Nova Southeastern University – Discovery Channel Joint Project in Middle School Science Professional Development for Teachers

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Nova Southeastern University (NSU) and Discovery Channel are collaborating in an initiative to provide online training modules to middle school science teachers to help these teachers upgrade their understanding of standards-based science curriculum and orient the teachers to the use of Discovery Channel’s united-streaming (2006) multimedia program for use in the classroom. Some key objectives of the program are for middle school science teachers:

- to learn how to log in to united-streaming, search for video programs, video clips, and images by keyword, subject or grade level, curriculum standard, or titles.
- to find out how to stream, view and download videos, clips, and images for use in a classroom.
- to see how easy it is to use learning tools and teacher features available through united-streaming.
- to learn how to integrate images and clip art from united-streaming into existing classroom materials.
- to also find out how to integrate videos to enhance materials already in use.
- to learn how to create thoughtful lessons and activities for all students using content from united-streaming.
- to also find out how to use united-streaming content to support special education and ESOL learners.
- to explore the facts about how united-streaming is scientifically proven to increase student achievement.

Participants will then use united-streaming images and videos to create an interactive, inquiry based lesson such as a web-quest or digital storytelling project. The hope is to prepare highly qualified middle school science teachers with the instructional knowledge and media needed to teach science inspirationally in today’s modern, inclusive classroom setting.

Modern science education is evolving in part because of new tools for learning.
Multimedia products have influenced education in successive phases. In the first phase, video tapes simply replaced films in the classroom. In the second phase, electronic software and the Internet began to provide access to multimedia via the computer screen. The widespread use of video downloads from internet websites are examples. A third phase has now begun. We are seeing changes in middle school science education curricula as a direct result of the availability of electronic multimedia information.

The application of multimedia to education supports the constructivist approach to education. Inhelder and Piaget (1964) have stated, “Only when we successfully match children’s mental ability levels with the process of inquiry learning can we expect them to reconstruct the knowledge we would like them to acquire”. Electronic multimedia provides a learning environment to present scientific concepts at a developmentally appropriate level for children. It facilitates the match between the subject matter in the curriculum and children’s levels of developing mental abilities. It also facilitates the translation of constructivism into practical pedagogy (Gagnon and Collay, 2001).

Nova Southeastern University Fischler School of Education and Human Resources (FSEHS) and Discovery Channel plan to offer professional development education to current middle school science teachers in 2007. There will be a comprehensive set of online pedagogical courses specifically designed for the three major themes of science instruction in middle school: physical science, life science, and earth-space science. The science content of these courses will be based on National Science Standards (2006) and the Florida Sunshine State Science Standards (1996). There will be two major emphases in this new program. The first emphasis will be a goal to provide middle school science teachers in particular with content knowledge needed for well
rounded lesson plans. The second emphasis will be to introduce the teachers to Discovery Channel’s *united-streaming* website as a resource for science videos and related resource materials readily downloadable from the website.

South Florida, the home base of NSU, is bracing for an enrollment explosion in middle schools as an extraordinarily large population of children currently enrolled in elementary school are beginning to move up to the higher grades. Metro-Dade middle schools are expected to add thousands of students to their current enrollment of over the next four years. In Broward County, middle school enrollment is also expected to grow quickly as students move up from large elementary school populations at present.

Consequently, there is a growing need for middle school science teachers, but there are few academic programs in Florida that prepare middle school science teachers specifically. NSU, as an institution of higher learning, is in a unique position to mobilize toward providing a middle school science professional development program enhancing the preparation of qualified teachers to meet the unique needs of middle school students. It cannot be overlooked that the independent institutions of Florida play a crucial role in educating teachers who can function efficiently and professionally. As an independent institution, NSU has the flexibility to make program adjustments in order to help meet the dynamic educational needs in the State. As a result, FSEHS provides higher education to a significant number of qualified teachers. The changing roles and responsibilities of classroom teachers and the mix of students and behaviors encountered in the classroom are very important concerns accounted for in NSU’s teacher professional development programs. Science teachers must enter classrooms equipped with the knowledge, skills, beliefs, values, and languages of the cultural context of the school in which they teach.
NSU’s professional development programs have been designed to meet these very important challenges.

Program Philosophy

NSU FSEHS believes strongly that all science teachers should have a thorough grounding in professional knowledge, including trends in research, educational reform efforts, subject area knowledge, including the history of the field of science education, and basic teaching competencies. This newly-developed online program is built on the assumption that future teachers should be cognizant of the opportunities associated with teaching science and be aware of the practical challenges that exist in the daily task of helping their future students to learn while they, themselves, act as models of learning.

Modern science education is also based, in part, on the No Child Left Behind (NCLB) Act of 2001, in which “scientifically based research” is considered an important component in the science classroom (Traub 2002). In addition to NCLB, publication of the National Academy of Science’s Scientific Research in Education ((SRE) (Shavelson and Towne 2002) and its sequel, Advancing Scientific Research in Education (Towne et al. 2004) has generated extensive discourse about methods of scientific exploration as well as its validity and relevance in educational settings.

Science teachers must be assisted in realizing their strengths and weaknesses in both teaching as a profession and in daily living. It is the duty and responsibility of a professional development program to present teachers with eclectic methodology and pedagogy from which they can develop and form their individual teaching styles. The primary objective is to prepare highly qualified middle school science teachers who will perform effectively and creatively in the classroom. They will demonstrate:
• Possession of recent knowledge of the best practices in the field (Singer et al 2005).
• In-depth knowledge about primary sources and research in the field.
• Familiarity and beginning proficiency with computers and other instructional technologies including the appropriate and innovative use of technology with community school students.
• A repertoire of flexible, effective teaching strategies and educational planning techniques (Bar & Zinn 1998).
• An in-depth knowledge about assessment or systems of assessment (Baxter & Glaser 1998).
• A recognition that students with disabilities are entitled to the same high standards, treatment and leadership offered to non-disabled peers (Abedi, 2003).
• An understanding that involvement of parents is critical to student success.
• A pro-active approach toward the identification of student needs in modern science instruction (Leighton 2004).

In order to achieve its primary objective, NSU’s online teacher professional development program endeavors to:
• provide middle school science teachers possessing basic knowledge of academic science areas with communication skills to meet the challenges of the 21st century (Dugger et al 2004).
• adapt the structure of the middle school science program to include the knowledge appropriate for standards-based science education.
• provide a learning environment in which educational theory is continually analyzed in light of contemporary experience (Scalise 2004).
• model the selection and design of instructional materials meeting the needs of the learner, appropriate to the nature of the discipline, and utilizing the best available educational technologies (Delgado 2005).

• assist science teachers to develop respect for the human dignity of each child or young person, with special regard for the multicultural, ethnic and racial composition of the classes they will teach (Cuevas et al 2005)

• support a population of middle school science teachers that represents the cultural, racial, ethnic, and age ranges of Florida’s population.

A Sample Online Professional Development Program

The following is a sample outline of a six-week online course for middle school science teachers exploring physical science and multimedia resources related to the subject:

NSU & Discovery Channel Course One: Middle School Physical Science featuring Discovery Channel’s united-streaming

PHASE I (2 weeks)

OBJECTIVES:

• The teacher will learn how to log in to united-streaming, search for video programs, video clips, and images by keyword, subject or grade level, curriculum standard, or titles.

• The teacher will also find out how to stream, view and download videos, clips, and images for use in your classroom.

• Then the teacher will use learning tools and teacher features available through united-streaming.
WEEK 1 TOPIC: Attend Online Chat Session: Interactive Training Module: Features & Navigation

ASSIGNMENTS:

Access united-streaming Website: http://www.unitedstreaming.com/

Through discussion board and online chat sessions, discuss application of this week’s pedagogical topic to the content and methods of teaching National Science Content Standards Grades 6 & 7 Expectations:

The teacher:

- knows that temperature measures the average energy of motion of the particles that make up the substance.
- identifies forms of energy and explains that they can be measured and compared.
- knows that many forces (e.g., gravitational, electrical, and magnetic) act at a distance (i.e., without contact).
- knows common contact forces.
- knows the various forms in which energy comes to Earth from the Sun (e.g., visible light, infrared, and microwave).
- knows that gravity is a universal force that every mass exerts on every other mass.

WEEK 2 TOPIC: Attend Online Chat Session: Advanced Techniques with Word

ASSIGNMENTS:

Discuss application of this week’s pedagogical topics to the content and methods of teaching Grades 6 & 7 Expectations:
The teacher:

- understands that the properties of materials (e.g., density and volume) can be compared and measured (e.g., using rulers, balances, and thermometers).
- knows that materials may be made of parts too small to be seen without magnification.
- knows that common materials (e.g., water) can be changed from one state to another by heating and cooling.
- knows that the weight of an object always equals the sum of its parts.
- knows that materials made by chemically combining two or more substances may have properties that differ from the original materials.
- recognizes various forms of energy (e.g., heat, light, and electricity).

The teacher will then develop a technology infused physical science lesson plan focusing on the topics of the last two weeks with 2 links to videos and 3 images, completed in MS Word.

PHASE II (2 weeks)

OBJECTIVES:

- The teacher will learn how to integrate images and clip art from united-streaming into the existing classroom materials.
- The teacher will also find out how to integrate videos to enhance materials already in use.
- The teacher will then create custom videos for use in the classroom.
WEEK 3 TOPIC: Attend Online Chat Session: Interactive Training Module 2: Integration Strategies

ASSIGNMENTS:

Through discussion board and online chat sessions, discuss application of this week’s pedagogical topic to the content and methods of teaching National Science Content Standards Grades 6 & 7 Expectations:

The teacher:

- knows the many ways in which energy can be transformed from one type to another.
- identifies various ways in which substances differ (e.g., mass, volume, shape, density, texture, and reaction to temperature and light).
- understands the difference between weight and mass.
- knows that atoms in solids are close together and do not move around easily; in liquids, atoms tend to move farther apart; in gas, atoms are quite far apart and move around freely.
- knows the difference between a physical change in a substance (i.e., altering the shape, form, volume, or density) and a chemical change (i.e., producing new substances with different characteristics).
- knows that equal volumes of different substances may have different masses.

WEEK 4 TOPICS: Attend Online Chat Session: PowerPoint in the Classroom & Advance PowerPoint Techniques

ASSIGNMENTS:
Discuss application of this week’s pedagogical topics to the content and methods of teaching Grades 7 & 8 Expectations:

The teacher:

- knows the difference between an element, a molecule, and a compound.
- knows that if more than one force acts on an object, then the forces can reinforce or cancel each other, depending on their direction and magnitude.
- describes and compares the properties of particles and waves.
- knows the general properties of the atom (a massive nucleus of neutral neutrons and positive protons surrounded by a cloud of negative electrons) and accepts that single atoms are not visible.
- knows that elements are arranged into groups and families based on similarities in electron structure and that their physical and chemical properties can be predicted
- knows the properties of waves (e.g., frequency, wavelength, and amplitude); that each wave consists of a number of crests and troughs; and the effects of different media on waves.
- knows that simple machines can be used to change the direction or size of a force.

The teacher will then develop a technology infused physical science lesson plan with a PowerPoint presentation containing 2 embedded videos and 3 images.
PHASE III (2 weeks)

OBJECTIVES:

- The teacher will learn how to create thoughtful lessons and activities for all your students using content from *united-streaming*.
- The teacher will also find out how to use *united-streaming* content to support special education and ESOL learners.
- The teacher will then, explore the facts about how *united-streaming* is scientifically proven to increase student achievement.
- The teacher will use *united-streaming* images and videos to create an interactive, inquiry based lesson such as a *web-quest* or a digital storytelling project.

WEEK 5 TOPIC: Attend Online Chat Session: Interactive Training Module 3: Differentiated Instruction

ASSIGNMENTS:

Through discussion board and online chat sessions, discuss application of this week’s pedagogical topic to the content and methods of teaching National Science Content Standards Grades 7 & 8 Expectations:

The teacher:

- knows the general properties of the atom (a massive nucleus of neutral neutrons and positive protons surrounded by a cloud of negative electrons) and accepts that single atoms are not visible.
- knows that radiation, light, and heat are forms of energy used to cook food, treat diseases, and provide energy.
• knows the various forms in which energy comes to Earth from the Sun 
  (e.g., visible light, infrared, and microwave).
• knows the processes by which thermal energy tends to flow from a system 
  of higher temperature to a system of lower temperature.
• knows that a change from one phase of matter to another involves a gain 
  or loss of energy.
• knows that most of the energy used today is derived from burning stored 
  energy collected by organisms millions of years ago (i.e., nonrenewable 
  fossil fuels).
• knows that energy conversions are never 100% efficient (i.e., some energy 
  is transformed to heat and is unavailable for further useful work).

WEEK 6 TOPICS: Attend Online Chat Session: Digital Storytelling & Video Editing, 
Web-Quests & Inspiration

The teacher will discuss application of this week’s pedagogical topics to the 
content and methods of teaching Grades 7 & 8 Expectations:

The teacher:
• knows that the electron configuration in atoms determines how a 
  substance reacts and how much energy is involved in its reactions.
• knows that the vast diversity of the properties of materials is primarily due 
  to variations in the forces that hold molecules together.
• understands that the rates of reaction among atoms and molecules depend 
  on the concentration, pressure, and temperature of the reactants and the 
  presence or absence of catalysts.
• understands the basic principles of atomic theory.
• knows that connections (bonds) form between substances when outer-shell electrons are either transferred or shared between their atoms, changing the properties of substances.
• knows that the number and configuration of electrons will equal the number of protons in an electrically neutral atom and when an atom gains or loses electrons, the charge is unbalanced.
• knows that nuclear energy is released when small, light atoms are fused into heavier ones.

The teacher then creates a physical science lesson plan incorporating either a digital storytelling project or web-quest.

Sample Middle School Science Lesson Plan

The following is a sample lesson plan, which would be provided to the teachers participating in the professional development program as a reference model, created using Discovery Channel united-streaming resources as an integral part of the learning experience:

**Topic:** Energy Waves

**Description of Learners**

This is a lesson plan designated to teach a hypothetical 8th grade science class in an urban public school system. The class consists of 24 students (13 females and 11 males), which include 14 are Euro-American, 5 are Hispanic and 5 are African-American students. There is one male Hispanic ESOL (English for Students of Other Languages) student.
Accommodations

The ESOL student is highly functioning and is flourishing in a mainstreamed classroom. Although accommodations are not necessary, the following ESOL strategies will be implemented for further enhancement of content:

- B5 – Pictures
- B11 – Computer/Software
- C2 – Small Group Activities
- E4 – Diagram rather than paragraph
- E7 – Repeat/paraphrase/slow down
- E10 – Use simple, direct language
- E18 – Outline Notes
- E25 – Repetition
- E26 – Question-Answer relationship

Learner Outcomes

Waves are regular disturbances that carry energy through matter or space. The two main types of waves are mechanical (carry energy through matter) and electromagnetic (carry energy through space). There are four main properties of waves: amplitude, wave speed, frequency, and wavelength: the shorter the wavelength, the higher the frequency, which means that more energy is traveling in a given second; the higher the amplitude, the more energy being pushed through the wave. Wave frequency is calculated just like speed, i.e., number of wavelengths divided by time. The electromagnetic spectrum consists of all waves that travel in space, from radio waves to gamma rays. For transverse waves the displacement of the medium is perpendicular to
the direction of propagation of the wave. In longitudinal waves the displacement of the medium is parallel to the propagation of the wave.

This lesson reflects the Florida Sunshine State Standards SC.A.2.3.1, SC.A.2.3.3, SC.B.1.3.1, SC.B.1.3.6, LA.A.1.3.1, LA.A.2.3.1, LA.B.1.3.1, LA.B.1.3.3, and LA.B.2.3.3

Learning Objectives:

1. Students will know the differences between mechanical and electromagnetic waves (Cognitive Domain)

2. Students will be able to compare transverse and longitudinal waves (Cognitive Domain)

3. Students will be able to describe the four properties of waves (Cognitive Domain)

4. Students will research and put together a PowerPoint presentation discussing waves (Cognitive, Affective and Psychomotor Domains)

Lesson Plan Design

A. Advance Organizer: The teacher facilitates a discussion by asking students the following questions:

- What is a wave?
- List some examples of waves.
- What is the difference between a mechanical and an electromagnetic wave?
- Label and illustrate the four properties of a wave.
B. **Main Activity:** The teacher initiates a discussion by asking students for examples of waves. After several answers, the definition of a wave will be discussed. The teacher will then present a video titled *Waves* derived from the Discovery Education *united-streaming* website. After the class has viewed the video, the teacher will separate energy waves into electromagnetic or mechanical waves on a chart and explain the two. Using a slinky the teacher will demonstrate a longitudinal wave and explain the displacement of particles. The teacher will continue to ask students the difference between mechanical and electromagnetic waves throughout the lesson. An electromagnetic spectrum will then be distributed and the four properties of waves will be discussed in relation to the spectrum. First the teacher will explain that radio waves are weak and are commonly used and then explain the gamma rays are highly radioactive and can cause cancer. The teacher will illustrate frequency and wavelength on the board and ask the students the relationship that exists between the two. The higher the frequency, it will be explained, the shorter the wavelength and the more energy being carried. With a jump rope, the teacher will ask students, if the rope is taught when jumping, is more or less energy being expended. This concept was demonstrated first by having the jump rope slack, and then taught. The students will see that it takes more energy to move a slack jump rope than a taught one. The teacher will then refer this concept to amplitude: the greater the amplitude, the more energy carried.
After presenting the introductory information about energy waves, the teacher will begin to explain the students’ project requirements. In groups of four, students are to develop a PowerPoint presentation describing the properties of the waves, the difference between transverse and longitudinal waves, and one type of electromagnetic wave. In order to find more information on energy waves, students will surf the web, utilizing a Web-quest with the teacher acting as a facilitator.

**Authentic Assessment: Check for understanding and strengthen student thinking:**

After completing the class demonstrations, lecture, and discussion, the students will create a PowerPoint presentation using the information discussed as well as their newly researched information.

The teacher will observe students’ participation in class discussion. Students will also be evaluated by their ability to take responsibility for their duties, collaborating with their peers, and collecting information. They are to follow a rubric giving them clear instructions on how to create their PowerPoint presentation. The teacher will observe students’ participation in class discussions as well and their ability to work effectively on their project.

**Resources:**

The following materials will be utilized in this lesson:

- DLP Projector
- Macintosh Laptops per group of 4 students
• Dry erase markers
• Internet access
• Dry erase board
• Microsoft PowerPoint
• Jump rope
• Slinky

Self Reflection on Evaluation of Lesson: This lesson provides an efficient means of reinforcing concepts learned. It allows students to regulate the rate at which they learn and encourages them to do their own research.

Conclusion

The utilization of the Discovery Channel united-streaming website resources in the NSU FSHES teacher professional development online courses will help participants become aware of the practical utility of multimedia technology as a superb resource in the middle school science classroom. One of the most important teaching skills emphasized in this course, also stated in the Core Standards of the Interstate New Teacher Assessment and Support Consortium (INTASC, 1992) and the Florida Educator Accomplished Practices (EAP, 1995) is the ability to communicate to students the important interrelatedness of science, technology, and society.

The multimedia, multicultural context of this professional development program on middle school science education will be an important contribution to middle school teacher understanding of standards-based science content and best teaching practice in the modern multicultural, inclusive science classroom.
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