora Recipe

(eed.alaska.gov)

The structure of the online classroom is such that each group of approximately 20 students forms a learning community that works together through the course of the semester to build its knowledge base together. At the beginning and end of each semester, all of the students that can be reached via road are brought to one of the cities in Alaska for a 3-day retreat. The retreat at the beginning of the semester will focus on building interpersonal relationships within the learning community. This would be done through group projects to identify learning goals, identify classroom etiquette, and to create a student contract that lists the responsibilities that students hold themselves accountable for and the

responsibilities that they hold the teachers accountable for. While this would not be a legally binding contract, it would place the responsibility of creating goals and expectations in the hands of the student with facilitation provided by the instructor. Over the course of the semester, students will be working in smaller groups of 3-4 individuals on group projects for each topic.

The end-of-the-semester retreat would provide students to work together in the same physical space and put the last minute touches to these projects before presenting them to the rest of their learning community. This retreat would also allow students to visit the different learning communities and discover what they have been working on. These retreats are not only designed to give students the social interactions that are necessary for social development but also a chance for students to be introduced to a diverse group of peers. This would give them a chance to understand different learning styles and give them the chance to capitalize on the varying skill sets of their peers to create a project that best exemplifies all of their strengths and interests. At the beginning of each year, every student will complete the Index of Learning Styles Questionnaire. One of their instructors will then have an individual session with them to explain what their result means and the study skills that are appropriate for their learning style. It will also be the teacher's responsibility to ensure that each small group within a learning community has a balance of learning styles so the members of the group benefit from each other's strengths.

The curriculum emphasizes the ability for students to see a logical organization that supports students ability to create salient connections between previously learned and new information (Ramnath, 2012). The classes will be structured around instructional podcasts that students will be responsible for watching before each class. These instructional videos will be interactive such that students will have to answer questions about past material in order to progress through the video. If a student is not able to answer a question about previously learned material, they are then taken to the video and accompanying text for the corresponding class so they can review the material from it before moving on. The software for these interactive podcasts records each student's progress and performance on the videos so that the instructor has direct access to measures of student learning. In the case of the class on the orbit of the earth and how it relates to seasons, the interactional podcast would probably begin with a fill-in-the-blank question such as "The earth _____ around the sun" and "The earth _____ on its axis". These questions ensure that students have the knowledge base required to move to a later stage of learning. These questions would then lead to a video about the orbit of the earth and how it is maintained by the gravity of the sun and of Earth. These interactive podcasts will be supplemented with text transcriptions of the videos in case of technical difficulties with the software.

At some points in the video, students will be asked to make predictions on the upcoming information. For instance, once they have learned about rotation and how it causes different parts of the earth to face the sun at different points in time,

they may be asked to predict how long it takes the earth to complete a full rotation. This would test their ability to use integrate their existing knowledge of the length of the day with their new knowledge that the rising and setting of the sun is related to rotation. They could also be asked a multiple-choice question about why there are different time zones in America and what the time difference between time zones is. Once they have learned about the shape of the earth's orbit and the earth's tilt relative to the sun, they may be asked multiple-choice questions that lead them to the cause of seasons. Such questions would include

If the earth's tilt stays constant, the northern hemisphere would face the sun for half the year. For the other half of the year the northern hemisphere would face:

a) away from the sun
b) towards the moon
c) towards the sun
d) away from the moon

The correct answer could then lead to the question of "Which season corresponds to the half of the year when the northern hemisphere faces the sun?" Such questions allow students to not only integrate previous scientific information with new learning but also give students the skills to integrate information across departments such as linking geography and science (Ramnath, 2012). Such questions also address the content standards of "recognizing the relationship between the seasons and the earth's tilt relative to the sun and describing the day/night cycle as caused by the rotation of the earth every 24 hours" (eed.alaska.gov). At the same time, such probing questions also help address the standards for students to "develop an understanding that the processes of science require integrity, logical reasoning, skepticism, openness, communication"

(eed.alaska.gov). Once students answer such questions, they will be given feedback. If they were right, they will be instructed on the theoretical support for their correct answer and why it negates all the other options. If they are wrong, they will first be shown how the existing literature negates all the wrong answers and then why it supports the right answer. Such a process serves multiple purposes. First, it gives students experience working with multiple-choice questions, a commonly used format in standardized tests, and gives students the skill set to tackle such a format as it emphasizes the need to not only know why one answer is correct but also why the other options are wrong. Second, such an approach allows instruction to be specific to the student needs and hence address gaps in student understanding.

In this way, students do not waste time getting information that they already know, a common reason for high-performing individuals to lose motivation. At the same time, this approach addresses the gaps in understanding in low-performing students and fills it so that they are not lagging behind during their interaction time with peers and the instructors. Lastly, this approach introduces students to the models of scientific research whereby previously discovered information is used to generate research questions and hypotheses for further research. Students can also incorporate such research questions into their group portfolios and develop a methodology to answer the research questions. This form of instruction directly addresses the needs of associative learning, which emphasizes the importance of learning being a process of associating prior knowledge with new input (Ramnath, 3). When instruction takes on the structure of consistently building on the existing

knowledge base in an explicit and intentional manner, the logical organization caters to the psychological experience of learning because students are able to link the stimuli that are temporally related and semantically similar (Ramnath, 3). Swan and Shea identified three kinds of "presence" that were crucial to successful learning in a virtual environment. The first, cognitive presence, was "related to knowledge building through inquiry" (Swan, & Shea, 2005). The instructional medium of interactive podcasts addresses the first presence as students are forced to answer questions that lead to their progress in learning. The assessment techniques in the course would also emphasize this, but will be discussed in a later section. The second presence, social presence, is defined as the "development of relationships between community members" (Swan & Shea, 2005). Student success has been found to be directly correlated to "feeling like insiders" in the virtual community (Swan & Shea, 2005). This need will be addressed by the class time interactions of students with their peers and their instructor.

Class time, within the virtual learning environment will be divided into two "spaces". The first space focuses on face-time with the instructor and peers and will take the form of video conferencing whereby students can not only see the instructor but also the other students. Instructors will capitalize on this time for class discussions, presentations, and other activities that involve interacting with the material. Swan and Shea (2005) emphasized that, in online discussions, learning is mutual knowledge building, and each individual must be a contributor to the evolving knowledge base. Within the classroom environment, students will be

responsible for sharing their understanding of the material. Each class, one student will be responsible for conducting extra research on the topic and presenting it to the rest of the class and leading a short discussion on the new material. This extra research could relate to their individual portfolio or group portfolio, both of which will be discussed in a later section of this paper. In this way, students not only practice their presentation skills but also share their personal interests with the rest of the community, thus increasing their "social presence" in the virtual community. Lastly, such presentations would create joint responsibility for learning and each student would be given personal ownership over their learning and that of the rest of the class. This would only be feasible if the instructor works closely with the students to ensure that the knowledge they receive in this section is important, structured, valuable, and clearly shared. The class time would also work on emphasizing the last type of presence, teaching presence, which links cognitive and social presence through the design and facilitation of learning activities (Swan & Shea, 2005). In online learning, the instructors often shift from leaders to facilitators (Swan & Shea, 2005). In this classroom, the instructor is responsible for creating activities that allow students to engage with the material in different ways, such as presentations, discussions, and worksheets. These activities should test students on their understanding of the material so that the instructor can assess gaps in student understanding and supplement those with additional support immediately. Much research has shown that there is a direct correlation between teacher immediacy and learning as teacher immediacy leads to an increase

in motivation in students (Swan & Shea, 2005). Along with the instructors looking for gaps in learning, the class time will also allow students to ask instructors any questions they have regarding the material. Therefore, the classroom activities should be designed in such a way that students are tested on all six levels of understanding based on Bloom's taxonomy. In this way, students are given a complete understanding of what they are expected to be able to do with the information they receive in the instructional podcasts. By giving students and teachers an environment to interact and share their learning, the first "space" of the classroom, the class time, allows students to create a social presence that facilitates learning. It also allow teachers to diagnose gaps in learning and fill them. Lastly, this space allows students to interact with the knowledge in a way that facilitates learning content by asking questions, and skills through well-organized learning activities.

The second "space" in the classroom would be an online 3D interactive environment such as Active Worlds, software that has frequently been used for in online education at the college level (Dewey, 2005). In this space, each student would create their own virtual avatar and students would be able to share a virtual "space" with each other. Research on situated learning has shown that the physical situation of learning is integral to what is learned and physical contexts should be used deliberately to support pedagogical purposes (Swan & Shea, 2005). This virtual space will allow students to explore physical spaces of schools such as labs and classrooms but it will also allow students to go on field trips to museums,

aquariums, etc. On most days, this virtual space will focus on students going into a lab and setting up various experiments designed by the instructor. There will also be some time allotted each week for students to work in their small groups to set up the experiment that they would like to conduct for their group portfolio. However, for each unit, students will also go on a virtual field trip to explore the material that they are learning further. This unit will allow students to visit a planetarium. Students will be given the opportunity to explore the physical space of the planetarium in their small groups of 3-4 members. The instructor will take on the role of the tour guide and be responsible for answering any questions students have about the various displays. During this activity, students will complete a scavenger hunt for pieces of information found in various parts of the virtual planetarium and each group will be given a different list of questions to answer by the end of the field trip. The class time immediately following this field trip will be focused on each group presenting what they found on their scavenger hunt to the rest of the class. The different groups will have a few overlaps in the questions they were answering. This allows them to then discuss these overlapping questions to explore differences in their reactions to or opinions of this information. This virtual world creates an environment that supports the construction of knowledge through real-time communication and collaboration. It allows students to become embodied in the classroom and anchor their learning in a “real” familiar and engaging environment (Dewey, 2005). This approach also allows students to get a first-person perspective to interact directly with their peers and the information (Dewey, 2005). Providing

students with both "spaces" for instruction allows the instructor to tailor instruction to the student's specific learning style while allowing students to share their strengths and hence broaden each other's skill sets (Ramnath, 2012).

Assessment in this course will also cater to the student's learning style while still ensuring that students are prepared for the standardized testing formats. Alaska only mandates statewide-standardized tests for Reading, Writing and Math. However, students are supposed to have an understanding of Science as a process of inquiry by gaining experience completing laboratory work and should have an understanding of the models of the solar system and the theories regarding the origin and evolution of the solar system and the universe (eed.alaska.gov). As students may opt to take the SAT, GED, or ACT tests at the end of their high school career, the interactive components of the instructional podcasts will consist of questions that address the content standards of the curriculum while mirroring the format of standardized test questions. In addition to this, after every unit, students will complete a standardized test that assesses their knowledge of the information in that unit. During class time, one of the various activities conducted by the instructor will include questions that are similar in format to standardized test questions.

In addition to the tests, students will have two assignments over the course of the semester, an individual project and a group portfolio. These assignments allow the student to explore the material in a medium that is suited to their learning style. For each science, students will be given the opportunity to choose one from among

many research questions that address important issues in a specific unit. Over the course of the 2 weeks spent on that science, students will create a project on that topic. This project will include instructional material that the student could use to teach others about that topic. The student will be responsible for conducting background research that explains the existing information in that field and create instructional material in one additional medium to express this information. For example, if a student were doing his project on the planet Saturn, this could consist of an online simulation of Saturn, which would include information on the climate on Saturn, the seven moons of Saturn, the rings of Saturn, and its orbit around the Sun. If students are so inclined, they could also include information from history such as Greek mythology associated with Saturn and its moons or information relating to the discovery of Saturn. The project would also consist of a research proposal to extend the information we already know or verify it. For example, once students have learned about the relationship between the brightness of a star to its size and distance from the observer, the student could propose similar means to verify the distance between Saturn and the earth at ay given point in time. This project allows students to manage their learning experience as it guides their understanding in a field of choice. This project also supports exploration learning as students ask questions and research answers to increase their knowledge in this field. Students will also be expected to either turn in a paper reflecting the information in the paper or a written summary of the project, if it is in another medium, which would allow students to practice their skills for the writing grade

level expectations. Students will be responsible for submitting regular drafts of this written component and work on drafts of this written component over the course of the semester. These projects will be assessed regularly by the instructor for quality of work, effort, and regularity of input. This last criterion emphasizes self-management, a skill that will be useful in the professional field and allow them to be lifelong learners. At the end of each unit, students will present these projects to the instructor and members of their small group. They will also fill-out a self-assessment form and will be assessed by their peers based on a rubric created by the students at the beginning of each semester. This system of assessment creates greater accountability in students, facilitates peer-communication, and improves the student's self-evaluation ability, a skill that is easily transferrable to the workplace (Rastgoo & Namvar, 2010).

The group portfolio, as mentioned earlier, will be compiled by each small group. This portfolio will explore a broader topic and build off of the information students have already learned in that topic in class. They will also be required to capitalize on the varied strengths within each group to create a diversified portfolio to adequately cater to each learning style. To make this learning goal explicit, the group portfolio that each small group creates will be required to include information in at least 3 different media such as prose, videos, online simulations, a PowerPoint presentation, etc. Since the projects will be presented in person, they could also include real time aspects such as role-play. The varied media used in the final group portfolio will also allow students with different learning styles to fairly represent

their learning. Students will be responsible for communicating with each other to generate questions of significance and research the literature in that field. Students will be expected to make use of the 3D virtual environments of Active World to meet together and share their information and collaborate to create this portfolio. Such a platform provides a foundation for collaborative and cooperative learning to take place, thus enhancing the "social presence" of students in the learning community (Dewey, 2005). Students will be expected to each contribute to every stage of portfolio generation, which includes background research, presentation of this information, developing research questions, identifying sources to answer these research questions, and proposing possible ways to extend current literature on the subject area. Students will then create a 50-minute lesson to share the information they have found. This lesson must contain information in different media and incorporate activities that cater to each of their learning styles.

Collaboration between students for social learning and content learning has proved to be a valid method of balancing content and skill learning as students are able to modify instruction to cater to their learning styles but also benefit from working with people who have different learning styles and different strengths (Ramnath, 2012). These group portfolios will be expected to reflect the strengths of each of the members of the group. The instructor will use the same rubric as that of the individual portfolio to assess the portfolio over the course of the semester. After the final presentation of the portfolio at the end-of–the-semester retreat, students will complete a self-assessment and peer-evaluation form for the same portfolio.

The curriculum I propose for Alaska Virtual School's 8th Grade Earth Science course is focused on four key ideas: the importance of associative learning, complementary content and skill learning, catering instruction and assessment to individual learning styles, and exploiting technological advances to provide students with sufficient social experiences. The project-based nature of this curriculum engages students in the material while supporting critical thinking and higher-order thinking skills, thus preparing students for further education. At the same time, this education also provides students with important self-management and evaluation skills that prepare them for the workplace of they decide to choose a career rather that further education. Through extensive use of technology and creative learning activities, this curriculum supports a full-fledged education for students in remote communities.

References

Active Worlds and Education. Retrieved from www.activeworlds.com/edu

Alaska K-12 Science Curricular Initiative (AKSCI). Retrievd from www.aksci.org/nav_curriculum_earth_solar_system_and_universe.html

Alaska Virtual Academy. Retrieved from www.k12.com/akva/home

Assessment, Accountability and Student Information. Retrieved from www.eed.state.ak.us/tls/assessment.GLEHome.html

Dickey, Michele D., (2005). Three-dimensional virtual worlds and distance learning: two case studies of active worlds as a medium for distance education. *British Journal of Educational Technology,* 36 (3), 439-451.

Ramnath, Ramya, (2012). Standardization and specialization for and ideal education system. *Hamilton College.*

Rastgoo, A. & Namvar, Y., (2010). Assessment approaches in virtual learning. *Turkish Online Journal of Distance Education,* 11 (1).

Swan, K. & Shea, P., (2005). The development of virtual learning in communities In S. R. Hiltz & R. Goldman, *Asynchronous learning networks: the research frontier,* 239-260.