SPARK SCIENCE LEARNING SYSTEM CASE STUDY: DESOTO ISD

Ms. Stephanie L. Beasley, M.Ed.
Science Coordinator
DeSoto Independent Schools
DeSoto, Texas

Curtistene S. McCowan Middle School
Glenn Heights, TX

CASE STUDY: DESOTO ISD

Objective: increase academic success by applying constructivist learning theory through tehnology-based, hands-on science activities

Introduction

DeSoto Independent School District (DeSoto) is a mid-sized suburban school district in north Texas, located just south west of Dallas. The District serves a multicultural population of students from various socio-economic background. Curtisene S. McCowan (McCowan) middle school, a relatively new school within DeSoto ISD hosted the proof-of-concept described in this case study. Offering grades 6 through 8, McCowan's faculty of 56 teach approximately 838 students, representing a teacher student ratio of almost 1:15.

Guided by its mission: provide experiences for young men and women so they learn and practice the values of high academic and professional achievement as well as wholesome individual and civic character, the District established 8 strategic goals, two of which form the basis for the proof-of-concept project discussed in this case study:

- Goal 1: attain maximum student achievement through relevant and rigorous instructional programs.
- Goal 8: secure emerging technology to maximize student achievement and manage information efficiently.

SPARK™ Proof-of-concept Implementation

As part of its response to these strategic goals, in 2009 DeSoto implemented a proof-of-concept using the SPARK Science Learning System™ (SPARK) and PASPORT® sensors from PASCO scientific at McCowan. SPARK is an all-in-one mobile device that integrates over 70 sensors with inquiry-based content and assessment. The SPARK system includes a full-color display, finger touch navigation, and data collection and analysis capabilities (see Figure 1).

Figure 1 SPARK Science Learning System

The proof-of-concept program focused on an application of constructivist theory in the form of a hands-on approach to science instruction. The hands-on approach included the use of SPARK systems, sensors and built-in content called SPARKlabs™.

AIMS AND OBJECTIVES

Through this proof-of-concept, the District wanted to determine if such a SPARK implementation would be easy to implement, would improve students' abilities to apply science content and ultimately raise their standardized state assessment scores on the Texas Assessment of Knowledge and Skills (TAKS) tests. The District wanted to determine whether students would garner a greater understanding of the use of technology within the sciences as well as improve their ability to apply their science knowledge in real world situations.

Additionally, the District wondered if by using SPARK systems, teachers would be able to enhance the quality of learning experiences beyond those achievable with traditional teaching methods.

In summary, the DeSoto ISD wanted answers to the following questions:

- How difficult will it be to implement a SPARK-based program?
- What impact will the program have on students' science knowledge as measured on the TAKS?
- What impact will the program have on students' understanding the role of technology in science?
- What impact will the program have on students' abilities to apply science knowledge to real world situations?
- Will the program show efficiency gains of course content delivery?
- What impact will the program have on the quality of learning experience?

Proof-of-concept Description

To investigate these questions, the District implemented a proof-of-concept, paying special attention to technology implementation, constructivist teaching approaches, and professional development.

Implementing SPARK technology. Along with other peripherals, in October 2009 the District used supplemental funding to purchase ten SPARK systems and ten Middle School Standard Bundles, each of which includes the following sensors: Motion, Light, Hand Grip Heart Rate, Chemistry Sensor, Conductivity, Force, Weather, and Fast Response Temperature. After purchase, the District moved the materials to McCowan.

Applying Constructivist Approaches. Pedagogy in the proof-of-concept classes combined traditional classroom instruction with technology-based instruction offered in the science laboratory. In addition, to ensure an all inclusive approach, teachers increased their emphasis on the application of constructivist pedagogy. To support this approach, the District produced supplemental materials in-house to accompany the SPARKlab activities wherever needed. These materials gave introductory instructions on how to use the device as well as some direction on which activities to complete during the proof-of-concept laboratory investigations.

Delivering Professional Development. The District recognized that the effectiveness of the proof-of-concept implementation would depend primarily on providing teacher assistance and administrative support at the campus and district levels. Both PASCO trainers and District personnel provided initial professional development. Later, district personnel familiar with PASCO products provided supplemental training.

Outcome and Evaluations

The District learned a great deal from the proof-of-concept. This case study discusses their findings about technology implementation, student knowledge gains and understanding of the role of technology in science, the quality of the learning experience, and the impact of SPARK on teaching efficiency and content relevancy.

Technology Implementation

Overall, implementation of the proof-of-concept was relatively easy because of the small size of the school. Technology integration did not present a significant problem because the science department was well set up to take on SPARK, given that science laboratory investigations were already a part of the instructional program at McCowan. As well, teachers within the department had considerable experience in small group work with students, so they had already developed the inter-personal skills necessary to work successfully with more interactive technology tools.

With regard to the technology specifically, the intuitive nature of the SPARK systems made it exceptionally easy for students and teachers to use. The device provided students with a familiar interactive approach. Because students manipulate SPARK in a fashion much like most electronic hand-held gaming devices, the operation of the SPARK systems became less obtrusive.

Knowledge as Measured on TAKS Test

SPARK's level of technological transparency made it easier for students to focus on content. And the interactive nature of the product invited students to "play" with it as if it were a toy (although educationally sound), which increased their interactions with the content material.

As a result, students became more responsive to content. Student performance on the TAKS improved on average 13.5% after the initial implementation of the SPARK proof-of-concept. Furthermore, for economically disadvantaged groups and African-American students, scores increased by 19% and 18% respectively. This is an important finding given that historically, the District found it challenging to show academic improvement by these student groups on such measures.

Understanding Role of Technology in Science

Students carried out their science experiments in ways more representative of 21st century scientists. Not only did they visualize focal concepts, but also they experimented with them in real-time. As well as being an effective tool in laboratory activities, the District also found the SPARK systems particularly valuable for note-taking and laboratory report development.

Quality of Learning Experience

As a consequence of this improvement in student achievement, both teacher and student motivation increased. Consistent with constructivist notions, the proof-of-concept showed that students are more apt to participate in authentic kinds of science activities—ones that they themselves design, that include their data, and provide opportunities to conduct analyses that they can manipulate themselves.

Increasing Efficiency & Ensuring Relevancy

Teacher buy-in and input into the development of labs is critical. The District learned a great deal about processes connected with teacher buy-in from the proof-of-concept. To increase the level of participation in the future, the District will provide opportunities for additional teacher input into the development of SPARKlabs as well as feedback from students. Nevertheless, even though the proof-of-concept followed a proscribed set of experiments, the resulting motivation of staff and students was such that the District plans to expand the program to include Physics courses during the 2010-2011 school year.

See Table 1 below for a summary of SPARK's impact on technology integration, knowledge gains, technology's role in science, the quality of the learning experience, and elements that affect efficiency and relevancy.

FACTOR	OUTCOME
integrating SPARK	intuitive nature of the SPARK systems made it exceptionally easy for students and teachers to use; students manipulated SPARK like an electronic hand-held gaming devices; the operation of the SPARK systems became less obtrusive
knowledge gains	test scores on TAKS increased by 13.5% overall, and by 19% and 18% for economically disadvantaged groups and African-American students respectively
technology's role	students carried out their science experiments in ways more representative of 21st century scientists
learning experience	both teacher and student motivation increased; students liked to participate in authentic kinds of science activities particularly those they designed themselves
efficiency and relevancy	locally designed SPARKlabs can increase relevancy as well as teacher buy in

Table 1. Summary of SPARK proof-of-concept outcomes on factors deemed important by DeSoto ISD.

Recommendations

For those Districts or campuses who are considering an implementation of a SPARK -based program consider the following prior to initiation of the process:

- *Understand student needs.* Districts or campuses need to have a good understanding of the needs of their student populations. The teachers from McCowan understood the needs and learning modalities of their students prior to considering the implementation of the SPARK proof-of-concept.
- *Ensure teacher buy-in.* Consider teacher resources and their willingness to implement new technology. It takes additional time to integrate new approaches. Teachers need to have an opportunity to participate directly in the development of materials crucial to a successful integration. McCowan teachers were willing to consider non-traditional tools for classroom application.
- *Provide ongoing support.* Recognize that teachers require help when they take on additional demands connected with participation in a proof-of-concept or other new technology program. Be ready to provide supplemental professional development experiences and support for new materials development. DeSoto ISD provided such support to McCowan teachers.
- *Demonstrate commitment.* The overall vision for McCowan was to make it an exemplar school for science education in the southwest area of the District's region. The implementation process for this SPARK proof-of-concept represented the initial phase of a series of programs still to be implemented. Scaling up the SPARK proof-of-concept program will inevitably require the procurement of additional units, probeware, etc. From the outset, DeSoto ISD looked at the big picture and made provisions to expand the SPARK proof-of-concept if successful.