

THE EFFECT OF SAS CURRICULUM PATHWAYS  
ON STUDENT SCIENCE ACHIEVEMENT

by

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**ABSTRACT**

In this investigation SAS Curriculum Pathways, an online technology based curriculum, was implemented with the purpose of improving student achievement. SAS Curriculum Pathways provided a curriculum-based technology learning experience to both individual and group work settings. Student performance on summative assessments did not show marked improvement following the treatment. Students demonstrated and expressed more positive attitudes toward science.

## INTRODUCTION AND BACKGROUND

Edgecombe County is located in the coastal plains in Northeastern North Carolina. Edgecombe is a rural county situated approximately one hour's drive east of Raleigh and two hour's drive inland from North Carolina's beaches. The county is rural with its main source of income being agricultural. Nearly 65.6% of the residents are high school graduates. The median household income is \$33,346; however, 22.6% of the population is below the poverty level. Fifty seven percent of the residents are African American. Forty two percent are Caucasians (US Census, 2010).

Roberson Center for Academic Excellence (RCAE) is located about five miles outside the county seat, Tarboro. RCAE provides an alternative environment for students grades 6 through 12. Students attending RCAE have been assigned for either disruptive or violent behavior, drug related or attendance violations in a traditional school setting. The student body of RCAE totals 33 students. The ethnic population is 95% African American with the remaining 5% being Caucasian. Ninety percent of the students are male. One hundred percent of the students meet eligibility requirements for being classified as economically disadvantaged (NC State Department of Public Instruction, 2010).

Each year, schools in North Carolina may receive designations based on their performance on the state's tests which measure growth and performance in specific areas. Those designations are awarded on the basis of percentage of students performing at grade level and on whether students have learned as much as they are expected to learn in one year. At the end of 2010, RCAE students' End of Course Tests results indicated 28%



of high school students met North Carolina's performance standards as compared to the district's 71.6% and the state standard 80.7% (NC State Department of Public Instruction, 2010).

School systems across the state of North Carolina continue to push for higher scores in all tested areas. Each system issues its own set of mandates and guidelines, as well as those directives which come from the state department of public instruction. The goals of both organizations are increasing student achievement. As a result, teachers are constantly examining different strategies to raise student achievement.

I teach one course in high school physical science at Roberson Center for Academic Excellence. Physical science is required for graduation and has a state end of course test. Eighty percent proficiency is considered a passing score. With less than 30% of our students reaching a minimum passing score, I began to search for some means of raising achievement. Education is generally not a high priority at home. Consequently, the students are not highly motivated to learn. Some students are marking time to drop out when they reach the age of 16. Being a dropout makes the student eligible for Job Corps. They see Job Corps as a means of getting some education, and a means of leaving home. Student participation in the learning process is minimal. Maintaining order in the classroom is a high priority.

### Focus Statement

Many of the students perform at sub-standard levels because they are not interested and are unmotivated. More than half of the students do not complete or submit class assignments. More than half of students do not participate in class discussions, group assignments, or lab experiences. None of the students complete or submit homework assignments. The level of student participation in class related activities and assignments is unacceptable.

Using technology to improve student achievement led to my primary focus question: How will technology (SAS Curriculum Pathways) affect student achievement? SAS Curriculum Pathways.com is an on-line model that uses reading, graphing, research, web-searches, simulations, labs, and other media to instruct and enhance physical science. The program is aligned with the North Carolina standard course of study. Incorporating SAS Curriculum Pathways as a means of teaching and enhancing the physical science curriculum to increase test scores would also address my secondary questions: How will SAS Curriculum Pathways affect student participation? How would SAS affect class student motivation?

### CONCEPTUAL FRAMEWORK

Children between 8-18 years old spend an average of 7 hours and 38 minutes per day or more than 53 hours a week using entertainment media. Over a period of five years this time has increased by an hour and seventeen minutes. When young people are

spending more than a full time work week with media, we need to understand how it's affecting them for good and bad (Kaiser Family Foundation, 2010).

A recent survey conducted by Pew Internet & American Life Project (2009) found that twenty-one million students between 12 and 17, nearly 87% of the entire age bracket, use the Internet. Of the 21 million online teens, 78% say they use the Internet at school. The survey showed that most teens believe the Internet helped them to perform better in school. The Software and Information Industry Association in 2000 reviewed 311 research studies on the effectiveness of technology on student achievement which revealed positive and consistent patterns when students were engaged in technology rich environments, including significant gains in all subject areas ("Critical Issue," 2005). Researchers from the Northeast and Islands Regional Technology in Education Consortium identify five characteristics of a meaningful learning environment: active, authentic, intentional, constructive, and cooperative (NEIRTEC, 2004). These qualities, which are present in a web-based environment, are able to provide an atmosphere highly conducive to learning. Technology promotes experiential learning and real world context for learning. Science students who use simulations, computer labs, and videos to connect instruction to real-world problems outperform students taught by traditional methods alone (CEO Forum on Education and Technology, 2000). Learning environments can be enriched by sound, images, text, and interactivity. The Education Commission recommends web-based learning environments support and challenges students through multiple means of representation, expression, and engagement. The Commission also promotes texts, graphics, animations, simulations ("The Power of the Internet for Learning," 2000).

An in-depth study of 55 New York State school districts concluded that increased technology supports and encourages student achievement. The study involved 4,041 teachers, 1,722 students, and 41 superintendents. The average increase of high school students who took and passed the state Regents (college preparatory) examination in mathematics was 7.5%. The average increase of passing rates in the Regents English examination was 8.8 %. The teachers and principals reported that 42 % of the variation in math and 12 % of the variation in the English scores could be explained by the addition of technology in the schools (Valdez, McNabb, Foertsch, Anderson, & Raak, 2009).

Significant gains in student achievement were demonstrated in an eight year study of SAT I performance at New Hampshire's Brewster Academy. Students participated in a technology integrated school reform effort which provided them portable laptop computers with access to a campus network. They demonstrated an average increase of 94 points in combined SAT1 performance over students who participated in the traditional independent school experience (Bain & Smith, 2000).

Stanislaus Union Elementary, California, used Title 11, Part D grant money to implement technology integrated writing programs, online grade books, online assessments and student email services. All classrooms were supplied with multimedia presentation carts for daily teacher and student use. All students had email accounts and digital lockers to communicate and collaborate with their teachers and peers. Teacher use of technology to support student learning rose from 7% to 64%. Baseline 7th grade student writing scores rose from 21% proficient/advanced in 2007 to 62% in 2009; and

the 7th grade ELA benchmark scores rose from 9% proficient/advanced to 52% proficient/advanced in the same period (SETDA, 2010).

The Technology-Based Education Strategies Training project, Niagara Fall City School District, New York, funded through Title 11, Part D, provided professional development in the use of interactive whiteboards, tablet PCs and podcasting. These initiatives were in alignment with each district's strategic. Results include — Dunkirk: 22% increase in Middle School ELA tests scores; N Tonawanda: 22% increase in Middle school ELA test scores; 21% increase in Middle school Math test scores. Niagara: 21% increase in Middle School ELA test scores; 7% increase in Middle School Math test scores (SETDA, 2010).

Calhoun City Schools, Georgia, were awarded one of 80 statewide grants which provided opportunities to increase student achievement through the use of interactive technology including interactive boards, student response systems, and MP3 players. Teachers assessed their teaching strategies and student achievement before and after the use of technology. Standardized math test scores increased from 78% in 2008 to 84% in 2009 (SETDA, 2010).

In New Zealand, researchers found the use of computers contributed to higher performance on English, math, and science tests. The study was conducted with eighth, ninth, and tenth grade students. Each student had access to a computer for at least three hours each week for the integration of learning across English, mathematics, science, and social studies. Learning activities provided real-life problems, mastery learning, and a combination of individual and cooperative work. English, mathematics, and science examinations of the National School Certificate project announced students participating

in the project performed significantly higher than those who did not. However, with many variables, it was difficult to attribute the gains solely to technology (Valdez et al., 2009).

A systematic search of research literature conducted by the US Department of Education from 1996 through July 2008 reported learning outcomes for students who participated in online learning or technological enhancement software performed better than those taking the same course through traditional face to face instruction. Learning outcomes for students who engaged in technology based learning exceeded those students in a traditional setting, with an average effect of +0.24 percentage points favoring technology. Educational technologies enrich the learning environment and increase students' conceptual understanding ("Evidenced-Based Practices in Online Learning," 2009).

Academic performance differences between traditional and technology based learning was researched over a 20 year period. After examining data from over 20,000 students, it was clear that the probability of achieving higher learning outcomes is greater in the online environment than in the face to face setting. In 70% of the cases, students who were engaged in technology based learning outperformed the students in the regular classroom environment. The superiority of the face to face modality over its distance learning alternative has been successfully negated (Shachar & Neumann, 2010).

Technology rich schools generate impressive results for students, including improved achievement, higher test scores, improved student attitude, motivation, and student retention (ACOT, 2002). Educational technology has been found to have positive effects on student attitudes toward learning and on student motivation. Students felt more

successful and more motivated when using computer-based instruction, especially when technology permitted the learners to control and actively participate in their own learning. Courses using computer-based networks increased student-student, student-teacher interaction, and student-teacher interaction with lower performing students. Many students who seldom participate in a traditional classroom setting became more active participants (US Department of Education, 2009).

According to Murphy's (2002) traits of effective teaching, interaction encourages class participation. When enabled by the computer, such participation requires student engagement. At the minimum, the participation may mean nothing more than reading on-screen text and responding to options. However, even this requires the student thinks before answering, and the answering and the results are part of interactive participation (Hedberg, Brown, & Arighi, 1997). Students are placed in situations where they must read, think deeply, write, make choices, and respond not only to the computer but also to collaborate with others (Marshall, 2002). The process of learning can become more appealing as students have access to different types of information in ways that were never possible before technology. Students, with the use of computers, are able to communicate reports, answer research questions, and lab results in a variety of ways to teachers and other students in their classroom or around the world (ITSE, 2008).

Michigan's Freedom to Learn model (2005), which provided students and teachers with access to wireless laptops, has been credited with improving grades, motivation, and discipline in classrooms across the state. In 2001, Missouri implemented a statewide technology initiative, enhancing Missouri's Instructional Network Teaching Strategies (eMINTS). Students scored higher on the Missouri Assessment Program (MAP) than

students who did not participate in the eMINTS program. The higher MAP results were found to be associated with instructional practices which have been enriched by the integration of technology into the content areas. The eMINT program has expanded to 232 Missouri districts, 10 Utah districts, 56 Maine districts, two Nevada districts and one Illinois district. Test results show that, in most states, students enrolled in eMINTS classrooms scored higher than students enrolled in non-eMINTS classrooms (“Evidenced Based Practices in Online Learning”, 2009).

Findings also indicate teachers who had students using computers to solve simulations and focus on applications increased scores. Research gives credence that technology is a strong tool for supporting active, inquiry based learning. Student achievement increases when technology is combined with activities that require higher order thinking and problem solving skills (Becker, 2000).

Statistical Analysis Systems (SAS) Curriculum Pathways is a technology based, internet learning program with state aligned objectives in science, math, social studies, Spanish and English. The SAS Model adheres to research based instructional strategies, which include student research, simulations, data collections, report writing, and journal writing using the internet and email. Simulations enable students to visualize processes, manipulate variables, and observe the relationships that occur on a micro and macro scale. Virtual labs present abstract concepts that enable student to visualize cause-and-effect relationships that cannot be demonstrated using traditional classroom methods. Teachers that have used this model across the state of North Carolina have seen a significant improvement in the end of course science tests given in North Carolina (SAS, 2010).



Using SAS Curriculum Pathways with an experimental group and a traditional approach with a control group in a high school chemistry class, there was an increase in performance with the experimental group using SAS Curriculum Pathways. The study supported the use of SAS as a means of increasing student understanding in chemistry. It was concluded SAS can be used to build foundational knowledge prior to traditional instruction (Lamb, 2008).

SAS Curriculum Pathways won the 2009 Award of Excellence given by *Technology & Learning* magazine as one of the best upgraded products available to schools, teachers, and students. *Technology & Learning* magazine also awarded best web-based software to SAS. CODiE honored SAS in 2008 as the award winner for best k-12 instructional solution, and in 2009 as the winner for best reading and English Instructional solution. SAS Curriculum Pathways is currently being used by every state in the United States. Since 2008, the program is being provided at no cost (SAS Curriculum Pathways/Awards, 2010).

## METHODOLOGY

The primary focus of this study was to describe the effects of SAS Curriculum Pathways, a technology based physical science program, on student achievement. North Carolina's Standard Course of Study has six competency goals for physical science. Three of the competency goals were taught using the SAS Curriculum Pathways as an instructional tool. The competency goals (CG) used with SAS were CG. 2: Forces and Motion; CG 3: Energy and Conservation; and CG 4: Electricity and Magnetism. The remaining three, CG 1: Process Skills, CG 5: Structure and Properties of Matter, and CG

6: Regularities in chemistry, were delivered in a traditional manner without the SAS treatment (NC Standard Course of Study, 2004). Pre and post tests were given in these competency goals without the SAS treatment. Test scores from the non-treatment and treatment units were compared in order to determine the effects of SAS Curriculum Pathways.

The research methodology for this project received an exemption by Montana State University's Institutional Review Board and compliance for working with human subjects was maintained. Parents were given the Parent Consent Form explaining the nature of the study, the documents used to collect data, promise of privacy and the hope of improved achievement scores (Appendix A). The Parent Consent Form requested the parent's signature giving permission to include their child in my study.

As a pre-treatment measure, a Pre-Structured Interview was conducted with students to ascertain the beliefs and attitudes of the students concerning physical science (Appendix B). At the beginning of each competency goal, a pre-test in physical science was administered to each student to establish our baseline. Each pre-test, released by North Carolina's Testing and Accountability, was also used as the post test that was administered at the completion of each competency goal, (NC Department of Public Instruction, Testing and Accountability, 2008). These are formative tests and served as benchmarks of student progress. Each test played a major part recording and assessing student progress.

SAS Curriculum Pathways treatment for physical science competency goals began as soon as the pre-tests for each goal were administered. Competency goal two was forces and motion, competency goal three was energy and conservation, and competency goal four was

electricity and magnetism. The students went to the computer lab twice a week for three to four weeks, approximately an hour for each visit. They logged on [www.sascurriculumpathways.com](http://www.sascurriculumpathways.com), selecting the competency goal being studied in the classroom. Each session included a variety of activities such as reading, research, responding to focus questions, electronic labs, writing lab reports, creating an electronic report of their results, collecting data from animations, simulations, creating a web-based fact sheet, communicating findings by email to other students and teacher, and writing questions to be used in an evaluation tool. Students were encouraged to work in pairs or independently. They could ask for peer or teacher assistance. The day after being logged on SAS Curriculum Pathways, the first 15 to 20 minutes of the class period were devoted to groups sharing data and answering questions relating to the SAS activity completed on the previous day. Their findings were presented in a visual, either as a poster or power-point to the entire class. Additional time was given for student reflection, journaling, and making sure students understood daily objectives. A classroom assessment technique, included as a piece of The Reflection Journal, was administered daily in order to monitor student progress and achievement. The two instruments provided a quick indication of the students' understanding of the concept being studied plus the level of student involvement in the process. The Reflection Journal was on the left side of the paper, while the Participation Checklist was on the right. Journal entries included the following classroom assessment techniques for each of the nine SAS sessions such as: Define mass, describe air resistance, and what was the variable being tested in today's lab? Part of the Reflection Journal gave student an opportunity to tell what they didn't understand and anything else they would like me to know. Sample SAS assessment questions were: Describe how mass affects the final velocity

an object reaches as it falls, how does air resistance affect the motion of falling objects, and how does the distance covered by a falling object change over time when there is no air resistance. Data from student responses were recorded in The Reflection Journal/Participation Checklist (Appendix D). A classroom assessment technique (CAT) recorded in the Reflection /Participation Journal was used to measure student understanding and monitor student progress on a daily basis, (Appendix D).

For the first two weeks of instruction for each competency goal, I was an active participant observer. I moved from group to group, listening, directing, monitoring, answering questions, and recording observations. The last two weeks, I was engaged as a passive observer, using The Teacher Observation Checklist in both settings and recording comments. Teacher observations were made on nine occasions during the time students were involved in SAS activities, either on the computer or in a follow up session. Each students' behavior was recorded in The Teacher Observation Checklist (Appendix C). Observable behaviors were marked as Yes, indicating the behavior was consistent; Somewhat, or No. The number of Yes recordings increased both in areas of participation and motivation. The number of Yes recordings increased in the number of students attempting to complete the assignment with some degree of accuracy.

The secondary focal question was to examine how the SAS Curriculum Pathways affected student participation. The Pre/Post Structured Interview was conducted with students to determine their attitudes and feelings on class participation (Appendix B). Students were interviewed individually to rate their feelings from one to five about science, classroom procedure, and learning strategies such as lab activities, homework, and working with a computer. In the scoring scheme, a one was the least, and five was regarded at the

most favorable choice. Finally they were asked to state changes they felt would be helpful in their learning process and anything else they would like for me to know. At the end of the treatment, the same survey was conducted in the same manner at the pre-survey. Results were compared in graphs to the pre-structured interview to measure any changes in feelings toward science. At the end of each class period, all students wrote in a Reflection Journal (Appendix D). Each page was divided in half: the left side was for journal entries, and the right side was a Participation Checklist, to be filled out by each student. Journal entries included a variety of simple positive or negative comments, questions of concern, muddiest points, barriers, one line summaries, teacher prompts, or anything else they wanted me to know. Each entry received a positive response which was not graded; however, participation was noted by teacher and student. The Participation Checklist was a record-keeping chart for students to record their participation in homework, class work, group discussions, journal entries, and emails. The Reflection Journal and the Participation Checklist were checked on a daily basis by the teacher to monitor progress in student growth. Data collected from The Reflection Journal/CAT/ Participation Checklist was recorded, organized in a table, and graphed to show differences throughout the project.

The other component of the research project was to describe the effect of SAS Curriculum Pathways on student motivation. The Attitude Scale Survey was completed twice during the treatment (Appendix E). The Attitude Survey assessed changes in students' opinions and beliefs about science in school and the importance of science in their lives. The scoring ranged from one, with one strongly disagreeing, to five as strongly agreeing with the statements. Students were given time to discuss their changes and note their progress in small groups. Data from the two surveys marked changes in participation and motivation.

Results were recorded and tabulated in a chart. On four occasions, The Self Evaluation Checklist measured how students felt about their level of participation, how motivated they felt at the time of the checklist, and their skills and abilities using SAS Curriculum Pathways (Appendix F). Students rated themselves from zero to three in performance with three being the highest level. This final data source, completed by the students, was compared to the Teacher Observation Checklist. Results were summarized in Data Analysis. The Post-Structured Interview (Appendix B) was conducted to compare changes in the students' responses in participation and motivation. The data collections summaries for this project are summarized in the following data matrix.

Table 1  
*Data Triangulation Matrix*

Focus Questions	Data Collection Methods						
	Pre/post Tests	Teacher Observation	Reflection Journal/ Participation checklist	CAT	Pre/Post Interview	Attitude Survey	Self Assessment survey
Student Achievement	X	X	X	X			
Student Participation		X	X		X	X	
Student Motivation		X	X		X	X	X

## DATA AND ANALYSIS

Pre and post tests indicated an average increase of 19% in student achievement ( $N=7$ ) over the three competency goals. In the non-treatment units, the average increase in student achievement ( $N=7$ ) was 18.5% (Figure 1).

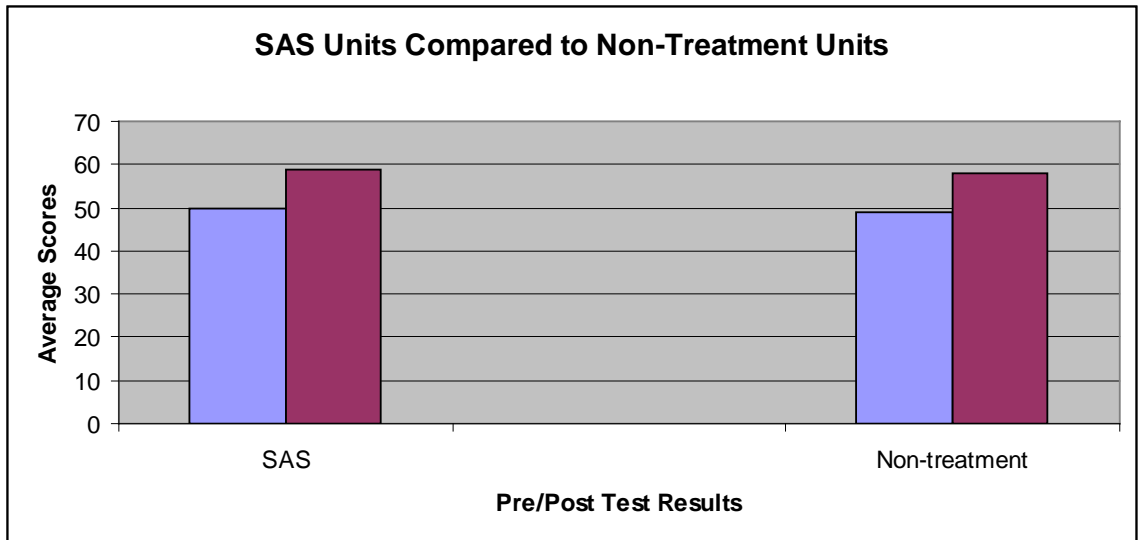


Figure 1. SAS Pre/Post Test Scores compared to Non-Treatment, ( $N=7$ ).

The Teacher Observation Checklist (Appendix C) yielded 15 No responses, 37 Somewhat, and 2 Yes on the first observation. Nine of the 15 No responses were observed with the same student. Four of the No responses showed lack of participation the class discussions and three students would not volunteer to answer questions. The 37 Somewhat recordings indicated five students asked questions, five students participated in small group discussion, five were seeking information, and five were cooperating with others some of the time during the first observation. The two Yes responses were in the category listed as cooperating with others. A field note recording reported one student absent because of an arrest.

By the fourth observation, the number of No observations increased from the initial 15 to 23. Eighteen of these negative recordings can be attributed to two students. Field notes indicated both students were argumentative with each other and had to be removed from the class. There was a decrease in the number of Somewhat responses, from 37 to 28. There were increased changes observed in the number of students participating in small groups, asking questions, and cooperating with others.

Two students remained inconsistent in the same categories. There was an increase in the number of Yes observations: two observed in cooperation with others, one participating in group discussion, and one asking questions. The two Yes responses were the same students who were cooperating with others in the first observation. One student was observed participating in group discussion and asking questions for the first time. Four out of the six present failed to be on task most of the time and were disruptive as noted in field notes. Before the class ended, four students were removed by the police officer on duty.

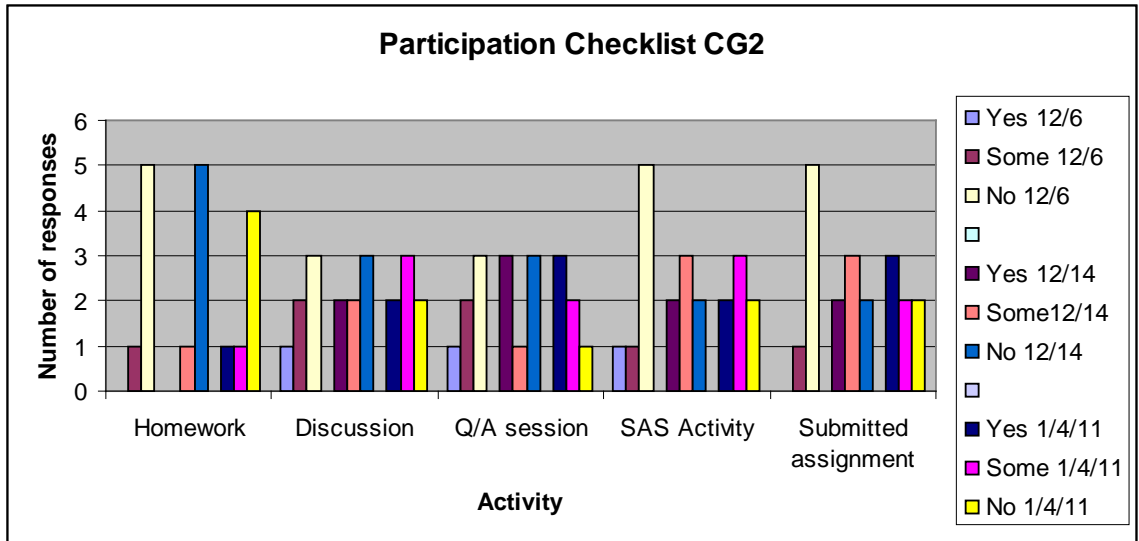
The eighth observation revealed the greatest change in student behaviors. There was a decrease from 23 No's from the fourth observation to nine No's in the eighth observation. The same student continued to be unresponsive, scoring No observable behaviors in all nine categories. There were 27 recorded Somewhat responses which is one less than the fourth observation. There were 18 recorded Yes's, an increase from the initial observation beginning with two. The category with the greatest change was completing assignments which increased from zero to three Yes's. Three students were participating in small groups and asking questions. Three Yes's occurred in cooperating with others and working toward the quality of the SAS assignment. For the first time one



student scored a Yes in all nine behaviors. Two students continued to be off task and disruptive as recorded in field notes.

The ninth and final observation was similar to the eighth observation. There was one less No and one more Somewhat. For the first time, the student who was consistent in having all No recordings, was observed participating in small group discussion. The results of the Teacher Observation Checklist (Appendix C) indicated the majority of students did not participate in class and were not motivated enough to seek understanding or information in the early stages of the treatment.

At the end of each period that was spent using SAS, students were asked to complete the Reflection Journal/Participation Checklist (Appendix D). Data from the Participation Checklist was collected on three occasions. Student responses show that six of the seven students did no homework on two occasions. During the third session, one student said they did the homework assignment. One student attempted some of the assignment in all of the sessions. Participation in the discussion and the question/answer section increased slightly. Students' responses to the SAS activity decreased from five to two in the no column. The number of assignments submitted increased from zero to three (Figure 2).



*Figure 2.* Participation Checklist. Response Choices and Dates are Indicated in the Legend, ( $N=7$ ).

The results of the Pre-Structured Interview indicated that five of the seven students were neutral about their attitudes toward science (Appendix A). One student said, “I don’t care one way or the other about science.” One student indicated that she liked science. Four of the seven were neutral in how they felt about what we do in class. Six of the seven had negative responses to homework. Three students strongly disagreed and one disagreed with reflective journaling. Three disagreed with any vocabulary activities. Six reported from neutral to negative feelings concerning cooperative or group learning. Four students preferred a large group setting for question/answer sessions, while three students preferred small group question/answer sessions. Five of the seven responded favorably to lab activities. Three of the seven strongly agreed that working with computers was most helpful. Four students were positive in responding to web-quests (Figure 3).

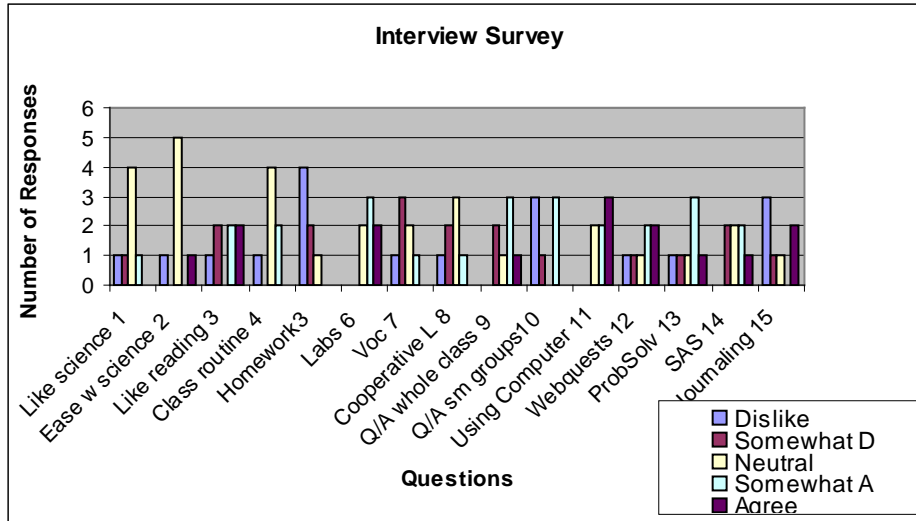


Figure 3. Pre-Interview Survey, ( $N=7$ ).

When students were asked what they would do to improve the classroom, five said no changes were needed. One wanted more time and the other one wanted to “Be by myself”. In response to what best helps you learn, two wanted more hands-on activities, one thought pictures would be more helpful, and one thought worksheets would be best. The remaining students did not respond to the previous questions. Data indicated most of the students had no strong feelings about anything except homework, small groups in question/answer sessions, and journaling. The last question asked if there was anything else they would like to tell me. Five responses were no. Two others responded by telling me they were “good people.”

The results of the Post Interview Survey indicated five of the students ( $N=7$ ) remained neutral about their attitudes toward science. One student said he liked it better now than before the SAS treatment. Another student said he thought science was easier to learn with SAS. These two students were the minority. The remaining five did like the SAS program. Four out of seven also remained neutral about what we do in class. The number of students preferring to work with computers using the SAS activities

increased from three to four. On the other hand there was a drop from three students feeling positive about science to one. The responses to reflective journaling decreased from three students feeling positive to one. There was increase in the number of students who felt neutral about journaling. When asked to compare the classroom setting now with the setting prior to the SAS treatment, two liked the SAS setting. Students continued to say that no changes were needed in order to improve the classroom. Three students changed their responses to say using the computer helps them learn best. They also went on to say that SAS was too difficult or boring. Three of the students who did not respond in the pre-survey said in the post survey that journaling, participation checklists, and frequent teacher monitoring helped more than computer activities, labs, or class discussions (Figure 4).

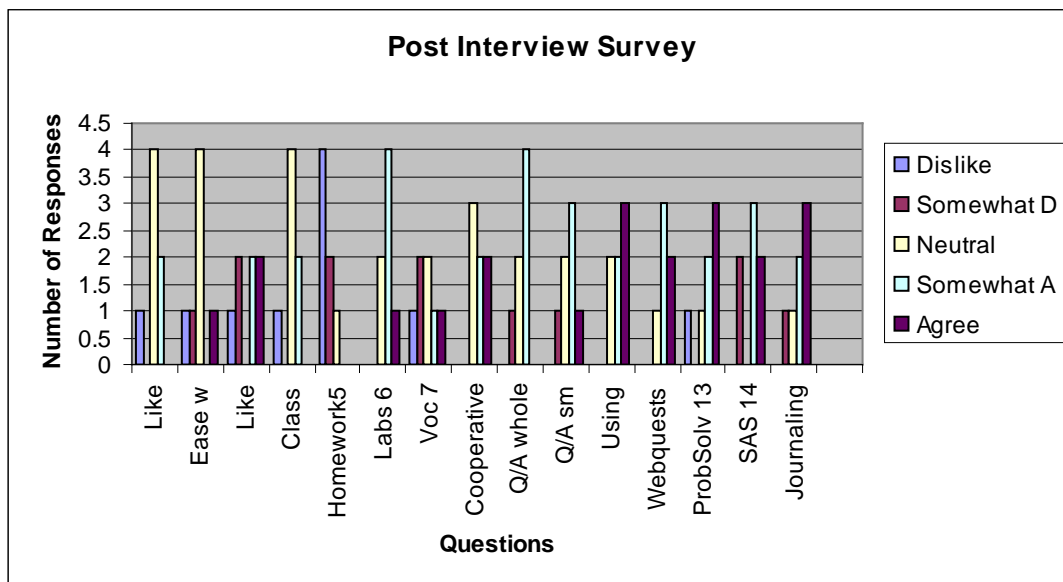


Figure 4. Post Interview Survey, (N=7).

The Student Attitudes Scale Survey (Appendix E) was administered twice instead of weekly. Student attitudes quickly changed when another form was introduced. Over the period of nine weeks, one student began to enjoy science more than when the SAS

treatment began. One student was no longer nervous in science. Another student no longer thought science was so difficult. Initially three students were not sure or neutral with SAS, at the end one student remained unsure. This particular instrument yielded no measureable changes in student attitudes toward science.

The Student Self Evaluation Checklist was administered on four occasions (Appendix F). Their final evaluation showed students rated their class participation from one to three in a positive direction both in whole group and small group discussion sessions. They indicated an increase in asking and answering more questions by 50%. Completing assignments increased from one to three. The rest of the categories showed no change.

## INTERPRETATION AND CONCLUSION

There was very little difference in student achievement between SAS treatment units and non-treatment units. At the end of the academic year, none of the students received a passing score on the North Carolina State Test for Physical Science.

As I look back one of the strategies I would change is more demonstrations on how to use and interpret on-line simulations with students. More time would be spent walking students through parts of the SAS units that were too difficult for my students. I would build in scaffolding as a foundation piece of the learning experience. Classroom assessment techniques would be shorter, but more frequent, as would formative assessments. Small group sessions would be a rigorous routine

Student participation increased from almost none to 50-75%, depending on the day, mood, who was absent, and topic. The Teacher Observation Checklist was most helpful in visualizing progress on the whole and individually. It was easy to see that as the class moved forward in the SAS treatment, more students were volunteering answers, asking questions, and attempting to complete assignments. I learned more about my students' personalities and personal problems from The Reflective Journal responses. As I saw students struggling with life in general, I became more understanding of their lack of motivation. The Self Evaluation Checklist and Participation Checklist were not effective because these students tended to evaluate themselves more highly than I did. Both instruments would be valuable in another learning environment.

Student motivation increased from almost none to 50-75%, again depending on the day, mood, who was absent, and topic. Many of the students wanted to learn, and some made valiant attempts. The behavior changes were not lasting. Four weeks into the SAS treatment, students were angry with forms and surveys. My initial intention was to have students complete The Attitude Survey and The Self Evaluation Checklist on a weekly basis. I ended with pre/post data collection with both instruments. Students would mark anything, making the surveys invalid.

## VALUE

The SAS program made no impact on student achievement, participation, or motivation. The student responses in achievement, participation, and motivation correlated with student behavior. All of the students were placed in the Alternative

School for infractions such as fighting, drinking on campus, chronic disruptive behavior, blatant disrespect and/or truancy.

While my expectations and encouragement levels were high, there was very little student buy-in. I entered their classroom after the semester started. Developing rapport was slow with some and none with others. Establishing some sense of order in the classroom was a daily chore. Students were absent frequently for being in jail, appearing in court, or simply “laying out.”

Before a rigorous program such as SAS can be implemented with success, there must be student buy-in...either in the teacher or themselves. There should be some prior knowledge of basic science skills. My students performed at a very low academic level. In an alternative school setting, it would be necessary to model your expectations and monitor the students. The earlier the program, the rapport, the expectations; the sooner the student buy-in. Slowing the pace of the program will be beneficial to struggling students. Showing student success and progress, even if it is minute, is another key to positive outcomes. I believe the SAS Curriculum Pathways is a valuable learning tool that will promote student achievement. I have experienced more success with student achievement in a regular classroom setting than in the alternative setting.

More than anything, I realize and embrace the value of reflective journaling, not only in teaching but also in my personal life. Reflective thinking is a necessary part of a teacher's planning and evaluation process. I especially like the change in process that reflective thinking can bring about in mid-stream, reflection-in-action. Taking the time to reflect has always been part of my being a teacher, but not to the degree that Action Research required. Reflective journaling is the component that has made the biggest

difference in every aspect of my life. As a teacher, the journal I kept, kept me. This only happened as a result of doing research based on the action research model. I was able to keep up with thoughts, actions, plans, student requests, something that a student said or needed, meetings, and things that I needed to consider to make learning easier or more challenging for students. This part of my action research became habitual. As a result, my teaching became more effectual. I found this habit flow over into my personal life. Recording personal thoughts, actions, prayers, and intentions helped me cope with difficulties that hit us and our families unexpectedly.

Reflective journaling made me realize the value of flexibility. Students mean more than scores.



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APPENDICES

APPENDIX A

PARENT CONSENT FORM

Date

Dear Parents,

As a part of my work with Montana State University, I am conducting a piece of action research into studying how the SAS Curriculum Pathways will affect student performance, student participation, and student motivation. SAS is a computer based program which began here in North Carolina at North Carolina State University. The area of study that I am interested in is Earth Science. The SAS program is aligned with the North Carolina Standard Course of Study. The activities will enhance the regular classroom instruction.

I retired from teaching after 33 years in the classroom teaching science at the high school level. It has been my lifelong dream to get my master's degree in science education. I am almost there.

I would be grateful if you would give your permission for your child to take part. My data collection methods will include interviews, journal entries, surveys, observations, assessments, and reports. I guarantee that I will observe excellent ethical conduct throughout. I promise that I will not reveal the name of colleagues, parents, or children at any time. If you wish, I will be glad to inform you of progress upon your request. At any time, I would be delighted to meet with you.

I would be grateful if you would sign and return the slip below by Date.

Sincerely,

Nancy H. Talley

2010 Elizabeth Street

Tarboro, NC

I \_\_\_\_\_ (parent name) give permission for  
 \_\_\_\_\_ (Student name) to take part in your research.

Parent signature \_\_\_\_\_ Date: \_\_\_\_\_

APPENDIX B

PRE/POST STRUCTURED INTERVIEW

## Pre/Post Structured Interview Questions

Name: \_\_\_\_\_ Date: \_\_\_\_\_

Circle your answers from 1 to 5 with one being the least and five being the greatest.

- |  |                          |
|--|--------------------------|
| 1. How do you like science?  | 1....2.....3.....4.....5 |
| 2. Is science difficult or easy for you?   | 1....2.....3.....4.....5 |
| 3. Do you like to read?  | 1....2.....3.....4.....5 |
| 4. What do we do in class that helps you learn?  | 1....2.....3.....4.....5 |
| 5. Homework  | 1....2.....3.....4.....5 |
| 6. Lab activities  | 1....2.....3.....4.....5 |
| 7. Vocabulary activities   | 1....2.....3.....4.....5 |
| 8. Cooperative or group learning   | 1....2.....3.....4.....5 |
| 9. Question/answer sessions as a class   | 1....2.....3.....4.....5 |
| 10. Question/answer sessions in small groups   | 1....2.....3.....4.....5 |
| 11. Working with computer  | 1....2.....3.....4.....5 |
| 12. Web-quests   | 1....2.....3.....4.....5 |
| 13. Problem solving activities   | 1....2.....3.....4.....5 |
| 14. SAS activities?  | 1....2.....3.....4.....5 |
| 15. Reflective journaling  | 1....2.....3.....4.....5 |
| 16. Is there anything that you would change in our class that would be helpful to you? |                          |
| 17. What best helps you in learning science?   |                          |
| 18. Is there anything else that you would like to tell me?                             |                          |

APPENDIX C

TEACHER OBSERVATION CHECKLIST



### Teacher Observation Checklist

**Student performance indicated as Yes (Y), Somewhat (S) or No (N)**

**Student names→**

**Behaviors↓**

Participates in group discussions

Participates in class discussions

Asks questions

Volunteers answers

Actively seeks information

Actively seeks understanding

Completes assignments

Collaborates with others

Quality of work using SAS

**Quality of work overall**

**Field notes**

**Comments**

APPENDIX D

REFLECTION JOURNAL/CAT/PARTICIPATION CHECKLIST

Name: \_\_\_\_\_ Date: \_\_\_\_\_

### Journal Entry

### Participation Checklist

Check the appropriate answer below:

Classroom Assessment Question  
(From lesson objective)

**Activity**

**Yes**

**Some**

**No**

**Homework**

**Discussion**

**session/ QA**

**Lab activity**

**SAS activity**

**Submitted**

**assignment for**

**evaluation**

SAS Assessment Question  
(Activity used with lesson objective)

I didn't understand....

APPENDIX E

STUDENT ATTITUDES SCALE SURVEY

## STUDENT ATTITUDES SCALE SURVEY

Name: \_\_\_\_\_ Date: \_\_\_\_\_

DIRECTIONS: The statements in this survey have to do with your opinions and beliefs about science in school and the importance of science in your life. Please read each statement carefully, and circle the number that best expresses your own feelings. Remember that this is not a test, and there are no “right” or “wrong” answers. Please respond to every item.

1. To what extent do you agree or disagree with each of the following statements about science? (Circle one number on each line.)

	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
a. I enjoy science .....	1	2	3	4	5
b. Science is useful in everyday life .....	1	2	3	4	5
c. Scientists often don't have very good social skills .....	1	2	3	4	5
d. Doing science often makes me feel nervous or upset.....	1	2	3	4	5
e. Science challenges me to use my mind .....	1	2	3	4	5
f. The science instruction that I have received will be helpful for me in the future .....	1	2	3	4	5
g. Scientists usually work with colleagues as part of a team .....	1	2	3	4	5
h. I am good at science .....	1	2	3	4	5
i. I like using technology and computers to learn about science.....	1	2	3	4	5
j. I usually understand what we are doing in					

science class.....	1	2	3	4	5
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APPENDIX F:

SELF EVALUATION CHECKLIST

**Self Evaluation Checklist**  
For Students

Student Name: \_\_\_\_\_ Date: \_\_\_\_\_

Rate your performance on a scale from 0-3 with 3 as the highest performance level.

Rating scale→	0	1	2	3
Behaviors↓				
Participates in group discussions				
Participates in class discussions				
Asks questions				
Volunteers answers				
Actively seeks information				
Actively seeks understanding				
Completes assignments				
Collaborates with others				
Quality of work using SAS				
Quality of work overall				
Comments				