Monarch Monitoring:
A Teacher/Student/Scientist Research Project

Case Studies

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Appendix D
Case Studies

Group 1
Donald Anderson Case Study

Prior to the Monarch Monitoring Institutes
Donald Anderson had taught science for 26 years when he applied to be part of this Monarch Monitoring Project. Providing field experiences for his students would not be a new thing for him. In fact, when his new high school opened in the 1997-98 school year, he lost no time in building partnerships with community agencies and coming up with ways he could involve his science students in field projects using the 70-acres of land the school co-owns with the city in which it is located. The land includes prairie, NURP (National Urban Runoff Ponds) and mitigation ponds, forest, and a creek.

During the 1997-98 school year, he had students help with planting 300 native Minnesota trees and shrubs on the edge of the forest next to the school. In the future, students could study the influx of animal diversity that would start to use this area. Students planted wild rice as part of a project to get more plant diversity in the run-off pond close to the school; students could watch in the years to come how it did or did not produce. They planted over 2000 plugs of native plants in the prairie. Twice a year his students collected and identified invertebrates for the Hennepin Conservation District. They put up a deer exclosure to see if they can get regeneration of different aged trees – another project they could follow for the long term.

Donald had developed numerous partnerships: The city (he is liaison from the school on their open space committee), Hennepin Conservation District, U S Fish and Wildlife, the Wildlife Science Center, and North American Prairie Restoration. He mentioned schools that are involved with GIS packages. Donald brought resource people from these groups into his classroom to help the students with planning whatever project they would be doing, and they helped implement the plans as well. An additional benefit to all these activities, that was important to Donald, was that the students were made aware of careers they would otherwise not have known about. These partners sometimes had resources of plant materials and buses to transport the student laborers.

Whenever you talk with Donald, you will hear about his vision for what he and his students could be doing for the school and community. He would like to keep adding more partners so that there would be more monitoring for his students to do. About the monarch project, Donald said, “I am passionate about biodiversity issues, and felt that this project would create several more partnerships that will allow me to involve a larger number of students in direct inquiry.” He believes it is important work that they are doing for the big picture. “If we are looking at losing major ecosystems and huge numbers of animals through extinction through the next 40 years, we don’t have time to waste. If we can get the model to work well within the school system, maybe we can get other schools in the state to use it.”

He had seen his students get engaged too. “It seems like once students get their hands on and start to get involved with the restoration, that something happens to them, and they have ownership, and they want to do more of it.”

Donald heard about this project at the NABT (National Association of Biology Teachers) national conference in Minneapolis. Donald had volunteered to do registration work for a couple hours at the desk. He said, “I always like that cause you get to network with people, and so I was talking with this person and found out she was a grad student from the U, and she was working on this butterfly project
with schools.” She came out to talk with Donald’s wildlife biology classes, and about a month later she sent him a pamphlet on the project. He applied right away. He had worked for the past two years helping with the district’s science curriculum review cycle and hoped to be able to bring something back to his colleagues in the district.

Donald said, “I’ve been moving this way for some years, more and more I’m becoming a coach or facilitator. I’m working at trying to give students the basic process of learning science. In high school, instead of killing curiosity in eighth or ninth grade, we want them to have it all of the time, and we want them to use it. Those are things that I have to get better at doing.” He wrote that he had been doing no active research where students formulated questions and/or designed research protocol.

First year after the Monarch Monitoring Institutes

The first year after Donald attended the two institutes, 1998-1999, he did many of the same field experiences that he had done in previous years. In addition, the fall botany class worked on a stream restoration project, putting down organic mats on the bank and planting cedar, dogwood, and cottonwood. Donald said, “We have 20 years of stream restoration projects we could be doing within our own land here on the school site.” He also developed a couple of research questions his students could work on related to a bird monitoring project.

Donald described in detail the grad standards performance package he was developing for his wildlife biology classes. He said, “I’m starting to see that I can do what we’re doing in terms of real science in this format.” But he was not there yet. Donald also brought monarchs into the school’s greenhouse and gave the kids some hands on experience with them. He said they learned a lot about their ecology through that. He could see that when they got the standards going in regular biology classes that monarchs would be a good organism for people to use to set up a study, but he admitted, “We didn’t start to do research on them.” He said, “It’s just that I’ve got to get the kinks worked out of the greenhouse.”

Donald was proud of the team-generated research project that he and his two students worked on with the teacher and students in Texas. Dr. Oberhauser had come out to help them prepare for a presentation to a group of parents and teachers and then to the school board. He wanted the school board to know, “This is the kind of work that grad standards are about.” He appreciated all the help he had from Karen and Michelle who both came out. He saw that he and his classes could use and add to the U of M data bank for years to come.

During the first year after he attended, Donald thought the institutes were excellent on “how they would give us the concepts, and then they would get us to act on them.” Both students and teachers worked hard – starting with breakfast at 8:00 and sometimes continuing until 10:00 at night. In Texas, after a state park overnight where they had done a lot of field work, he though “maybe we’ll have a chance to take a nap today,” but they started cranking numbers right away and even delayed supper just a little bit. He felt the institute staff were getting as much out of it as the teachers and students were. Given his passion for the environment, Donald was particularly pleased that the “the kids got to see stewardship in action” when they were part of a fundraising event in connection with the bat cave they visited in Texas.

Second year after Monarch Monitoring Institutes

By school year 1999-2000, Donald Anderson had made dramatic changes in organizing his classes. He didn’t even want to talk about last year when we interviewed him in October 1999. He said, “Last year, with the biology classes, the amount of research-based stuff was nil. I didn’t have it together yet.” After describing what he was doing this year, he said,

It's really jelled, and it's really come together. It's like, as I built my own knowledge base on how to do the research and have gotten more confidence in that, I've been able
Donald said, “I’ve got a graphic organizer now for everything.” He could plug in what content area he wanted to work on with his students, and he could find an experiment, or as he said, “find an area to get the kids to develop experiments from, whether it’s the pond study kind of thing, or, I don’t know what it’s going to be when we’re into genetics.” He and his student teacher are planning day-to-day and unit-by-unit, reorganizing Donald’s courses.

Donald and his student teacher had worked this out together. It was no small help that the student teacher was Liz, formerly a U of M research assistant with this Monarch Monitoring project. Donald said, “I’m teaching her classroom management, and I have a scientist with me every day. You know, it’s been so creative that I’ve never been this tired this early in the school year. We are just bouncing off of each other.” Earlier, Donald had said how he needed somebody like Karen or Liz to bounce ideas off of.

Donald described in detail the step-by-step scientific research process through which the two of them were taking all of his three classes, using monarch butterflies as the first student-generated experiment. They brainstormed questions and formed class-wide hypotheses to test. For the assessment, they used a “test” that consisted of students writing out what they had done during the class experiment and why. This assessed what students had learned in the class and met part of a graduation standards requirement. They went on to have the students decide on questions and procedures for doing an insect diversity study on the prairie, a pond study, and then an individual inquiry. He was pleasantly surprised at how easily the students could develop their own experiments. He concluded, “The experiments are going to be hard for them, but they know how to set it up. I think that if I was going to lecture them about scientific method and then ask them to do it, I know from past experience that it doesn’t work.

Donald was pleased that the other biology teachers in his department adopted the insect biodiversity field study to meet the field study requirement of the graduation standards. He responded to “probably half a dozen e-mail inquiries [from colleagues], you know, how do you do this, where do you get that?” He hoped that when the department debriefs how it went this term that he would be able to tell them the advantages of adopting some of the other methods he was using that built up to that project. He felt that the impetus of the graduation standards requirements was opening his colleagues up to trying some new things. He was convinced that “if they see how many applications, how many ways they can use it where the kids just get emotionally hooked” that they will happily do the extra work that it takes.

Last summer and fall, Donald was one of the instructors for Groups 2 and 3 of this Monarch Monitoring project. Undoubtedly this also helped him in processing what he was learning. It had also given him additional teachers with whom to network. He deliberately tried to find people who were trying to do similar things in the classroom. In October 1999, he said he got at least one butterfly e-mail every week. He said it was important for him to see other people doing the same thing he’s doing. The visits and e-mail from staff had also been important to him. This year, his classes were connected to the researchers from Texas. The students helped prepare 150 monarchs to send to them for research. “We had a role in getting butterflies for the scientists,” he said, “and that’s pretty exciting for [the students].”

Donald knows that he has more to learn, in particular about using statistical tools. He said, “That’s the part I’m still working on – understanding more about chi square and t test and how to use those tools, when to apply them, but that’s coming along.”

Donald’s work has not gone unnoticed by his school district and his community. He said the district support has been above and beyond. He had received e-mails from the superintendent, curriculum director, and principal. The district newsletter did a big article on what his department was doing. The
city recognized him this year as an “environmental champion,” which was front page in the local paper. Parents came in and were very inquisitive about what he was doing, giving him positive feedback, and asking whether there were volunteer opportunities. He said, “This monarch stuff infiltrates homes like cold in wet weather. Parents come in asking questions about monarchs and about the research.”

Donald’s dream was that in the next three or four years, he will develop 10 projects like the monarch monitoring project with real agencies needing real data. He was already monitoring the stream, Elm Creek, and the amphibians for the amphibian guy at Hamline, who runs 1000 Friends of Frogs. He would like to do biodiversity monitoring for the city and archive it on GIS software, he said, “So we can know what the parts are that we’ve got here, and are we gaining species, are we losing species, what are the effects of putting the road through this particular area?” He wants to “plug in the birds.” He dreams, “We could feed that data back to the environmental commission of the city, and then they can disperse it to city people who need to deal with it.” He hoped Liz would become a permanent member of the staff; they had hired her for spring semester. He also hoped to include other members of his department now that he felt more confidence about what he was doing.

**Third year after Monarch Monitoring Institutes**

Donald has yet again expanded his involvement in the community, with non-profit organizations that are developing education programs for teachers and students. He joined the educational board for Camp Courage for their environmental education program. Donald said, “One of the issues we’ve worked on there is how to bundle standards so that they can offer them to certain age groups effectively and help teachers. So, through their environmental education — through Environment Learning Centers — I think that’s one way that teachers could get some help with focused inquiry.”

Donald just connected with 2 other non-profits. One is Friends of the Boundary Waters; he joined their education committee. He reported, “One of the things that they’ve done in the past is support, with some small amount of grant money, boreal owl research. A man by the name of Bill Lane does that research, and Bill has his own website so his data is accessible.” What Donald is hoping Friends of the Boundary Waters will do is to use that to develop some inquiry that people can use — to use his data, use him for question and answer.

He is also on the Board of Directors of the Wildlife Science Center in Forest Lake. Donald said, “They have 40 wolves, and they deal mainly with predators and teaching and research about ecosystems.” Donald reported,

> “We’re working at trying to get their website turned into having some distance learning things that would have to do with inquiry and research. We could take a group of primary teachers and work through an inquiry that we could do with the wolves that would be developmentally appropriately for their students. And I’m putting together an education committee for that group — a little ad hoc committee — try to get a primary, an intermediate, a middle school teacher, then I’d work with the high school end of it. So that we could put some inquiry on the website that would be something where a teacher would get support BEFORE they came out, then come to either a website event or an event at the Wildlife Science Center with the students.”

Donald also went to a workshop about curriculum developed by the International Wolf Center, or Wolf Foundation, at Ely. He reported:

> “Carolyn Towler is working and she was involved in putting curriculum together for the Wolf Center. So they’ve got it on platform out of UC-Berkeley, and it’s a collaborative learning curriculum. So my groups can sit down at the computers here in groups of 4, and they can go
through wolf biology, wolf ecology and then issues about wolves. They can work with population models. We can do lots of different activities with mapping and ranges. And then we can write a management plan for gray wolves in Minnesota. And that’s all on that curriculum. So it’s very much of an inquiry-based... All the information is there. You don’t need to have an expert come into your class and talk about wolves. The information is all provided. Curriculums like that, I think, will be helpful for teachers.”

Donald thought these inquiry resources might help teachers, but it may still be difficult. Teachers may still want to have a set of answers that are right. Donald said, “Those of us who have been involved with Dr. Oberhauser and other people doing research, realize that answers are pretty hard to come by.” Donald believes that his experience with the monarch project is “a huge piece in the mental construction of how I can do research and inquiry with my classes.” With other teachers, he sees, “One of the big pitfalls for them is that they have this linear progression through the scientific method, like in the textbooks, and it doesn’t really work that well.”

He described how he goes about doing science inquiry in his classroom. “When we do our fieldwork, we start out just by taking kids out and doing observations. And then from those observations having them focus on what are the questions that you’ve got? . . . That’s the way we started our inquiry with Dr. Oberhauser. We would take groups of people and do inquiry.

Donald talked about how teaching this way is different from what he did before the monarchs project. He said, “I just feel like she’s given me a real focused vision of how I can do it. Up until I had that experience, I just didn’t have that.”

“I’m a lot more solid in my understanding of the structure to do that. And I adhere very stringently to the structure, but now that I have that structure, I feel like I can do inquiry with a large group of people. I can facilitate the observations and questions and get the process working.”

He gave an example of an experiment that his classes were working on at the time of the interview in May 2001. Students must do an individual experiment for a graduation standard for biology. The students did observation, generated questions, and decided on a procedure to perform. Donald had them develop hypotheses and null hypotheses.

“So all the students are working with the same thing; we’re going to germinate popcorn, basically. The observations that we had were of the actual popcorn seed itself, but then we did seed anatomy, coloring plates out of a botany coloring book and then a small article out of a plant physiology book that had to do with germination, scarification and then the anatomy and functioning of the seed. So that’s where we pulled our observations from and then we generated questions. One of the questions that they wanted to focus on was what is the relationship between scarification and germination? Then they decided they all wanted to produce their own treatment. So some people want to maybe boil theirs in water before they germinate. Some may want to put it in Drano or urine or... They know that there are inhibitors in the seed coat; they read about that. So they think after they do their treatments, all of these need to be soaked in water for a period of time and then germination will go better. From those different treatments, they formed hypotheses. Treating the seed with Drano for 2 hours will improve the percentage of seeds germinating. That was a hypothesis. Then they made sure, and I helped them to realize that when we do all these alternative hypotheses, we need to include the null hypothesis. That if none of the treatments cause any effect, that would be the hypothesis we would then select. Looking at making sure to set up a control group. I’m doing this with a lower track Biology
group and they know the parts and, basically, how we set up going about doing this. So they’ve really driven it.”

What he learned through the monarch project gives him the framework – skeleton – for all the science activities he does. He uses it to help the students know what to do next.” He asks them where they should go next. “Do they need more information? Do they need to work more on their method of what they’re going to be doing, if that’s not clear? What’s the next piece? If they think they’re all ready to go with their experiment, do they have data charts ready so that they can collect information?” Donald said it is very helpful “to have the realization that nobody’s got the answers all the time.”

Donald said that it’s given him a comfort level and confidence that what he’s doing is real science. One activity he does at the start of the year is connected with his research with the teacher in Texas. They gather butterflies for the experiment, making observations of butterflies’ larvae and eggs. Then they gather all of that data and send it down to Texas. He said, “It’s a wonderful thing for observations and question developing.” He said that in the Texas school situation, it’s more formalized, and he thought they won a Texas award for a science fair project with all the data combined.

Donald was doing some volunteer work giving presentations at elementary schools in his and other districts. He can do it from his greenhouse where he has a TV and speakerphones. He developed materials for the teachers to use in advance of the presentation. He said, “What I really want to do is to help elementary teachers find developmentally appropriate material to do inquiry. They’re so loaded with the diversity of things they need to be able to do, if I can help them out with just this one piece, maybe that will be worthwhile.”

With regard to student engagement, Donald found that “when we’re hands-on – when we’re doing this, it’s a lot easier for me to see that I have fewer discipline problems; I have more on-task behavior. It’s kind of a no-brainer in that respect.” He added, “You just need to facilitate people’s thinking and try to help them find those interest areas that they’ll want to work on.”

Donald seems to have transferred the scientific process to other subject matter beyond monarchs more than other teachers who have learned to work with monarchs. He said that what he has learned “comes out in different ways.” He thought some of the people that have gone through the monarch program were really focused solely on monarchs. He said,

“But I see it as a bigger picture. I love monarchs; they are a great organism to work with. But right now in the state of Minnesota, the wolves are a huge issue. The monarch is, too, in terms of you’re getting media attention so that kids go, “I did see something about that in the paper or on the news.” So I think we need to try to focus on some of those things that are naturally [of interest]. But the bottom line is if we can continue to work with different groups of people and let the topic and the subject that they want to get involved with, be their decision, it really does help a lot in terms of you’re not pushing the rope.”

Donald was selected Teacher of the Year for 2000 by the Minnesota Science Teachers Association. He said, “I feel that without the structure and vision of the monarch project that honor would never have happened.”
Group 1
Diane Comer Case Study

Prior to the Monarch Monitoring Institutes
Diane Comer was involved with monarchs in her classroom before she met Karen Oberhauser at the University of Minnesota. Diane was first introduced to Karen during the summer of 1994 when she and another teacher worked with Karen in the Research Exploration (REX) for Teachers program. The following summer, Karen conducted the first Monarchs in the Classroom week-long session for 15-20 teachers, and Diane was one of the instructors. She has continued to teach this summer class with Karen (except for one summer when she was completing her Masters Degree) and has increased her use of monarchs in her classroom every year. Karen has continued to mentor her and keep her supplied with eggs and plants if she needs them.

In winter 1997, Diane and two of her students traveled to Mexico to see the overwintering colonies. “There are a dozen locations the size of a football field that they go to,” she said. “It’s just awesome to see.” All of Diane’s students are involved each year in tagging and releasing of a couple hundred monarchs. She said, “They feel like they are part of an international research project. One of our monarchs was found in the Mexican colonies.” Diane took 12 students the next year.

Diane said this kind of teaching becomes very time-consuming. Diane has taught a “monarchs for parents” class to answer the questions that parents have. Students’ brothers and sisters want to raise them. If there’s an early frost, you need to have collected milkweed leaves and have frozen them in order to feed the monarchs. Diane has begun to grow milkweed in her classroom, but then she has to worry about the parasites that are attracted to the plants.

During school year 1997-98, Diane tried for the first time to have each class develop a research project with student-generated questions about monarchs. In her application to be included as a participant in this project, she wrote that the “logistics of this were difficult and the pathway exhausting to navigate.” She wanted to “collaborate with other teachers who are attempting to do this.” Diane wanted to learn how to do field research, which she said was not really a component of “monarchs in the classroom.” Diane said, “Working with butterflies has really infused my classes with a lot of energy and excitement, more than anything else that I’ve ever done in teaching.” “It changes the way you look at teaching,” she said. “It has for me. I try to do much more inquiry-based learning.” She wanted to learn how to expand what she could teach using butterflies.

Diane also wanted to learn from other teachers how they deal with their district’s curriculum requirements. She has been frustrated at times with teaching content just for her district’s science test she must give to her students at the end of the year. “My students always score ‘very’ high on process, and they score high on content, but not ‘very’ high.”

First year after the Monarch Monitoring Institutes
Diane and her students participated in the institutes during summer 1998. The 1998-99 class-wide research projects worked, Diane said, “Much better than the previous year.” Diane and 10 of her students brought their research to the Monarch Science Fair at the Science Museum of Minnesota. The two girls that had participated in the institutes were encouraged by a Kansas monarch researcher to repeat their research and publish their results. Three of Diane’s classes developed research projects that “were good enough to send to the Monarch Fair” and the students who went were those “who worked hardest on the project.” She excitedly described each of the three projects in detail.

It appeared that Diane had learned how to organize each class to generate and select one researchable question. She said, “I did not come up with these ideas.” She said she felt more confident leading the
research component. She was able to explain independent and dependent variables – “one thing,” she said, “that I did this year that I have never done before.” Diane could also give the null hypothesis, which she said, “I didn’t know before I took the class.” She “really focused on all these classroom projects” so that “every student in every class knew what projects were going on in all five classes. They knew what the hypotheses were, they knew what the independent variable and the dependent variable was, so each student has five good foundations.”

Diane was surprised on a test that she gave that, with 89 or 90% accuracy, the students could tell her the independent and dependent variables in an experiment that was something they had never seen before. Diane was convinced, “They had to have transferred what they learned from the experiments we were doing in class to that new experiment that we had never talked about in class.”

When asked whether any of the research her students were doing was breaking new ground, she laughed and said, “Karen is so good . . . she just kind of makes us think we are breaking new territory, but I don’t know if it’s new territory or not.”

Diane and her two students faithfully monitored the field they had selected to monitor as part of the Monarch Monitoring project. They found very few eggs and very few larvae. Another time she might pick a location where they could find them much better, though she said, “It was a good experience because we went out there real regularly.” She was too busy in her classes that September to take her classes out to the field.

About this year’s tag and release activity, Diane summarized the experience:

We feed them before we release. We tell them to fly south on a full tummy. It takes the whole period to do that because while they are feeding them, they are also looking on the anatomy to see where that third pair of legs are. They look like they have four legs, but the students know that all insects have six legs and so they do a lot of observing. It’s such spiritual thing. Those kids feel connected to the forests in Mexico because they know that’s where those butterflies are.

Besides the class research questions, Diane had a dozen kids who were doing individual research projects. Every student was required to do some kind of out-of-class enrichment project. Some do the individual research project for the science fair, some make presentations about monarchs to elementary classes, some do Odyssey of the Mind, and some take a 12-hour class at another location.

There were still problems that came up while doing the classroom experiments. To help with the logistics, Diane had project leaders, which she had done last year, who would get the work done or delegate the work to other members of their group. Sometimes there was not enough time during class to get all the weighing and measuring done and accomplish other curriculum. Students needed to come in during “targets” (study hall) in the middle of the day. Diane had to come in on the weekends when butterflies were emerging.

Diane found Liz, one of the project research assistants, was “a big help” when Liz visited and talked with Diane’s classes about their variables and about “making a testable hypothesis.” When the district issued a memo saying monarchs could only be used in first grade and seventh grade, Karen supported Diane with a memo explaining why the students were making presentations to many different elementary classes.

Diane felt that what was particularly helpful to her about the institutes was all the research they did. She said,
I had never done much research, and I just didn’t feel real comfortable leading my class through research projects, not having done it, and at the institutes, we not only were working on our little individual research project, like what I was doing with the girls. We did so many mini-research research projects, like migratory habitat, monitoring the roosts and making census, sex differences in the behavior of the monarchs in the tents . . . We would divide up into four teams, you’d collect data, and come back, share your data, make transparencies, maybe do a statistical analysis, and then present your results to the big group. We had to do this six to eight times . . . you really got kind of good at it.

During the school year, 1999-2000, Diane was able to organize her classes to go out 2-3 times to monitor the milkweed around the school building. Last spring, the classes went out 3 or 4 times. Diane said, “Our milkweed comes up the very first in Rochester because we are a brick-bermed building. The brick heats up, and it heats the soil . . . The growth was just astounding. [The students] could not believe the growth from about May 15 and beyond.” Diane chose not to continue monitoring during the summer because of commitments she had made to complete an advanced degree in the next three years. For the degree, she was planning on doing her field study on a question related to monarchs.

When considering what was valuable about the Monarch Monitoring Institutes, Diane said that the team-generated research project “was probably one of the biggest learning experiences I had. It helped me realize how tough it is to design an experiment, and how hard it is to think about everything, and how important it is to have a couple trial runs and practice. I feel that I am much more equipped to teach students how to do research projects than I ever was before. . . . I feel I’m so much more equipped to help them ask testable questions because kids ask great questions. It’s just that many of them aren’t conducive to finding out the answer through a research project.”

In addition, Diane has found the team research project to be “something concrete in my classroom that I can refer to.” “I can say that I worked on this with students, and I was a co-learner, and it’s nice to have it.” Diane felt it was important to have students attend the institutes “because that gave you an idea of how students react and the level of your presentation and the degree of their understanding of various experiences.” She also thought, “It was a very valuable experience for the students.”

Diane does what she can to help other teachers in her district work with monarchs in their classrooms. She has convinced a new teacher in her building to apply for the next summer institute for this project. Teachers across the district, especially in the high schools and middle schools, share resources – the high school can grow milkweed in its greenhouse and Diane has plenty of eggs to share. Diane informally mentors a number of teachers who have heard about what she is doing. They contact her and check out materials, and Diane answers their questions.

Fall 1999, Diane had about 30 parents at the Monarchs for Parents class. She spent about an hour telling them about monarchs and then about an hour talking about how to mentor their child in a science fair project. She said, “At least a dozen of [their children] do science fair projects on monarchs.”

Second year after Monarch Monitoring Institutes

During this school year, 1999-2000, it appeared that Diane had further refined how she had organized her classes for research. She was using more of the materials from the middle school monarch curriculum developed at the University, particularly the sheets on “how to ask a testable question,” “making a hypothesis,” and “designing an experiment.” She said, “In other years, I didn’t follow the curriculum as closely.”
To give an example of a typical day in the classroom, Diane told the story of how, on this particular day – day of the interview – she and her students had spent the study time when they were supposed to be doing silent reading, instead, scrambling to get all the cages cleaned for the long weekend coming up. She had helped a student dissect a chrysalis that had died and watched students cauterize the gold dots off a chrysalis. About the dissecting and cauterizing, she said, “That was awesome.” After all that, Diane said, “It all works. For some reason, it all works. It’s very hectic in here sometimes.”

**Third year after Monarch Monitoring Institutes**

During the third year after she attended the institute, Diane said,

“Something new and interesting has happened in my life in that now every single 7th grader at Willow Creek School is raising a monarch butterfly because all of us who are teaching 7th grade Science now team teach. We removed the portable wall that separated our classrooms and so there are 3 of us. And it’s really a huge project in the fall because those butterflies are very labor intensive, but it’s very invigorating at the same time. So, while I’m not formally mentoring anybody, the 2 other 7th grade teachers with whom I now am teaming, have never been through our Monarchs in the Classroom class. So I was essentially giving them lessons and private instruction in how to do everything. And now they are experts.”

Because of a retirement in her school, science teachers were reassigned, and she and a close colleague were teaching the same subject for the first time. There were benefits to the teachers beyond sharing knowledge and skills about teaching with monarchs. Diane thought the best part about their set up was that they were no longer teaching in isolation. She said,

“For the first time since I’ve started teaching in 1967, I can watch another teacher teach, which is pretty amazing. I can count on one hand the times I had done that before, other than college classes that I took myself—to actually watch a colleague teach is really an incredible opportunity because you can talk about your lessons and perfect them. Sometimes, another thing we’re noticing is, if a student is hesitant about approaching her, then they’ll come to me and the same way who are hesitant to approach me, then they’ll go to her. And for whatever reasons there are that you connect with some kids and don’t with others, there’s more of a variety. Now they can go to any one of us. And then there’s a third teacher who teaches the extra section of our team. And she’s new and young and very dynamic and so we’ve got her input, too. I love watching what she does with her kids, too. It’s been really collaborative.”

Because of Graduation Standards requirements, Diane needed to give her students an opportunity to do a field study. She wanted to find something that the students could monitor, but she found it hard to monitor milkweed growth easily in the fall and it wasn’t up yet in the spring. Diane said that she was still networking with other monarch teachers and “shared some ideas at the last Science Teachers’ Convention up in Duluth.” They were going to do a joint monitoring project spring 2001 – monitoring the nematodes that are in the soil in the grounds around their school building. She said, “I feel much more qualified to do that, having done our monarchs monitoring and our milkweed monitoring.”

Another big project that is new this school year is their Butterfly Club. Diane described how it started “out as a Monarch Club because these kids just couldn’t get enough time in, feeding the butterflies and being in the tent. So we started this Monarch Club. And it was very, very intense — once a week on Wednesday nights in the fall.”

Some students wanted to keep the club going so they searched for something to do and found it in developing a butterfly garden.
“And then, after all the butterflies died, we went from maybe 25-30 kids, down to 10, that keep coming every week. So then there was the problem of there’s a Butterfly Club, and we don’t have any more butterflies. Then we focused on trying to keep our milkweed alive because we had a lot of milkweed that we were growing inside. And it just got terribly eaten by thrips and aphids. They’re just the bane of my existence when I’m trying to keep the milkweed alive. Then, after that, all the milkweed died. Now we’re in February and all the milkweed was finally dead. So then we had a Valentine party, and we laid off for about a month. But then, one of the students on Mrs. Hendrickson’s team has a mother who’s a master gardener. And I gave her some larvae last summer and she’s into gardening. And she did a huge garden at one of the local elementary schools. And she said, what a nice project this would be, to put a butterfly garden in here at Willow Creek. And I said I’m really busy with my graduate work. I’ve got this huge field study that I have to do and I don’t have a lot of time. She said, don’t worry, I’ll do it all.”

In April 2001, Diane reported on the results of bringing in parents and community people.

“Now, the Butterfly Club planted little seeds and we’ve got a grow light out in the hall — 2-tiered, 4 trays in each tier. So it really holds a couple hundred plants. We’re growing plants for our butterfly garden we’re going to put in, hopefully in another month. We’re raising the plants.” “We’re going to take up some sod. And the kids designed it and the shop teacher is going to help them build some benches, and it’s going to be in the shape of a butterfly. I’m just delighted that this mother comes to all our Butterfly Club meetings now, and she helps the kids talk through what’s good and what’s not. And then she brings her intern master gardener with her, so it’s nice to get community members involved in the school.”

Diane felt that the support that she received from the University of Minnesota staff and from her colleagues was very important in her feeling comfortable to have student do real research projects and to keep trying new things. She thought the best was the way the monarch monitoring project worked with researchers and teachers working together with their students.

“It helps to have a support system in place. I had Liz and Karen. If I had questions or if my students had questions…and there WILL be lots of questions that you can’t answer. There WILL be times when you’re too busy to really give something the thought that it needs to be given. Because if you’re doing research, part of doing GOOD research or having projects come out well, is clearly thinking through what needs to be done. And if you don’t give it a clear focus, sometimes you have unforeseen problems anyway, they’re just more serious if you don’t think through it clearly, ahead of time. Having a support crew in place, the University of Minnesota was our support crew, [is important]. Having colleagues … this is really a good way to try new things – to watch other teachers do them — try things out and see how they work.”

There was an additional benefit of the project for Diane in being a better science fair judge. Diane felt this was an important part of being a science teacher. Diane felt,

“Not only am I a better teacher, but when I’m asked to judge Science fair projects, I can go and judge a science fair project, and I can understand much more fully the strengths and weaknesses of that project. And I’m able to guide students by asking them questions. You always have these 10, 15-minute shots where you’re at a science fair and you’re interviewing future scientists, and if you can help them understand what’s good and what could be better about their project, I think you’re really doing them a service.”

Diane hoped these experiences for teachers would continue to be supported in the future. “I know it’s incredibly expensive, but it’s incredibly valuable.” She would not want to “give up having the
researchers. It’s SO important to have people who have really DONE research.” It was also “good to have students there because they ask so many good questions and you get their perspective and you see where their hang-ups are. Because when you’re teaching it in your class, you’re going to be experiencing some of those same hang-ups, and you see how the researchers, how those who are supposed to know what they’re doing – but they’re having trouble grappling with some of these difficult questions. Then it makes you feel, if THEY are grappling with these students’ questions, it’s okay for ME to really have to work to come up with answers.”
Group 1  
Julia Brown Case Study

Prior to the Monarch Monitoring Institutes

Julia has taught science for 16 years – 13 years before taking a “burnout” leave for three years and three years since she returned. She characterized herself as one who is willing to try lot of different things. She is also active in a statewide science teachers’ group, Texas Environmental Educators, which she feels is very supportive and “eager to do these kinds of things.” She learned about the opportunity to participate in this monarch project a few days before the applications were due and immediately contacted people to try to find a partner and students who would be willing to join her in applying.

Julia felt this monarch project “got dropped on her desk” just when she was about to start a butterfly garden near her school. She had also been part of a team in her school district that was looking at inquiry learning. She felt that they, on the committee, “ didn’t have a real good idea about how you go about doing this.” “We were not taught by inquiry.” She was convinced that inquiry learning improved student learning and saw this project as an opportunity for her to learn how to do inquiry teaching. She said, “In terms of doing truly inquiry-based teaching, I needed help. That is not the way we have traditionally taught.”

Before attending the two institutes, Julia was doubtful about whether her students were prepared by their previous schooling to do inquiry-based activities. “They absolutely have no inquiry skills,” she said. Julia also knew that the students she had at this time were different from students she had in earlier years, and she needed to work harder to get them interested and engaged.

Julia was also aware that inquiry-based science was more time consuming than the way she traditionally had taught. She would be unable to teach the assigned curriculum, already a big problem because of the block schedule they had implemented. Julia knew also that she would need to continue seeking grants and other additional funds in order to purchase the necessary materials to teach inquiry science.

First year after the Monarch Monitoring Institutes

After participating in the two institutes during summer 1998, Julia felt she had “absolutely” changed her focus and how she approaches her teaching. She said, “I am much more leaning towards handing them things and letting them figure them out.” On the first day of the 1998-99 school year, she handed out butcher paper to groups of students, gave them pens and caterpillars and said, “You write down anything and everything that you want to know about these things and all the observations you can make, and it was wonderful!”

With several other lab-type activities where she would “normally just tell them how it works,” she put them in groups and had them figure out what’s going on. Julia took the risk with the students she had and, to her “amazement,” they did it. It took longer for them to figure out how to make a copy of DNA, but when finished every student “knew replication perfectly” and could explain it for the test. “And they were so proud of themselves.” In previous years, when she “would just tell them how it works,” some of them got it and some of them didn’t. Julia was surprised that some of her very weak kids “really did pretty well,” and some of her “strongest kids couldn’t do these activities at first.” Even though the students came in with few inquiry skills, it was amazing to her how well they had done. She said, “Every unit that I do now, my whole focus is how can I turn this around for them to do.”

During the 1998-99 school year, Julia’s classes participated in many more field experiences than they had the previous year. Many of these were related to the Monarch migration research project that Julia’s team had begun during the institutes. The University of Minnesota sent Julia two batches of monarch eggs,
which she reared in her classroom and shared with other teachers. She had her students generate observations, questions, and hypotheses with these monarchs, but she “didn’t get to do the experiments with the kids.” By the time she felt that her students were ready to design experiments, the monarchs had completed their life cycle. She used the monarchs in her tenth grade biology and her 11/12 grade environmental science classes, but found that it was very difficult to find time to use them as extensively as she would like. She described ad hoc experiments that occurred in the back of the classroom, where the monarchs were kept. For example, students noted that monarchs were most likely to come out at particular times of the day.

Julia tried other new activities during the year, including using Wisconsin fast grow seeds and adopting a stream for the Texas Watch Program. She felt she would not have done these projects were it not for the inspiration of the monarch institutes. Julia had also used the plot sampling technique in her biology class that she learned at the Wilder Forest institute.

Second year after Monarch Monitoring Institutes
During early October of the 1999-2000 school year, Julia’s classes were “getting ready to start designing experiments.” She had made the big step. This year they are planning to carry them out.

Last year, Julia also recruited about 15 students who came in every Wednesday over a long period of time to study the local site they had selected for the project and report their data to the national monarch monitoring project. The monarch monitoring activity has been fascinating to Julia and her 15 students. They learned that “some of this science bit is wear and tear and you don’t see anything.” “If we don’t come, then we can’t say there wasn’t anything here because we don’t know, and then, now in the last three weeks, have been finding eggs and caterpillars everywhere, and they are not supposed to be here right now.” This happened two years in a row and Julia and the students are asking the experts “why?”

Julia has had to reconcile herself to covering fewer chapters in the textbook. She has concluded that her students are going to “know what they do well” and “have some skills.” She feels her students can “use their brains and do science” while other students have been “shoved a bunch of information that they have forgotten.”

Julia credits Karen Oberhauser and the University of Minnesota program with all the changes she has made. She said, “This is by far the best thing I have ever done.” This past summer, she attended a workshop at the Botanical Research Institute of Texas (BRIT). It was one of the best inquiry teaching workshops she’s “attended locally ever.” The woman responsible for the workshop had been a student of Dr. Oberhauser. Julia said, “They are sitting on a gold mine at the University of Minnesota.”

Julia felt that the activities of the institutes modeled for her how to do the various activities back with her students. She saw how they would give some lecture information and then send them out to do the task. She said it was particularly important to do the specific activity during the institute so that she could see how it worked. She said, “We can pull up something on a web site and read about it, but so what, you don’t really know how it works until you’ve done it.” “You have to have a feeling of how it’s going to work.” “Instead of being ‘told’ how to use inquiry learning, we were taught by inquiry learning. By experiencing the process several different times, the techniques became second nature to me. Not surprisingly, I learn in the same way my students learn – by doing.”

Julia felt that all the parts of the two institutes were important. She thought the team-developed research project had shown the students that “science is really alive and is something that you really do.” It was important to keep it because it “makes you go home and do what you did. Julia said, “A lot of times you will go to a workshop . . . and then go home and you don’t practice it, and it’s not yours until you have.”
For Julia, the contacts with the University of Minnesota experts through e-mail have been very important. “I e-mail somebody almost once a day, depending on whose area of expertise it is. “So they are going to be inundated, when they signed up to be a mentor here!” Julia has ordered eggs, larvae, milkweed, and bt toxin from the U. of M.

The visit from the University of Minnesota scientist was one of the best things for Julia. “The kids could see a real, live scientist, somebody besides their teacher telling them people do that, hearing what she does.” “I wish I had somebody every year that would come.”

The two students Julia brought with her to the institutes came back and helped expand the participation to other students. Julia thinks students should continue to be part of the institutes “because they buy into it, and they get excited about it, and they come back and they become the teachers.” She thought it was important to watch how the students worked through the activities. The adults served as models for asking questions for the first day, and as the students “got the hang of it,” the teachers learned to let the students do the talking. Julia said, “The whole interaction is important.”

Julia felt that spreading these practices to other teachers was a slow process. She said some people probably would never adopt what she has been doing because “the time I spend here is enormous.” When asked why others did not do a turnaround like she has, she said, “It just happens that I’m a compulsive workaholic, and I love kids, and I want them to like what they are doing, and so, it does have a lot to do with personality type.” She did involve one biology teacher and his students in caring for the chrysalises while she was gone to the Minnesota institute. Other teachers have told Julia their students were complaining that they were not doing the kinds of activities that Julia’s students were. One teacher said, “They are all mad that we’re not doing it, so maybe you need to be telling me how to do that, and let’s be ordering two sets of what you’re doing.” Julia had predicted this would be one way that she could have an impact on teachers in her building – through her students spreading the word. She felt that if she was able to lay out the lesson cycle and provide the materials needed, they would be much more likely to do it.

For Julia, this project had been a very special experience. As a result, she was nominated to be a Tandy Scholar – 100 outstanding teachers selected each year. She had also been selected one of three teachers from Texas to receive a Presidential Excellence Award in math and science teaching sponsored by the National Science Foundation. If she was selected to represent Texas, her school would receive $7500 for use in the classroom. Julia and the school had received an EPA grant and other grants to do this work. All of these happenings resulted in local newspaper coverage several times since Julia took part in this Monarch Monitoring project.

**Third year after Monarch Monitoring Institutes**

In January, 2001, Julia said that “because of this major family pressure” she had not done “very many ‘NEW’ things so far this year.” But she continued to do “all of the same inquiry activities with them that we have done in the past two years. She said, “They continue to be very effective, and my students continue to say that biology/environmental science is their favorite class because they get to "Do" such neat things, and they learn so much.”

Julia had continued to do the monarch monitoring part of the project with some of her students. In fall of 2000, they finished their third year of doing the monitoring and sending their data to Michelle Prysby.

“*Our introduction to the monitoring program came in June of 1998, when I was selected along with two of my students to participate in the Monarch Monitoring Teacher/Student/Scientist Collaborative Research Project sponsored by the University of Minnesota. At that time, Michelle Prysby sent us copies of the monitoring protocol for us to practice before arriving in Minnesota.*”
I must say, since we had no previous knowledge of monarch ecology, we were extremely insecure about our first monitoring efforts. Truthfully, we had no idea what we were doing or if any of the things we were doing were correct. It was not until we had hands-on training in Minnesota that we felt both comfortable with the protocol and confident in our abilities to conduct the research in Texas. Since we have now completed our third year of monitoring and have seen our research team grow by leaps and bounds, it is obvious that the training techniques were effective.”

Julia was pleased with how her students were dedicated to the monitoring project.

“Doing research is hard work and requires a tremendous amount of dedication. Larval monitoring in Arlington, Texas begins in March and runs about eight months into the first two weeks of November. During our three years of monitoring, we have found eggs in the spring, none in the summer and then eggs again in the fall. This directly corresponds with the presence of monarch adults in the spring and fall and virtually none in the summer, though Texas reportedly has a summer breeding population. Monitoring in the Texas summer heat can be brutal, so it means getting up early in the morning on our monitoring days throughout the summer. That is true commitment from teenagers.”

They also continued to collect data for the third year of the migration study they were working on with students in Minnesota and San Antonio, Texas. This was the team-generated research project that began during the summer of 1998 with these same Minnesota and San Antonio teachers. The students changed over these years as they moved on in school, which means that new students were added to the project. She said, “We are currently negotiating with Karen Oberhauser to see if we can fly her here to work with us for a few days to evaluate our data and prepare a professional paper. We hope to bring her here in February or early March.”

Julia was excited about all that she and her students had learned about monarchs. She said, “It is exciting to know that the data we are collecting is adding meaningful information to the scientific community’s understanding of monarch biology.” She added, “My students are amazed at all of the interesting things they are finding out just by consistently doing simple scientific field research. The more they find out, the more questions they have and the more they want to do.”

“One of the most interesting things that my students discovered this year deals with the presence of monarch eggs and caterpillars here in the fall. Our monitoring site for Michelle is across the street, about 100 yards from our butterfly garden on campus. The species of milkweed in the field is A. virdis, the common milkweed for this area of Texas. On the other hand, we have tropical milkweed, A. currisavica planted in the garden. We had eggs and caterpillars in both places, but for several weeks, we had 100+ eggs/caterpillars in the garden whereas there might be 10 or so eggs in the field. The tropical variety is much taller and received regular water whereas the common field milkweed experienced quite a drought this summer, though it was amazing how well adapted it was to drought. The plants were still in pretty darn good shape after 92 days of no rain. In addition, there were numerous nectaring flowers in the garden as opposed to few in the field. Karen thinks we need to do a formal study on the effects of tropical milkweed species on monarch populations in Texas. Additional interesting information came from our migration study. We tagged more than 200 monarchs in the garden this fall. On numerous occasions, we recaptured the same tagged monarchs for one to two weeks. That tells us that they were in no hurry to migrate, even late in October. Many of the females also had spermatophores, which is not surprising based on the number of eggs we had in the garden.”

Julia had found that it was easy to involve students and community with their work with monarchs. She felt, “Opportunities for sharing monarch biology with others via the monitoring program are unlimited.”
In the last few months, my students and I have been asked to informally share our research and the techniques of the monitoring program with staff and children at the River Legacy Nature Center, the Arlington Master Composters and the Arlington Garden Club. In addition, I have been asked to prepare an in-service on monarch monitoring and ecology for area teachers. Other venues could certainly include Girl Scout and Boy Scout troops, school ecology clubs, senior citizen groups and the University of Texas at Arlington entomology department.

"Enthusiasm for monarchs is infectious. My students talk to everyone about monarchs. When we walk out to the field to monitor, students on campus ask about what we are doing and come out to help. When we monitor in the garden, students often ask to take a caterpillar home to teach monarch ecology to their brothers, sisters, and parents. That enthusiasm spreads to neighbors who then call Lamar High School to ask about planting butterfly gardens in their yards. The ultimate ability to share our monarch enthusiasm came this summer when, because of our involvement in monarch research, one of my students and I were chosen to be the Grand Marshals of the Arlington, Texas Fourth of July Parade attended by literally thousands of people."

Julia did find time to do one big program. “One new inquiry based program that we are beginning to get set up is the GLOBE program. I spent a week this summer in GLOBE training and this fall have been acquiring the equipment to get started with my environmental science students. I am hoping that we will pilot the program this summer and then be fully integrated into GLOBE next fall. It is an outstanding program!”

Julia was chosen as the Texas winner for the Presidential Excellence Award and did receive the $7,500 grant from NSF. She said, “This money allowed me to take 12 students on the fall migration field study trip to the Texas Hill Country instead of just two, and I was able to help pay the way for our San Antonio partners to come meet us. The money will also allow us to fly Karen here to help us. It is providing equipment for the GLOBE program and much, much more over the next couple of years. Without financial help like this, I could not do the things I do.”

In a letter of support to Dr. Oberhauser for a grant proposal, Julia wrote,

“This is my eighteenth year of teaching high school biology and environmental science, and I can truthfully say that the educational experiences gained by both me and my students through our monarch migration and larval monitoring research far exceed any previous learning experiences we have ever had. For the first time, my students are conducting valid, meaningful, scientific research and are learning first hand about the trials, tribulations, and jubilation of doing research. . . . It is the most valuable learning and teaching tool I have ever had because it incorporates inquiry, scientific processes, data analysis, ecology and stewardship all wrapped into one package. The more people we can involve in the program, the better. If you do, indeed, receive funding for this grant, I would love to be considered for a position on the advisory committee and will be more than willing to share my expertise with others in the state of Texas.”
Group 1
Rose Krueger Case Study

Prior to the Monarch Monitoring Institutes
Rose Krueger had only four years of teaching experience when she applied to be part of this Monarch Monitoring Project. As an undergraduate, she took extra opportunities to be “part of groups to improve science teaching.” During her college education, she had only one teacher, in chemistry, who “taught with the inquiry method and the constructivism model.” All the other teachers were the traditional – “here’s the lab, here’s the recipe, follow the directions, turn it in when you’re done.”

What Rose hoped to gain from this project was a “chance to see science done in the ‘real world.’” She started teaching right out of college and “wasn’t involved in the science of the researcher.”

During each of the summers since she graduated, Rose took part in “NSTA/NSF summer institutes designed to improve how teachers instruct.” In addition, during the summer of 1997, she participated in the two-week Monarchs in the Classroom project. Rose heard about Karen Oberhauser while serving as a member of the Minnesota Science Teachers Association (MSTA) board of directors. She said she does all these activities so that she can be the “best teacher” she can be.

The year following her first workshop with monarchs, Rose’s eighth graders were part of the Monarchs in the Classroom project. She wrote, “They were responsible for developing and carrying out their own research project on the development of monarch larvae.” She took the best projects to the Monarch Fair at the Science Museum of Minnesota. When the students’ larvae emerged as butterflies, they tagged them, released them, and sent the data to Monarch Watch. She said,

“...The students felt like a small part of a big picture when they found out that their data would be sent to Monarch Watch. We were then able to discuss how this tied to the work that Dr. Oberhauser is doing at the University of Minnesota, and how I was a part of that. That experience enabled me to explain to my students what being a field biologist is all about. I know that some of my enthusiasm carried over to them – judging by the critters they brought back from their milkweed hunting.”

During the summer monarch workshop, rose learned an acronym from another teacher – Pichydirt Co. Each letter stands for a piece of the scientific process (p=problem, ic=information collection, hy=hypothesis, dir=directions-materials and step by step procedure, t=test – data tables, and co=conclusions). She said, “Students remember it better. You can just ask them what process they are going to use, and they say “pichydirt co.” and they remember all the steps and can write them down.”

Rose required each student to do something extra to get an A or to raise their grade. She said, “We kind of flooded the elementary schools with eighth graders teaching about monarchs.” She thought, “Some of the elementary teachers got kind of excited about butterflies.” A lot of her students’ parents were teachers, so with the 40 extra larvae she had, she handed them out to students to take home to their parents to bring into their classrooms.

Even before participating in this project, Rose said she tried “to make science as inquiry-based” as she could. Her district had been a pilot site for developing graduation standards performance packages; she was involved with this work for three or four years. As a result, she worked with inquiry science for ninth graders and their labs have been “rewritten to be more inquiry and less recipe.”
First year after the Monarch Monitoring Institutes

During the year following the two one-week institutes, 1998-1999, Rose said, “I definitely do more inquiry-based science experiments.” Especially, she was better able, she said, “To help my students with it, and kind of lead them without telling them what would be a good experiment, or, well, it’s a good idea, but how are you going to collect the data, what kind of data are going to give you results.” “Karen and her team did a real good job of modeling how to do things, and so that taught us how to do it with our students. Karen’s team had us develop our own questions and work out how we’re going to do it.”

Rose said she seldom any longer uses any of the experiments from the textbook or the lab book. With the lab book pages, students would see the list of materials, see the steps, follow step by step, and not do “any thinking until they get all the way done with the lab and then have to answer two or three critical thinking questions.” Instead, Rose gives them a problem, has them in groups of four brainstorm what materials they are going to need, what steps they are going to do, what kind of data they are going to collect, and how those data tables are going to look. Then after 15-20 minutes, they pull that together as a class, take ideas from everybody, then they go ahead and do the lab. Rose said, “So this way they are thinking from the time they set up the problem until the time it’s done.”

Rose found that her students were “becoming more active learners, and they have a better stake in the experiment . . . They are a lot more excited about doing the lab . . . It just makes them better problem solvers, makes them better thinkers, and they remember the results better because they’ve done the entire thing.” Rose said, “I expect more of the students because I know that I taught it better, and so when they turn in lab reports they get it back sometimes because I expect more. I know more about it now, how to teach it, what’s a good conclusion, and what’s good data. So it makes the students better scientists.”

Another activity Rose adopted from the institutes was the 10-12 different stations set up in the classroom, like one station would be the eggs, the first instar and the second, etc., and everyone had questions to answer, draw what they see, and describe it using adjectives. She said, “It’s a nice way to start the year, they make observations, and they have to write these down so that other people understand, and that’s a really nice lab.” Rose had also planned to do a dissecting exercise with the butterfly unit, but their town had been through a tornado the summer before and the lab was not working for the first month of school. She had “never seen how a butterfly is dissected” before the institutes.

A problem that remained unresolved for Rose, even with the curriculum revisions made around the state graduation standards, was that “it is time consuming if you want to do it in it’s truest form where you let the kids do everything.” You still “have to hit so many things.” At the fall 1999 MSTA conference, she heard someone from AAAS say “don’t get hung up on all the words, teach the kids the idea.” Rose said, “That was the first time I’ve heard someone say, you can cut some things out, that’s okay.” “She said, if you cover the content, the vocabulary will follow. I don’t know.” Rose does know “for the better good, you have to do it, you have to have your students take an active part in what they are doing.”

Rose felt this experience “gets you excited to teach science and gets you prepared to use the scientific method as an inquiry tool for everything because you can see it works for any experiment you ever want to do. You can have the kids set it up instead of giving the kids the worksheet. It makes you a better science teacher.” Of the institutes generally, Rose commented, “They worked really hard to come up with things that were usable and that were good for students and were good for teachers to use in their classroom. I think Karen and her grad students put in a lot of time working on these things and getting things ready for us to use. They did an excellent job.”

Specifically, Rose could now expand what the students could do with field studies. She said, “There is more to study than just the actual monarchs themselves. You can study the plant that it’s on; you can study many more things.” She hadn’t learned many field study techniques before this project; now she
has more ways to study ecology and diversity of an eco-system. She added a number of new research projects to her classes this past year: determining what increases the rate of composting, determining the effect of fertilizer on algae/pond life, and determining the effects of cross-pollination on plants. For each of these research topics, she wrote, “The students chose what project they wanted to investigate, they designed the experiment, and they carried it out.”

Rose said that at first the team-generated research project did not seem like a valuable part of the experience, but when they took their data to the second institute, they realized, “Wow, we really did prove something. We just felt so good about it. We actually proved something – that numerically and mathematically, it’s true!!” At the second institute, both teachers and students learned how to use statistical formulas to prove whether the data on their graphs really show something. When analyzing the numbers, they could understand that “a small change could really be what you’re looking for.”

Rose did not think the institutes would have been as valuable if the students were not there. She said, “I think this is really for the students. It’s for your high achieving or students that are interested in biology. It gives them a chance to do something that otherwise they might not ever get to do. But this is something that can really turn a kid on to biology.” With the students, there were “just more people to think about the problem.” Rose appreciated that the teachers and students were all handled like students. She said, “We could kind of see how the students would work through the process, and how they will get frustrated, because we’d get frustrated not being able to tune up our questions, and so just really put us in their shoes for the two weeks, and that was really valuable.”

Second year after Monarch Monitoring Institutes
Rose moved to a different school district for the 1999-2000 school year. In October 1999, she was still using monarchs in the classroom with seventh and eighth grade science students. Rose is also a math teacher and clearly saw the connections between math and science. The state graduation standards in math also required students to formulate questions, test hypotheses – in other words, the scientific method.

One thing she did a little differently this year was have the class vote on a class research question instead of each student picking their own individual projects. “Rather than 10-15 different experiments, we decided to do one class experiment and collect data.”

“That worked – the reason we did that is because we had talked about science and how scientists try to recreate data or recreate their experiments and collect a lot of data on the same things to see more of how accurate – because if they did all their own, they would have only 3 caterpillars to base a hypothesis and a conclusion on whereas this way we had a 100 caterpillars or more. There was one question for two classes.”

Rose had some involvement with teachers in her previous school in spreading the word about using monarchs in the classroom. She is trying to talk a new tenth grade biology teacher in her current school to attend the next summer institutes. She said, “She’s trying to learn some new field techniques, and this is just her second year of teaching, and I think it would be valuable for her to learn more field techniques. I think she would get a lot out of it.”

Third year after Monarch Monitoring Institutes
Rose was teaching a 10th grade biology course for the first time and was not sure about the curriculum, so she did not do the monarchs this year. Nevertheless, she was not “real big on the cookbook labs where I give the kids the step-by-step thing. So she said, “We did a lot of – okay, here’s the problem . . . so what is the information collection.” She still uses the “pichydiert co.” scientific method to do inquiry labs.
The monarch project helped her be “more comfortable with inquiry based labs and letting the kids set up some of their own parameters – instead of it has to be this way.” From the whole Monarch thing she learned that “if it was going to be successful, you had to let the kids go with it. You would see that success and how the kids really take ownership in the labs, because it’s theirs. They have decided virtually everything.” She said she preferred doing that with other labs though “you can’t do it all the time.” She thought, “There’re some labs where you just have to follow this process to get it done.” Rose said the project helped her get use to “not having full control of everything.”

Rose attends many professional development opportunities offered by the Science Museum of Minnesota and others. She rated the monarch monitoring project “a really great project – a really beneficial one I used a lot in my classroom. It showed exactly what you needed to do and how to do it.” She added, “I know the parents and students really liked it at St. Peter. They just kept talking about their caterpillars. I think it’s going to affect the students a long time because they know the life cycle of a monarch. They know what it looks like. Who know how it’s going to affect what they do.”
Thomas Aaron Case Study

Prior to the Monarch Monitoring Institutes

Thomas Aaron did not start out to be a science teacher. He was “thinking about being a vet or just being a biologist.” As a consequence, he was involved in undergraduate research before switching to studying “how to be a good teacher.” He said that he had spent the past 10-12 years learning how to be a better teacher, but that he has missed out on “just learning science for science sake.” He saw this monarch monitoring project as “an opportunity to learn more science and actually do some research.”

For three years before applying to be part of this project, Thomas had been involved in Minnesota’s state-sponsored “Science Best Practices Network.” Through this involvement, he had “worked to disseminate and model best teaching practices in science instruction including constructivism, inquiry-based learning, and cooperative learning, while at the same time developing and implementing the Minnesota Graduation Rule Science Standards and Science Frameworks.”

When Thomas heard about this summer institute opportunity, he felt that this experience would help him prepare for teaching Advanced Biology, which had been assigned to him for the coming year. Students self-select to take Advanced Biology, usually because they are interested in a science career. This course was “inherited from a man who had always required the students to do an independent research project, and many of those students have gone on to science fairs – state and international science fairs . . . it’s kind of expected that that is the way it will be.” He would be “emphasizing scientific research and doing the whole nine yards,” whereas in the past he didn’t “because of the level of courses” he had taught.

When Thomas turned in the application forms to his principal, he did not think he could qualify for school staff development money to cover his share of the costs because the local rules were that “you really have to basically reach all your students.” Thomas was focused on providing an opportunity for four promising students to “get a head start on their project” for the Advanced Biology class. At the time, he didn’t feel he “could make a good enough case” that what he “would get out of it would eventually benefit” all his students. He applied instead to the city’s Education Foundation, a private group that funds school-related projects.

Thomas had written in his application that participating in a research experience with monarch scientists “would improve my ability to bring this type of real scientific inquiry-based learning to my students.” Perhaps he had only the Advanced Biology students in his thoughts at that time. He also wrote that “it would enhance my knowledge of research techniques including data collection and analysis which would be readily applicable to the classroom.” He wrote that his ninth grade physical science and biology students were “frequently given opportunities for inquiry-based experiences” and with the “Minnesota Graduation Rule Standards these experiences will become even more common.”

Those who went from high school to the two one-week institutes were Thomas, his four high school students, and a science teacher from the middle school. The Monarch Monitoring Project design included required team-generated research projects to be planned and carried out by teams from a given school or district, for example, the six people from Thomas’ district. Project staff characterized Thomas as “adamant during the workshop that the students would learn best if they did the research on their own.” They said they tried but could not convince him otherwise. Therefore, Thomas and his students did this part of the project in a different way than all the other participants. The middle school teacher was not part of the follow through research activities of the high school students, though she had them come to her classes and talk about their research and mentor her students.
First year after the Monarch Monitoring Institutes

During the school year following the institutes, 1998-99, Thomas had what he later described as “a pretty stressful year.” He was “teaching three new classes, and it was very time consuming.” During an interview halfway through that year, he nevertheless put the best face on the transfer of what he learned in the institutes to his teaching—it just reinforced what he had already been doing:

*I guess I like to think that I have always been a fairly good teacher and so a lot of what I’ve learned and was exposed to in the institutes was stuff that I was already doing so there hasn’t really been much of a change. We do a lot of active science here. It’s not a textbook kind of thing. It’s not just kids reading and answering questions. We’ve always been very hands-on oriented and, that’s what I’ve stressed. It’s always been more of the process than the product of the science. In that respect, I don’t feel I benefited a great deal from the institute— it reinforced.*

Thomas described in detail the field activities carried out by the students during the ecology unit of their biology classes. He said he and his students “probably take 6 to 8 field days with the kids identifying different habitats and making measurements of the different factors in those habitats.” He said that had been “a real big part of the curriculum here for a long time.” It was not clear how much the students helped develop the questions that the data were being collected to answer. He also said, “In the general biology classes over the years, we have kind of dabbled in setting up experiments, scientific research, but to a smaller degree.” For another field project, in addition to studying the health of the river as part of the classroom curriculum, some students volunteered to come after school to measure different factors in the St. Louis River. These data were compiled for a riverwatch monitoring program.

During 1998-99, both Thomas and the middle school science teacher were involved with district science teachers in designing curriculum for implementing the Minnesota graduation rule in science. Thomas felt the two of them were “very helpful with other teachers in how to set up research-type projects for kids.” He also said, “It’s been really helpful to me in designing these performance packages or performance assessments.”

For one very specific example of how the institutes helped him, Thomas related that he was pretty comfortable requiring the Advanced Biology students to find a mentor for their independent research projects because he had thought of people at the University “as being more intimidating than they’ve actually been. . . now I know that they are not just going to be turned away.”

Second year after Monarch Monitoring Institutes

Only eight months later (fall 1999), Thomas’s view of the past year seemed somewhat different than when he was in the middle of it. He then characterized the year as one where, other than “the research projects that my students in my tenth grade Advanced Biology classes were doing, I didn’t really do much else.” He was proud of what the Advanced Biology students did—six advanced to the state science fair competition and two qualified for the international science fair in Philadelphia. Thomas felt that the four students who experienced the project institutes benefited greatly—two of their projects went to state competition and one went to Philadelphia. Thomas thought he had learned a great deal as well from working with these students all through the year. He helped them “analyze their data, write their papers, do their research.” He said, “All of those things benefited me because I was kind of doing the research as well, and so that was good practice, a good reminder of how to do those kinds of things.” Thomas mentioned that “a lot of things” they learned at the institute were helpful and useful, particularly helpful was practice in making formal presentations and writing a technical paper.

But Thomas really didn’t want to talk about last year; he was more excited about this year—1999-2000. For this year’s ecology unit, his students were currently doing a field study that he had “designed as part
of the new state graduation rule, guidelines and standards.” Thomas now felt that his “experiences in the institute have helped that out quite a bit in planning that field study.” He said he was basically having his students do the activity he had done at the institute where they “actually set up some study plots and counted and identified different plants that were within those study plots.” “And,” he said, “we’re using some mathematical formulas to calculate some relative numbers so that we can compare them statistically.”

He credited the institutes with giving him a chance “to really think about these kinds of things . . . and got reminded of some of the really hard core science that I could be doing with my classes.” It seemed that Thomas was trying what he considered “difficult,” “abstract,” mathematical procedures with his classes that he might not have if he had not experienced them during the institutes, and he said, “It’s going pretty well.”

With his Advanced Biology classes, he said, “I feel more comfortable tackling some of those questions – those research questions, and then setting up research protocol to answer those questions.” He knew he would be doing that anyway with these classes because “it’s what they do,” but he feels a lot more comfortable “after having been through the institutes and working with those students so closely.”

During 1999-2000, Thomas was chairing his school district’s science curriculum review committee that was looking at the whole K-12 science program. He felt that he can share what he “picked up at the institute” and that it will help them “align their curriculum, and scope and sequence it, and align it with the grad rule and the national science standards.”

Besides being beneficial for the students, Thomas thought that having students present at the institutes was helpful to the teachers. “They’ll be asking questions that maybe wouldn’t get asked otherwise,” he said, “and they have a way of bringing things down to their level which benefits everybody.” Thomas felt strongly that “the students make really great ambassadors.” “When they come back in the classroom, the students don’t have to just hear it from me. They can hear it from their peers, and some times they can explain things a whole lot better than I can.” This was “really beneficial” as far as Thomas was concerned. His students have had a lot of social contact with other students in the project since they’ve been home.

Thomas had also kept in touch with other teachers, particularly Dave Astin in Wayzata and Bob Shoemaker in St. Peter. He had “exchanged some different teaching activities with Bob” and had “talked about some of these grad rule standards with Dave.” He had hoped to see them at the Science Teachers Convention but didn’t make it there. He saw Mary Watson at the science fair and De Cansler at the best practices network meeting. He had not kept in contact with any of the project staff though his four students had communicated with project staff about their individual research projects. Thomas said that when he saw Bob Shoemaker in St. Peter at the Nobel Conference, Bob told him about his work with Karen in setting up his masters’ theses. He said, “I was a little envious that I hadn’t maintained any contact with Karen or the other researchers – the grad students that were there.” He wondered if there was something that he “should have been doing to maintain that or if there was something that they could have been doing.” He wanted to stress that “it isn’t a sign that it wasn’t an effective thing” for him. He said, “It was very useful and beneficial to me and the students here, and we continue to use that information and the procedures that we learned.”

He also wanted the project to know that he was “encouraged to look at other things similar to that.” An example he gave was a web site that he found from Kansas that was devoted to student-teacher-scientist collaborations, and he was looking for other summer institutes for him to participate in where he would actually be doing some research, not just taking a class.
Group 2
Elaine Lutter

Prior to the Monarch Monitoring Institutes
As of 1999-2000, Elaine Lutter was new to the teaching profession having taught three years. She teaches at an urban junior high school whose students come from diverse ethnic and socio-economic backgrounds. Elaine has done substantial hands-on active learning with students prior to participating in the monarch project. She commented, “One major component of my curriculum is allowing students to design and carry out their own research projects. These projects entail asking a question, designing an experiment which seeks to answer the question, and presenting their data to peers.”

The science department at Elaine’s junior high school consisted of five relatively new teachers, and she became an active leader in the department and dedicated many hours to writing and implementing curriculum for other teachers to use in their classrooms. In her application for the program, Elaine said she supported and encouraged her colleagues to explore alternative ways of teaching such as research projects, monarchs, using the Internet, and other strategies she had learned through summer classes. She was also involved in a partnership program with Tamarack Nature Center and a middle school in White Bear Lake in which the teachers were helping Tamarack write environmental curriculum to share with other schools and teachers in the future.

Elaine had been involved with studying monarchs for several years. And the opportunity to participate in the monarch project served to solidify her comfort level of using “active research” and designing experiments. She wanted to learn more about active research and how to carry it out more consistently throughout the school year. She stated, “My science teaching would greatly improve if I was able to provide my students with more science experiences outside of the classroom.” She also wanted her students to have the opportunity to apply what they have learned in science to a realistic situation.

The school is located in an area where there are not a lot of trees and other naturally occurring living things. Because of limited access to a natural habitat with substantial naturally occurring living organisms, Elaine believes that this has hindered their ability to complete ecology projects. Elaine commented about the location of their school, “It would be nice to go outside and do ecology projects. But we are located in the middle of the city and don’t have any neat trees.”

To compensate for the lack of an ecologically enriched environment, Elaine and her team have done several things. She said, “Last year we planted a butterfly garden so kids would have something to do outside the classroom. It would be really neat to have a larger outdoor area that we could study.”

There were students at the school where Elaine teaches that lack strong motivation to do their best science work. In describing her students, Elaine addressed three areas, motivation, quality of work, and independence. She stated, “I have a wide variety of students. One-half are extremely independent; one fourth need guidance; and one fourth need to be walked through activities. And the students that are not independent and not self-motivated get by doing as little as possible.”

Elaine believed that having some of her students participate in the monarch project would give them the opportunity to experience science learning in a real-world situation, and become empowered to apply what they have learned. During the telephone interview she commented, “I want my students to feel empowered and successful as they apply these new skills to a realistic research situation.”

It was apparent during our interview that Elaine was aware that students from underrepresented ethnic groups and women were historically left out of the larger scientific community dialogue, and saw that participating in the monarch project could be a rewarding and fruitful venture. She commented, “I think
this project could spark an interest in a science career for some of our minorities and young women who traditionally are not pursuing science in high school and college.”

After the Monarch Monitoring Institutes

Elaine and her student team have done a remarkable job of getting their community to support more students’ learning about monarchs in their natural migratory habitat. Elaine took 10 students to Mexico to see the monarch’s final migratory destination. This was no small task. First, they needed district and school approval. Second, they needed substantial funding. And third, they needed moral support. Elaine was able to get the entire school community to rally behind their fund raising efforts for the monarch trip. In fact, initially, the district denied them permission to go to Mexico. But a group of “parents” who believed in the quality of learning that was resulting from students’ involvement in the monarch project petitioned the district to rescind their decision and allow the students to go to Mexico during their spring break. The district eventually agreed. But Elaine and her students had to raise their own funds. The spring break trip that Elaine and 10 students took to Mexico was truly a community effort and benefited the entire community. The students got an experience of a lifetime, i.e. to observe the monarchs final migratory rousing place, and they agreed to prepare a slide presentation of their trip to be shown to all interested community members. Hence, the community could vicariously share the Mexico trip with students. Elaine commented about parents’ involvement with monarchs, “The community is excited about monarchs. And they know about us going to Mexico. Parents call to tell us when they have seen monarchs; it has been a kind of bonding.”

Elaine had invited the scientist and student research assistants to come out to her school to give support, critique, and share their expert knowledge about monarchs. She commented, “I have communicated a lot with Karen and her grad students. Karen came out and watched us teach a random experiment to see how we implemented it. She gave us feedback and she taught a lesson with our kids. And we talked to the grad students a lot about our project.”

In addition, Elaine’s school involvement with monarchs had spawned not only a lot of interest, but also a desire to showcase what they were learning about monarchs to others. They now conduct their own school level monarch fair. Elaine’s perspective on what their participation in the monarch project meant is captured in the following statements:

“This project has helped me do some of my best teaching by far. It has been at the center of so many neat projects. When we went to Texas, it was great. Then we have our own monarch fair. What we have learned about how to design an experiment has been invaluable. I don’t set up the lab anymore. They [students] come up with their own questions and tell me what they need. They are in more control of their learning.”

In conclusion, Elaine told the story about how one female monarch institute participant changed her attitude about bugs and doing fieldwork. She stated, “I have one student who participated in the monarch institute that I would call my glamour girl of the class. She was real prissy and simply hated bugs. By the end of the Texas trip she was picking up all kinds of bugs with her hands. And she actually asked her mom if she could have a pair of hiking boots and gear to do field work.” The importance of the whole experience with monarchs was summarized by the following statement Elaine made, “It was worth all the hard work to help students see other possibilities.”
Prior to the Monarch Monitoring Institutes
During the 1999-2000 school year, Lucille taught at a large suburban junior high school. She had taught science for five years, and currently taught earth science. Lucille welcomed the opportunity to participate in the monarch institute, because she believed that her college preparation was not sufficient for her to teach students how to do quality field and active research. In fact, Lucille credits other learning opportunities and other teachers for the advances she has made in using active research methods. She stated, “My methods courses were average. With a few exceptional professors the others were outdated. Staff development and workshop sessions were wonderful as was the [staff] at the science museum.”

Lucille had held a variety of leadership roles at school and in her community. At her school, she was the coach for Odyssey of the Mind, drama director, and worked with a youth group after school. One community role she enjoyed each summer was teaching at the Science Museum of Minnesota. Another vital role that Lucille shared was that of science team member. She commented, “I also play a vital part in a close-knit science department that firmly believes we are all better through cooperation and sharing of ideas. Each of us brings to the table a different area of expertise, and we support each other daily.”

The school where Lucille teaches has a diverse student population. In fact, it had experienced some of the same “change” challenges that urban schools face. For example, challenges they have encountered included: students with low achievement scores, student mobility, students with low reading levels, and other issues that are often associated with poverty. Yet, Lucille and her student monarch research teams were committed to the project. She stated, “My student teams are doing an excellent job. They are very motivated and met after school to complete their project and turned in everything by January.”

Prior to the monarch-training institute, Lucille used a lot of commercially generated laboratory activities and mostly teacher directed lessons. After the completion of the monarch training Lucille reported that her lessons were more student focused. She stressed that students experienced more inquiry based science learning. “It’s a lot less teacher-led and it’s more student-led and more inquiry. And every year I get a little bit better at [inquiry-based teaching] as I practice and learn to let go of things myself and let the students generate what they would like to learn about the butterflies.”

First year after Monarch Monitoring Institutes
In describing what her students did with monarchs during the 1999-2000 school year, Lucille said that a monarch unit is currently part of the district regular school science curriculum, and that students have stated that it was one of their favorite units to study. All of Lucille’s students participated in the study of monarchs. They did measurements and journaled about their study of monarchs. In addition, they tagged and released monarchs, and sent some to the University of Kansas.

Lucille’s students participated in a school-wide science fair where they got an opportunity to showcase some of the things learned during the monarch unit. She also planned to continue having students use the scientific method and wrap-up the school year with an ecology conservation unit. A main focus of this unit would be to look at the various habitats of living things. Lucille stated that observation was a focal process she emphasized with students. “I have all kids do mostly observations and journaling of activities.” When commenting about how the monarch unit helps all kids learn active research-based science she said, “It made science very attainable. It made one think that science can be easy to attain. It is not out of reach. Sometimes you made mistakes, but you still learned.”
The school does not have sufficient computers. As described by Lucille, the computers are sub-standard. Yet, students who participated in the monarch institute were able to complete the needed parts of their monarch research project. She stated, “We used the spread sheet for graphing and analyzing data.” This was not the case for the entire class. The computer access and quality at the school where Lucille teaches did not facilitate the use of computers for all students. She observed, “I did not use computers much with the other students in my class.”

Lucille’s community efforts of sharing monarchs included not only teaching summer classes at the Science Museum of Minnesota, but she also taught in a summer program for gifted and talented students that included monarchs. These teaching opportunities allowed Lucille to teach monarchs to different populations of students.

She said she has not done as much to involve the community as she would like. “We HAVE invited the community out for some of our monarch releases and the newspaper has come and taken a picture of that one year. So our picture was in the newspaper and talked about that a little bit.”

Second year after Monarch Monitoring Institutes

This school year (2000-2001) Lucille expanded the number of student-generated research projects and has students using inquiry-based approaches to learning science in many of the daily activities. During the post interview Lucille summarized her more student-led approach:

“We usually do a student generated project at least one additional quarter. And I’m trying to increase that so that every quarter, that they have some questions that they have come up with on their own, and they decide ‘I want to try this’ and do it at home and present it to the class. But this year we had at least one additional project like that. So I’ve been able to increase that. And also, in my approach to some of my daily activities, my labs, I’ve rewritten some of those so that it’s not so instruction-guided. On a few of them now, I tend to give them some materials and have them generate questions and just try to figure it out without me giving the instructions – ‘Okay, first, put one tablespoon of this in here…’ So I’ve tried to move away, with a lot of my labs and activities, from written instructions, step-by-step what they should do, to let them just get a hold of the materials and figure it out.”

One variable that impeded Lucille from doing even more with active research in other science units was time. She said, “Time is an issue. We must take time from the regular curriculum to teach [science] standards components.” Time was an issue, but Lucille did have all students complete a cardboard car project. Lucille provided some of the materials and students created their car shapes. They had to consider many variables, for example: wheels construction, car shape, and overall design that could be built with the pre-determined materials and stay within a set cost guideline. Lucille summarized some of the details of the car project:

“An inherent problem in this cardboard car project is to keep a level playing field. I provide, for example, rubber bands of equal size and length and limit what students can spend on the project. The emphasis is not on how much students can spend on materials, but building the design testing prototypes, testing variables, and creating techniques.”

The cardboard car project aligns with Lucille’s teaching philosophy that students learn by doing. Lucille talked about being better able to live her teaching philosophy as a result of this project, “I’ve had a hands-on philosophy, but I didn’t have practical ways to apply that philosophy. I found that I would get very frustrated because even though my philosophy was this, the practical application, I could never figure out how to implement it in the classroom in an effective way.” She went on:
So it gave me the tools that I needed to bring my actual teaching practices more in line with my philosophy and has shown me that there are certain projects, certain topics that we can study that go very easily along with this inquiry, and it’s not as hard as I imagined it to be. The more that I use it, the easier it gets. So I feel like this whole training project gave me that tool that I needed, a way to implement it in my classroom in a practical and efficient way and not be so overwhelmed and scared off by the whole thing.”

Time was just one of the challenges that Lucille found when working with monarchs or when doing inquiry-based science. Time was always a challenge in the classroom “because the more kids you have, the more time they’re going to take.” Lucille explained, “They’re not going to have me right there if they run into a question, a big stumbling place when they can’t go any further. They have to wait for me to be able to come around because I have to help more students.” This can cause behavior problems, “When you have that many kids in the class, trying to keep them on task, waiting while the teacher’s helping one group, so now we can fool around and play around and throw things and stuff like that. That tends to be a bigger challenge with a larger group, as well.”

Lucille said that inquiry-based science “seems to require more materials because through the inquiry process, some of the materials can be wasted. They do it one way and find out it doesn’t work, so they go to re-do it, so you’re using double and triple the amount of materials.”

By the second year, Lucille was finding it easier to have the students generate questions. She explained some of her strategies:

“I think modeling it the first few times we do it is the best strategy we’ve found, especially with the age groups that I teach. A lot of times, they don’t understand what you mean when I tell them, ‘okay, generate some questions.’ And they’re so hung up on, ‘is this right or is this wrong?’ So I have to model, that there’s no stupid question; you can ask anything. But then when we go to demonstrate how to set up the experiment, ‘well now, is this a good question?’”

“Another strategy that’s worked really well for me is to have them potentially look for errors before they even do the experiment. Because a lot of times, that saves them from running it and then it messing up and them realizing, ‘oh, I did this wrong and it gave me bad data, so I’m going to have to go back and fix it and start all over.’ If I have them, in their minds, generate as many potential sources of error that they can, ahead of time, that has helped a lot, too.”

In talking about how she helped them learn about having too many variables in their experiment, Lucille thought she did a better job this second year.

“That is one thing they’re not very good at, at the beginning. They have lots of variables, so we have to try to really pare it down to where we say, that’s a great question, but you have 2 or 3 questions built in there. Let’s pick one and try it first, and then we’ll see about trying the other ones. So we really have to focus that first few weeks of school with trying to teach them one variable changed one thing and why is that important? Well, because you won’t know which one caused the outcome, if you don’t use it. And I think this year, I did a pretty good job with that because, by the end, they knew that and they were able to pick out, when other students were presenting their projects, they would ask questions like, ‘well, didn’t you actually have two variables.’”

Lucille had changed her teaching methods and examines what she does every year. She asks herself whether there is a way to “tweak some of her [units] to make them more inquiry-based, more hands-on
for the kids, get less teacher stuff?” She feels that every year, she’s gotten a little bit better at that. She found she uses “less and less notes and less and less worksheets, and more hands-on stuff each year rather than standing up there and writing on the overhead?”

In addition, Lucille found that she used the textbook even less than before. “I don’t teach out of the text very much, but I use it even less since I started with the monarch stuff. Because I find that the things that are very sterile in the textbook are covered very effectively through their hands-on explorations with the monarchs.”

And then as far as her curriculum was concerned, she found it had given her “a focal point—something to tie the entire year together.”

“We start out with the monarchs, and we use the monarchs for all the beginning of the year stuff like the needs of life and what makes a living thing and the scientific method and experimentation and ethics and handling and care for it and measurement—all those beginning-of-the-year stuff that you cover in science.”

“Then throughout the year, I bring it back up. Like when we’re talking about genetics, we bring in some monarch stuff with genetics. When we’re talking about the different kingdoms, we bring up the insect order, and we bring back the monarchs. How many legs did the monarch have? How many wings did the monarch have? All these things. And it gives them a focal point, again, to remember, ‘okay, well here are the parts of the bug because this is what my monarch had.’”

“And then, at the end of the year when we had the ecology, it gives them something that’s already touched their lives, to say, ‘why should I care about what happens in Mexico to these forests? Oh, because the monarchs. Why should I care if people are planting milkweed in their garden? Why should I care about genetically-altered corn? All those sorts of things.

Lucille found there were many times that the work with the monarchs related to recent issues in the news. She said, “Speaking of genetically-altered corn, it’s given me an opportunity to tie things in that are currently happening. There’s a lot in the news, the last few years, on this whole BT corn and the monarchs and their habitat and all that stuff. And so it’s added that piece to my curriculum, where the kids are looking more in the newspaper and listening to the news. And they hear things that we’re studying in class and they get excited about the everyday application about what they’re learning in science.

Lucille found that the state graduation standards and her work with monarchs has tied together very well.

“As a matter of fact, the standards and the monarch unit came into my life at the same time. Where other teachers were overwhelmed at having to re-write their entire curriculum to fit the standards, once I implemented the monarch curriculum and adjusted for that, the standards were there. . . . I can get out most of my standards right there at the beginning of the year because they’re all covered in that monarch unit – the whole inquiry standard, the direct observation standard.”

During the second year after Lucille participated in the monarch monitoring institutes, she said a big step was taken to spread what she had learned to other teachers in her district. She was able to present the whole monarch project and the approach to this project in the classroom at a district workshop. She said, “I was asked to share what our research was and what I’ve been doing in my classroom for the past few years. So I had lots of questions from teachers, not only our other junior high teachers but also some of the high school teachers, as well, at that workshop. So, in the building it has been happening for a few years. In the district, this year is probably the first year I’ve noticed it happening.”
Lucille found teachers in the district were interested in finding out how to work with monarchs and what they pitfalls might be. “They liked the approach, but they also were asking some of the practical questions like, what happens if you have this? Or, how much does it cost? Or, how much time am I going to have to adjust my curriculum to make room for this?”

Lucille has a strong interest in ecological and environmental sciences. And the monarch project was a right fit to broaden her interest in this field. She stated, “I know having personal experience observing and studying the monarch in the wild will add to my own sense of wonder at life, and I can in turn translate that to my students.”

Lucille talked about the impact that she felt the students experienced through their work with monarchs.

“The appreciation, the compassion for another living being, and just their whole approach to the ethics of handling it and the research and caring for the animals while they’re here, even though before hand, they’re just bugs. And afterwards, ‘that’s my monarch!’ And they’re very concerned with, ‘are they going to make it to Mexico okay?’ And ‘Miss Foster, are you making sure you’re giving them enough food?’ ‘Miss Foster, their cage is looking kind of bad. Can we clean it out?’ That whole thing and just being up close and personal with a creature like that, that a lot of them, especially living in a more urban area, have not gotten to see or handle. So that’s another thing besides just the whole scientific approach that I think they really gain from it. They talk about it all year. They’re always, have you heard anything about our monarchs, Miss Foster? It’s been nothing but a positive project for me. “

Lucille also found that because she did this project at the beginning of the year there was “an immediate connection to the parents.” She said, “I find I have better turnout to conferences and better parental support right off the bat because the parents get just as excited about the project, sometimes more excited than the kids themselves.”

She found the long term help from project staff to be very helpful, “They have been very supportive and very helpful, as far as checking up on me and seeing ‘how are things going, do you need any help?’ Answering my e-mails and always being available for my millions and millions of questions and having great suggestions for how to handle things.”

In conclusion, when describing the monarch experience Lucille stated: “Personally the program has been one of the best. It opened my eyes to see the scientific method from different angles.”

“I just think it was one of the best things that had ever happened to my teaching. . . . So many workshops I go to are pretty worthless. And I sit there and I might glean one or two good things from them, but I’m sitting there for hours and hours, going, ‘uh, I paid for this?’ But this one was non-stop learning and I felt like I’ll never be able to put all of this in the classroom because there’s just so much. It was just the best one I’ve ever attended.”
Group 2
Marcia Crawford

Prior to the Monarch Monitoring Institutes
As of 1999-2000, Marcia Crawford had taught nineteen years. Presently, she teaches at an urban charter school. The student population is mostly Native American and economically disadvantaged. Her major teaching responsibility is to teach life science and ecology. She has a unique situation in that she teaches science to students who are in middle school and senior high school (grades 7, 8, 10 and 11).

The students Marcia teaches have not had substantial experience doing “hands-on” science learning. During a telephone interview, Marcia commented, “My students in the past mostly had teachers that had them do a lot of book work.” This may explain why many of the students in Marcia’s classes had not shown a lot of enthusiasm for learning science. Marcia was hopeful that the Monarch Project would ignite students’ interest in learning science.

Marcia has the challenge of stirring up excitement about doing science and helping her students create a picture of the possibilities that they too can attend college. She stated: “It is very challenging for our students to think about going to college, for most of them they would be the first in their families.” It is interesting that these students can attend a school that is located adjacent to a large, Midwestern university campus, and yet many of them do not appear to grasp that they too can someday attend that same university, or maybe a university of their choice.

On a survey filled out before the Monarch Monitoring project began, Marcia gave two examples of active research projects that sounded somewhat like typical textbook type activities where the question and procedure have already been established. She mentioned only one field experience.

First year after the Monarch Monitoring Institutes
During the school year after the institutes were held, many of Marcia’s students did participate in various aspects of the Monarch Project. There were about 60 students working on the Monarch Project and each had the responsibility of raising their monarch to maturity. The University of Minnesota staff sent over 160 monarch eggs and each child received a canning jar with milkweed and eggs. The extra caterpillars were fed in the classroom. During the school year, for some reason, the students experienced a lot of their caterpillars dying. But they were able to salvage enough mature monarchs to conduct several experiments and send some adult caterpillars to Texas. A few students designed and completed their own experiments on caterpillar behaviors. As part of the research project, they designed their experiments, carried them out to completion and wrote up the results. Marcia summarized their monarch raising experience:

“I had about 60 students working on it. Fortunately, we had a lot of extra caterpillars because we had a lot of caterpillars dying. I am not sure why that happened. I don’t know if it was the milkweed or humidity. But we were able to get 41 of the original group raised to adulthood toward the end of the semester.”

Marcia made substantial progress in getting her students to actively participate in completing various stages of the Monarch Project. She probably would have liked the students to have done more, but considering the dynamics of the school culture she came into (this was Marcia’s second year at this school) and that students were not familiar with doing active research, their completion of the unit was “progress.” Marcia reiterated that these students have not had a lot of experience doing hands-on science, and she has started to emphasis a variety of skills. She commented: “This is all new to my kids. They have never done this before.”

To build a “hands-on” science-learning climate, Marcia completed the monarch butterfly unit with many of her students who wanted to participate (60). Marcia has also included various processes of the
scientific method into all of her classes. For example, she discussed how students are learning to develop their observation skills: “I am having students work with each part of the scientific method. I started with observation. Each table has a bowl with a fish inside. Daily, students are expected to make observations and journal about various fish behaviors they’ve observed.”

Students in Marcia’s science classes have started to go beyond just textbook learning. They have experienced active science learning and fieldwork opportunities as evident by her instructional methods. She was proud of the progress that her students have made. She has been able to broaden her use of formal research practices to other science topics. Many of Marcia’s students have progressed from showing little interest in science, to actually designing their own research projects. Students are developing the necessary skills to successfully complete a research project. They have developed their own researchable questions, written hypothesis, gathered needed materials to conduct the research, designed the experiments and tested their hypothesis. In the following excerpt, Marcia states that students are transferring skills they learned during the monarch experience in researching other science topics. She said, “The skills we learned as part of the Monarch Project we have used to start projects with rats. We tested their diets i.e., we fed some sugar and others milk. And now we have fish in class.”

In addition to the formal research, Marcia mentioned a field experience outside of the monarch fieldwork: “I took my students, who were doing chemistry, to do water testing at Minnehaha Falls.”

Marcia felt that the monarch project did influence how she teaches. She explained, “I’m much more open to doing open investigations with the students, where most of the labs that are presented to us in our curriculum are labs that the question, the procedure have already been established. . . . I really am working towards getting all my students to do their own investigation.”

The school has few computers available for students’ use. Hence, there is not widespread student access to computers at school or at home. To address this concern, Marcia used her home computer to communicate to other project staff and participants, and she brought in computer hard copy information to share with students. The hard copy graphs and data sheets that Marcia provided to students allowed them the opportunity to analyze their own real monarch data, but, did not give them the opportunity to have individual computer access to generate the data themselves. In spite of these hindrances, students are working with real data that they participated in gathering.

Marcia felt she got a lot of support from the university project staff. She spent one day in the field with Karen and some of her staff. She said, “I have been able to keep in contact with Liz Goehring who was kind of our team’s contact person. She was a graduate student working with Karen Oberhauser. And I have, from time to time, talked with Karen Oberhauser. So she’s been great about that. She’s always been willing to talk to me and answer any of my questions or whatever I need. She’s always been really helpful. So that’s been really lovely.”

Second year after the Monarch Monitoring Institutes
During the post-interview in January, 2001, Marcia stated that she did not have physical science certification and needed to complete a student internship at another school during the first semester to meet state teacher certification requirements. Therefore, thus far this school year (2000-2001), she had not been able to do any work with monarchs. Marcia had plans to study monarchs with a group of maybe five to ten students this upcoming summer. She was also hoping that as a part of a biology unit about plants “to do a bit on the milkweed and hopefully monarchs. Hopefully, we’ll be able to go out in the field in late May and watch for the first monarchs and do a little tie-in with that.”

Marcia felt that the school did support her efforts in doing the Monarch Project. Marcia commented about the support she received, “People at the school are very excited about the project.”
Marcia extended the influence of her monarch training beyond her classroom by providing information/teaching to elementary teachers on portions of the monarch unit in an age appropriate way. When speaking of her opportunity to share the monarch project, Marcia commented, “I shared a lot of my monarch materials with elementary program students and teachers in summer school. They raised their own monarchs and were real excited about the project. I expect to expand the monarch unit for elementary teachers for the upcoming summer.” This collegial and professional support to expand the Monarch Project to elementary grades will provide a greater number of students the opportunity to do “hands-on” science while studying monarchs.

The Monarch Teacher-Student-Scientist Project was viewed positively by Marcia, the school staff, and students. Marcia was pleased that her two students had this opportunity, but would have liked to include more of them in the training sessions. The majority of her students have had limited experiences and opportunities to participate in this kind of science learning. Marcia believed that this monarch training experience provided a needy student population with a great opportunity to learn in a setting that many of them had never experienced: “I would like to see more opportunity to travel. Taking the team of two students last year made such a splash at our school. Everyone thought we would do it again. We have a very poor economic student population. This was a great opportunity. Many of them don’t get a chance to see anything. 95% of our students are on free/reduced lunch and have never left the state. This was a great experience.”

Another benefit, one that she did not anticipate, was that Karen and her staff helped to introduce her students to the university and “to get them kind of familiar with what the different facilities are over there, what they’re like, what the people are like.” She said, “And that’s been really rewarding. I’ve been able to take over some students and get them a little bit more familiar with seeing the behind-the-scenes stuff at the university so that they know what they might anticipate, because they’ve never had an opportunity to be over there.”

Marcia was looking forward to participating in another project spring and summer 2001.

“I’m involved with the Science Museum of Minnesota, and we’ve got a Lucent Technologies grant. We’re working with teachers from [two other high schools], and we’re developing an Earth Science curriculum that teaches Earth Science content through scientific investigation. The students will actually have an opportunity in the summer to go out and dig for fossils, gather fossils, and then they’ll be analyzing their samples and answering their questions that they develop from their observations from what they’ve collected. Although that doesn’t involve monarchs directly, it does involve the scientific investigation part of it.”

Marcia also hoped she would be able to participate in other opportunities like the monarch project.

“I’d love to have a follow-up session to reinforce some of the skills. We were a week in Texas and then a week in Minnesota. Those were very intense weeks, and I just feel like, every once in a while, even if it was just for a week-end, it would be nice to go out and have a little refresher course to reinforce those things we learned so we stay on the right track.”

In conclusion, Marcia’s expansion of active research and field work opportunities to other science units and her willingness to share her monarch training experience with others appear to support her commitment to expand “active” science experiences. She felt very supported by the monarch project staff and wanted the opportunity to have additional similar experiences for herself and her students.
Group 2
Marianne Kuster

Prior to the Monarch Monitoring Institutes
Marianne Kuster was a veteran teacher, having taught nineteen years. She has an undergraduate degree in biology, not biology education. Traditionally, undergraduate biology majors in contrast to biology education majors have substantially more active research course work in college. This probably supports why Marianne has a strong comfort level consistently using active research methods. She has had substantial experience using active research projects and field experiences with students.

The private school where Mary teaches has grades 6–12. The subjects she taught during the 1999-2000 school year were: grade 9, biology, level 1 and grades 11 and 12, environmental science.

Before participating in this monarch project, Marianne used a variety of teaching methods that included: standard textbook assignments, hands-on laboratories, field experiences, individual student projects and presentations, discussions of local case studies, current events, and debates of controversial science issues. Although Marianne has had extensive years teaching, she believed that the Monarch Institute would help her improve her teaching techniques. She wanted to learn field techniques for monitoring the monarch butterfly. She and her students had occasionally participated in Monarch Watch and had tagged monarchs during their fall migration through their part of Texas. She wanted to learn more.

Marianne had also done considerable work with scientists in her community and with the Texas Parks and Wildlife Department. She stated:

“We have worked with mentors from the Texas Parks and Wildlife Department as ‘Nature Trackers’, monitoring the big red sage and the bracted twist flower. Other students have monitored water quality in a near-by watershed, planned a model for a research site on land next to the school, and analyzed air pollutants at the local elementary school. And a plant taxonomist has helped me start a research herbarium for the school.”

First year after the Monarch Monitoring Institutes
During the school year after Marianne attended the Monarch Monitoring Institutes, she went into the study of monarchs in a big way. She and the students who attended the institutes worked on their team-generated research project asking “Are all migrating monarchs in reproductive diapause?” They found that early October migrants had spermatophores, while later October migrants were in reproductive diapause. In her environmental science and independent study classes, students set up an individual inquiry project, carried it out through out the fall, completed a paper, and presented it as part of their semester exam. One student was inspired to do a study of monarchs called “Affects of Temperature on Monarch Development.”

Marianne had extended the study of monarchs to several different formats. She had students experience monarch field visits, students led a monarch camp for other students in 8th grade, invited the media to cover the release of their monarchs, and reached out to neighboring urban public schools in the community to share their monarch learning experience. Marianne commented:

“There is a lot of enthusiasm for monarchs. We are looking forward to recovering tags, and the local project scientist has been our mentor. Students at a public high school in town have worked with our students. In fact, we have worked with three schools in all. It was a positive experience for our students.”
Marianne was committed to expanding the monarch work in her school. She encouraged two other teachers to apply to participate in the monarch institute. The two teachers [one math and one science] were accepted to attend the monarch training, and they did complete the two weeks during summer and fall 2000. Marianne took four students on a monarch watch trip to Mexico to visit the over-wintering sight.

To get additional support to extend the study of monarchs and other active research projects at her school, Marianne had successfully gotten outside grant money. Marianne had a grant request accepted where her school would receive between one and five thousand dollars to be used towards purchasing equipment for the monarch project. She was chosen to receive one of five highly competitive monetary school awards and received a $4,000 award for the monarch project.

Marianne had been instrumental in publicizing her students’ study of monarchs. She shared much of what students learned about monarchs through newspaper articles, TV coverage, and Junior Academy Science Fair participation. Students have taught adults in the school community about monarchs, including presentations at the Audubon Society.

In addition, Marianne had substantial school support to continue studying monarchs. Adjacent to the school is a large field suitable to carrying out many field experiences. Marianne was the science department chairperson and had requested and received increases in monetary support for science classes. The support that Marianne received extended to what curriculum was taught. She commented, “There is a lot of flexibility in terms of what is taught in the curriculum during an active research project such as the Monarch Butterfly Project, and it would not be interrupted because of school curricula requirements.”

The support teachers received at this school extended to staff development opportunities. Marianne had been involved in sharing her monarch expertise with other staff. She stated, “The building science team and I were actively involved in doing staff development sessions for other teachers. There are four science teachers who work collaboratively. We expect to share this experience with the mathematics teachers.”

Marianne’s students that attended the monarch institute were very instrumental in assisting her in extending monarch-learning experiences to vast audiences. As mentioned, the student teams worked with other students in and outside of their school building sharing what they learned about monarchs and active research. The students felt that they were “part of something bigger.” They were learning from those who were most expert in the field, i.e., real-world scientists.

Marianne felt she had a lot of positive things come out of this project. The only challenging task mentioned during the spring interview was “incorporating pictures into their team report.” Marianne was positive that in time they would meet this challenge too. The students had succeeded at entering data into Excel and completing various parts of the report. Marianne also discussed the challenge of keeping low motivated students focused for extended periods of time, and contrasted the excitement grade seven students show when studying monarchs to senior (grade 12) students who tend to get focused on other things. Marianne made a comment that summarized their experience with monarchs. “We are learning a lot.”

Second year after the Monarch Monitoring Institutes
During the 2000-2001 school year, Marianne taught life science to grade 7 students and botany and aquatics to students in grades 11 and 12. This was the first year in a number of years that she had taught 7th graders. Marianne found, “Everything we do, they are so excited and so enthusiastic, and that really
has brought to me a new appreciation for teaching and a new joy because the kids are so excited about it."

During the second year after the institutes, Marianne continued working with students in a monarch team that would meet periodically after school and on weekends. She reported, “We have traveled to the Texas Gulf Coast to monitor the butterflies down there. Earlier in the year the students on the team did independent projects and several of them are working to prepare those projects now for science fair, for the Junior Academy of Science and the Alamo Regional Science Fair.”

In her seventh grade classroom, all the students have participated in Monarch Watch type activities or monarch lab activities. Marianne described what they did, “We’ve had eggs, 150 eggs. They helped gather the milkweed for them. They did all the measurements on the larvae; then each class got to see a larva become a pupae. We had each of those 7th grade classes monitor milkweed in the fall and will start again in February, the 7th grade and botany class.”

Marianne said the second year after the institutes they had a very successful year. She said, “We have really done even more this year than we did last year because last year was kind of a learning experience for us, and now we know what we’re doing.” She described in detail what they did this year.

“We have continued the research full steam ahead and really the 7th grade and the botany students are very immersed in it. The aquatic biology class hasn’t done anything with it. Because I got a grant last year and had money to buy nets, we have 40 butterfly nets, so during our school day, we have, after 2nd period, a chapel service and then we have a 20-30 minute break, and the students come around to the greenhouse and pick up their nets. This year, luckily for us, we had a wonderful fall migration, so as the butterflies were coming through every day, the kids, on their own, were all out there catching. We had a large walk-in cage that they could go in and put their butterflies in and then later on, either after school or during class, we would measure those butterflies, take their wing length and their mass and check them for spores, check them for semataphores and then tag them.”

Though she was not planning to use monarchs with her aquatic biology class, she was planning field experiences for them. She explained,

“This spring, we will do a fresh water, open-ended kind of study where we will be monitoring a stream. In the fall, we took a trip down to the coast, and we did a waterfall we’d been monitoring. We asked questions at different locations, talked about things like salinity and dissolved oxygen and used some of the techniques for questioning and hypothesizing that I’d learned with the Monarch Project, but we have not carried it through full-scale to a full project. This spring, the botany students will do some independent research or will do research together as a team on projects like I’ve done before, for example, the number of bluebonnets on the hillside and learning the techniques for doing field study.”

Marianne found that learning with monarchs was easier than with some other field experiences.

“The paperwork that we have to do to take them out into the field makes it hard to go on field studies. Getting the permission slips and the transportation and all those things. And as far as applied biology, there are not any ponds or creeks or rivers right here on the campus. With the milkweeds and the monarchs, they’re right outside the window.”

During the final interview, she looked back to her original goal for going to the Monarch Monitoring Institutes, “I could improve my work with students if I had more experience with field techniques, more
experience with analyzing data and drawing conclusions, and more experience helping students focus on meaningful topics for research.” It was evident that Marianne thought that she had gotten the training she needed to improve active research techniques as supported by her statement, “That was our philosophy to begin with [referencing using scientific method]. I think what we’ve gotten are the techniques to use to implement that philosophy that we all wanted to be doing, so I think learning the techniques to work with the students has been very beneficial and has helped us to put in our philosophy of teaching – doing active research and getting out in the field – just given us more reasons to be there.”

Marianne summarized how the Monarch Monitoring project influenced her teaching. In order to study monarchs when they were available, she reorganized the seventh grade curriculum so that they studied ecology first, and then went into the study of plants and animals. She also used monarchs to teach science techniques in a more engaging way. She said, “When you’re just starting off on your study of measuring, rather than measuring the tabletop and the text book and those things, we measure caterpillars and monarch wings and find the mass of the monarch, so it just makes science come alive for the kids, and it’s much more interesting.” She added that the school was trying to focus this year on graphing, and making tables and charts. She felt, “All of these data we’re collecting really [work with] that type of lesson, and I think the kids have something real that they’ve enjoyed that they can use to practice these skill.”

Marianne expressed a commitment to continue studying monarchs. “We are going to continue working with monarchs. And having the University of Minnesota, University of Kansas, and Bill Calvert to continue to be our mentor would be very useful.”

Marianne reported that at a regional science fair in March 2002, one of her teams won the Grand Prize for a tachinid fly/monarch larvae study. These students went to the Texas State Science Fair, Texas Junior Academy of Science, and the Intel International Science Fair. One of her zoology students won second place for a study of monarchs and fungicide.

In conclusion, Marianne said, “It has been an outstanding experience, and I’ve appreciated all their support through e-mails and through correspondence that we’ve had. It’s been very successful. It’s been the most successful National Science Foundation Project that I’ve worked with, and I’ve done quite a few. I think it’s very well done, and I hope they’ll continue the funding.”
Group 2
Ronald Smith

Prior to the Monarch Monitoring Institutes
Ronald Smith had taught for twenty-five years. During the 1999-2000 school year, he moved to a new school. Ronald was definitely excited about this new school building, which is located in a middle to upper middle class suburban school district. The school is a math/science academy, and its main focus is to develop mathematics and science excellence. Ronald has a teaching situation that is unique to most public schools. He teaches a variety of science courses to students at five grade levels, i.e., grades 6 to 10. Currently, the school serves 200 students at grades 4 to 12. Students choose the school they attend.

First year after the Monarch Monitoring Institutes
Most students at the school where Ronald teaches have had substantial opportunity both at school and at home to have a variety of learning experiences. In the school district where Ronald teaches, students can choose the school they want to attend. The original team of students that attended the monarch training with Ronald chose different schools. Ronald retained only one student of the original team at the new school. Ronald felt that the separation of the team members would not stifle the growth of what the new school staff expected to do with monarchs. The new school has the facilities, materials, and land space to extend students’ learning opportunities. Ronald commented, “At our new school, we have designed a butterfly garden, and everyone is excited about getting started.”

Students in Ronald’s chemistry class had the opportunity to apply various techniques learned from the monarch training experience when the class made its own nylon. When asked to describe a unit in chemistry where he incorporated some of things learned from the monarch project, Ronald responded, “We took nylon, we took the polymers and we made from a couple of chemicals a lump chained molecule which I tried to relate to industry, and while doing that, I tried to mention that it’s the same format for all research, including field research that I did with the monarch project.”

Ronald has stirred up some excitement among staff and students to do some kind of research with monarchs. He was pleased with the opportunity that the project allowed him to work so closely with other teachers, scientists and his own students. He commented, “You get to work elbow-to-elbow and you get to work with the kids quite a bit. This was a tremendous experience.”

Interestingly, Ronald expressed some uneasiness with having to change roles consistently (i.e., teacher in one instance and student in another) during the institute. Ronald commented, “Teachers are caught in the middle sitting learning like a kid and then next the teacher role. The back and forth was sometimes disorientating.” Usually, if there is one teacher uncomfortable with the constant change between the role as teacher and then the role as student, there are others who feel similarly. However, in commenting about his uneasiness, Ronald did not find a lot of teachers who voiced support of his perspective. He commented, “I got no sympathy from other teachers.”

Ronald collaborated and assisted other science teachers who were interested in studying monarchs with their students. He stated, “Sure [I collaborate]. They all know I know way too much about the Monarch butterfly and also, I’m sort of the resource person for this, if ever we want to get some caterpillars.” Ronald has shared his learning experience with not only teachers at his school but other teachers too. He commented, “I share a lot with others that this is a real good opportunity. I do a lot of word-of-mouth sharing with other teachers.”

Ronald had also been involved in sharing his science expertise with others in the community. He stated, “I participated at the science museum and helped with materials and completed a science project at the local library.” Ronald’s other community sharing opportunities about monarch research occurred
through regular parent contact opportunities. He stated, “We have open house and parent night and monarch stuff is around the classroom. Whenever it comes up, I mention it to parents as a really great way to get kids involved in active research.”

Ronald teaches a substantial number of science topics and has included the monarch unit in the curriculum. This was positive in that Ronald said, “I have integrated a couple of things from the packet into my already crowded lessons.”

In addition, Ronald has been a strong supporter of the monarch project. He has rendered his services teaching several of the units, and assisting the museum and university project staff. Yet, it was by chance that Ronald got involved in the monarch project. He commented, “I don’t think it is advertised enough. I heard a message on the Children’s Science Museum voice message service. I got tired of calling so many times that I just left a message on the voice machine.” Ronald was pleasantly surprised that he was accepted to participate in the institute. “It was a shock to be accepted and I had to apply to the school board to get days off.”

For Ronald, this was an important step in his teaching career. He referred to himself as a veteran teacher who was accustomed to doing cookbook science experiments. The monarch training provided techniques to learn and do science like scientists. He commented, “I have never done something so bold in 25 years of teaching. It has changed from the right answer-wrong answer to more a generalized feel for research. Research is itself it’s own reward. Just being able to feel that you’re doing something similar to what real professionals do. So, I would say I’ve moved away from textbooks and right answers to more of hands on and being involved in research.”

Ronald was supportive of the fact that there were paid days, especially for small school districts. Small school districts often lack the funds to accommodate paid regular school days for teacher enrichment. Ronald reiterated the importance of having funding available if teachers are to take advantage of the type of staff development opportunity provided in the Monarch Project. He stated, “They pay for virtually everything and for small districts that is really important.”

Second year after the Monarch Monitoring Institutes
During the 2000-2001 school year, Ronald’s teaching responsibilities included chemistry, physics and one earth science class. This change in science teaching assignment (from biological sciences to physical sciences) affected the amount of time Ronald could commit to monarch research within the framework of a physical science focused curriculum. Ronald commented, “Since the fall we’ve gone over descriptions of [monarchs] and [their] life cycles. We haven’t worked directly with them this school year. We would like to work with them in the spring.” Ronald has not abandoned teaching students about monarchs and anticipates that he will do some research involving monarchs before the conclusion of this school year.

Ronald included active research techniques and shared details of his monarch training to the extent he could in his chemistry classes. When there were parallels that could be made between the Monarch research and some area in chemistry Ronald included those examples. During the post-interview Ronald stated, “In my current classes, chemistry especially, we do experiments and I refer to that very valuable field experience working with the researchers quite often. I tell them the parallels, although it’s pretty lose between chemistry and biology. I tell them whenever it’s appropriate that we did some real research which we felt was valuable to the University of Minnesota and whenever [I] can slip it in, have a big poster of the life cycle on the bulletin board and a big card of the monarch.” He mentioned that he mainly brought in what he had learned in indirect ways.

Ronald said most of the things he does in class were made more active, more hands on, by the fact that he’d really done this research now. He described the impact of the monarch project as being indirect in
that he takes things a little step farther than just the regular classroom work. He said, “This project has affected me, in that it’s made me have the kids do more of a hands on type of thing, more where they could see start to finish, rather than just a piece of an experiment, where you get the right answer.”

Ronald found the University staff very helpful, knowing that the graduate students and the professor were available. He explained, “To know that I could get live specimens . . . To know that within striking distance, which is not too many miles from here, the University would be very supporting and even encouraging if we wanted to take on a similar project or another project. And I know that Karen Oberhauser has a website where we could access that. This has sort of expanded our horizons quite a bit, to know that I could get some of these things and get going and get the students involved in raising the monarchs, tagging them, following them even on the website.”

Ronald had taken advantage of a variety of learning opportunities, and believed himself to be a fairly good judge of high quality staff development opportunities. Ronald was very complimentary about his experience in this Monarch project. He commented, “I have done a lot of workshops. I have been a Danish exchange teacher, done science in the Rockies, and this ranks up there at least with the top couple.”

In conclusion, Ronald felt that all science teachers should have an experience like the Teacher-Scientist-Student Monarch Institute. He commented, “Every science teacher should jump at something like this.” “We got to see what real research was like, and it was beneficial for all three of us, and I would say especially me.”
Group 3
Catherine Peel

Prior to the Monarch Monitoring Institutes
As of 1999-2000, Catherine had taught for 6 years. She currently teaches science to students in grades seven and eight at a suburban K-8 private school. Prior to teaching middle school, Catherine was an elementary science specialist. Over the last five years, Catherine had been involved in curriculum planning and teacher staff development. This year (1999-2000) she will help develop a new inquiry-based middle school program for a her school as well as provide assistance to elementary teachers in planning and implementing science in their classrooms. This is Catherine’s third year (2000-2001) teaching the middle school science.

For two years prior to participating in the monarch institute, Catherine had been involved with Monarchs in the Classroom, a less research-intensive teacher training for elementary teachers. And Catherine thought that the monarch institute would be a way that she could learn about monarchs in greater depth. She said, “I have always loved field biology. I am interested in exploring monarch biology in greater depth, learning more about other species and practicing new skills and techniques that will help me design a more student-centered, inquiry-based curriculum in my school.” Catherine had also presented on elementary science teaching to other educators in her school at a nearby university.

In her application to attend the Monarch Monitoring Institutes, Catherine wrote about the uniqueness of monarchs for classroom work.

“One of the most successful inquiry topics that the students are involved in relates to the raising of monarch butterflies in the classroom. I am in awe over the interest and sustained learning opportunities that this insect has provided. Inquiry is the heart of science, and as is seem with the monarchs, students take real ownership if the questions come from their own interests and experiences, and they are allowed to follow through with their own methods of problem solving.”

First year after the Monarch Monitoring Institutes
Catherine’s learning about monarchs can possibly benefit the entire school through her lead role and work on the building science curriculum. Catherine is also the only science teacher at her school and this can be obstacle to her sharing with other colleagues. In the monarch project, sharing through e-mail was one way to connect Catherine to her peers. The teacher that partnered with her for the project was at the local high school, which worked well. Catherine commented, “I am the only science teacher at my school. But I do belong to local science groups, and a high school teacher at a nearby school did our project together. We have built a sharing kind of relationship, which was great. I love e-mail.” The monarch experience according to Catherine helped to meet some of her personal and professional needs, i.e., relationships and peer communication about a shared profession – science teaching.

Catherine’s school was a private school that had adequate computer access for students and staff. There was no access to the Internet, but many students had computers at home that they could use to complete projects. They used the computer extensively to enter data each week into the Excel program and to communicate through e-mail. The principal supported Catherine’s efforts to extend the teaching about monarchs. She said, “My principal of the school has been extremely wonderful in allowing me to go off to do this teaching, to do research during the school year, and, also, they are supporting me over the summer, taking these kids [to do field research]. The support that the principal gave Catherine was also financial in that she was paid a salary over the summer, and funds were provided to purchase supplies needed to do the monarch research. Catherine also received parent support. She stated, “The parents are supportive, once they’ve hooked into it [monarch research].”
Catherine had selected two eighth grade students for the monarch institute training. The two students have shared their monarch expertise with students in other grades. In fact, Catherine stated that they “were excellent.” In addition to completing their own research project, they have been involved in several other projects. When speaking about her student team, Catherine said, “The two eighth graders have been phenomenal. They helped with the prairie day and took grade seven students out to a field project. Both students’ work was shown in the Monarch Fair and some of our students are going on the regional fair in Mankato in March.”

During the summer and fall, Catherine’s team monitored together every week at the Arboretum, where the staff were very interested in their work. They loved identifying insects and plants, and spending the time together. She commented that it was interesting to see how she related to the students during this experience. Even though she didn’t change her role completely, she felt much more that she and the students were learning together in the field.

Catherine has extended the active research to other science units. For example, she talked about the prairie unit, “The prairie day was a total investigation day. Students conducted brief experiments of their observations. But things like this take an incredible amount of time.”

Catherine identified time and need for more ideas of active research projects as barriers to her doing more active research with students. Time, according to Catherine, was one of two barriers to conducting more active research with students. She said, “I don’t have the luxury of a 45 to 55 minutes class periods. Time is a real barrier. And ideas similar to the monarch project would be great.”

**Second year after Monarch Monitoring Institutes**

Catherine said she became frustrated in that there’s never enough time during the school year “to squeeze in all the things you would like to do.” In addition, because of the seasons in Minnesota, she could get the kids outside to do fieldwork just in the little time in fall and maybe a little time in the spring. So when she got back from helping teach at one of the Monarch Monitoring Institutes, she took a group of 12 students and worked with them every week on a monitoring project, doing field biology out at a meadow site and then had them each develop their own research project. She worked with them over the school year as well, to continue to build these research projects. She reported, “They all went on to the state science fair this year and two of them I took to Kansas City for the monarch population dynamic meeting in May, which was very exciting for them.

During the 2000-2001 school year, Catherine had all of her grade seven students complete a research project. Each year, her goal is do more with the research component. This year, Catherine spent ten weeks studying and working with monarchs. The study of monarchs was extended for some students as they prepared for participation in local and region science fairs. Catherine said, “They do the projects, they collect the data, they put together a class presentation, and then some of them use this work to go on and exhibit their projects at the Monarch Fair at the Bell Museum in December.”

The monarch project was one of the high points of 7th grade biology as Catherine starts out the year and she refers to monarchs all through the year. She said that with that beginning, “I’ve got kids hooked, I’ve got parents hooked. And all through the year, I use the monarchs when I talk about conservation, when we talk about ecology, when we’re talking about classification and things like that. It’s just so easy to come back to that. And then we do Journey North in the spring. So the kids are supportive. The parents are supportive, once they’ve hooked into it. . . . They’re my support group.”
Catherine also found it easy to work with other teachers in the middle school. She reported, “The art teacher works with me in the fall and does monarch artwork. The math teacher, if I need help with graphing or I need kids to be aware of that, she does that. Our technology person does the Journey North with my students so I’m not taking out of my class time to do that. I set up everything but they get to use the computers to do that. We have a nice team thing going here which is also very helpful in doing anything like this. If I need extra time, I can do some negotiating with class time, if I need to be outside and things like that.’

Catherine used the monarch course materials to assist students in developing testable questions, and she had developed her own process to help students. When describing the process she used to help students develop testable questions, she gave the following explanation, “We start out from the beginning of the year basically in all classes, and I have papers all over the room. Whenever there was a question and we specifically do this with monarchs, I say ‘write it down.’ We just go up to these big pieces of poster board on the wall and they just write the question down. There’s a series in there [monarch curriculum] about how to develop a question – not being a yes or no question. They brainstorm in their groups. Every student had to bring a list of ten questions that they’ve used and journaled about over the class periods as well. And then they negotiate. They pick their two best questions, and each student, for example, in a group of four, then would explain their question, and how they would see their procedure develop.”

Catherine’s process of helping students write testable questions stretches over an extended period of time. Students had the opportunity to think about different ideas they had and determine whether or not they were testable. Catherine said, “You can’t just expect them, on the spur of the moment to come up with a question. It has to happen over weeks and months of thinking and writing it down and making observations.”

Catherine also identified how important building a team was for her. Team, as defined by Catherine, was peer teams, student teams, and teacher-student teams. Catherine commented, “Even though there are only two students in the research program, that made all the difference. As a teacher, I learned a lot, but students being able to talk to their peers about what happened made a difference. Just build a team and see what a team can do.”

Catherine had taken a leadership role within the monarch project in that she was a “teacher-of-teachers.” When asked to explain why she had become so involved with the monarchs project, Catherine said, “I do have a passion for science. I love science! Once I got into this monarch thing, it was perfect because there was so much networking that I could do.” She said that Karen Oberhauser has really been a mentor to her. Catherine particularly was hooked because Karen “was willing to take teachers into the science mode, to really make me feel like I am a real scientist. In fact, she also brings students along in the same role.”

Catherine said more about how much she likes to work with monarchs. “When working with other teachers, it’s so easy to get them enthusiastic. [The monarch] has so much to offer and there are so many different avenues, no matter what grade you’re teaching. There are just so many ways you can use this organism to teach science and kids respond so well. So it’s an easy sell.” “It’s hard to replicate that in other areas because of the depth and the intensity of what goes on.”

Catherine also gave her input as to why some participants may not continue doing monarch research with their students. She said, “It’s a lot of work. It is a tremendous amount of work and I think sometimes you just get overwhelmed with so many other things along the way, that you [fail to adequately] prioritize.”

Catherine will work with 11 students again this summer, both on monitoring and developing their own research projects in the field. She said, “We will spend the whole summer, at least one day a week this
summer, doing that again. And then they will spend, basically, the entire school year next year developing and finishing up that project for our science fair, for the regional fair. And then my expectation is many of them will go on to the State Fair and there will be other opportunities as well.”

Catherine already did a lot of hands-on work in her classroom, but she said, “What this butterfly project has taught me is the importance of kids developing their own questions, whether they’re developing them for science fair or whether they’re developing them for specific areas of study that we’re doing in 6th or 8th grade.” She has seen that it is exciting to the kids, “especially in middle school,” and they need to develop their own questions rather than, as she said, “have me telling them what the question is right off the bat.” “They need to explore and have real ownership in what they do.”

The other thing Catherine thought she learned to do with this project was much more work in the analysis part of it. She said she had overlooked this piece when teaching scientific method. She said, “And that’s something that I guess I would continue to expand upon. The statistical analysis is something really important. It’s a great way to integrate math into science and I would like to do a lot more with it.” She said she needed to spend a lot more time with it looking at all the different ways you can take the data and use them. She added, “It’s hard because that’s always at the end of the process and that’s when we’re scrambling for time. And yet it’s important to stop and give kids a long time to think about what they have and what questions they can answer from it. And what other questions the data are generating and all that.”

In conclusion, Catherine thought that the monarch training was a “wonderful program.” It had influenced her teaching a lot, and she said, “It probably will continue, not because of the topic matter, but because of what I’ve learned in engaging students in the research component, which has become very important to me.” Students also had benefited from the experience and had found they can really make a contribution that is important. Catherine thought this was another way that she had made a change. She said, “I always had a lot of faith in kids, but I’ve only been teaching middle school for 3 years, and I think there’s just some great potential there for them to really be contributing in a significant way, and I want them to see that they can do that.”
Prior to the Monarch Monitoring Institutes
During 1999-2000 school year, Darlene taught Biology I and II at a rural high school. She had taught science for 8 years. Darlene’s teaching responsibilities during the 2000-2001 school year included, Biology I, II, Advanced Placement Biology, and Anatomy and Physiology.

For a number of years, Darlene has required her advanced biology students to do a semester research project. Students came up with a hypothesis, designed an experiment, conducted the experiment, and then did a formal report. Students conducted the experiment outside of class.

Before participation in this research project, Darlene had had extensive experience doing fieldwork and including her students in projects. Darlene and two students participated in a project funded through Project First (Field Involvement and Research by Science Teachers) and the Wisconsin Academy of Science Letters and Arts. They were helping to establish baseline data of the lupine locations. Darlene said, “We spent many hours walking the roadways looking for lupine and then recording our data. Our goal was to establish a baseline of the lupine locations so we could look for the Karner blue butterfly which is an endangered species.”

Darlene had been instrumental in other community science education outreach programs. For example, she had developed a partnership with a military base near her town. She had worked with the biologist there developing several projects for students. She included students in a project to restore a prairie in the State Natural Area and a day to eradicate Glossy Buckthorn.

Darlene has also shared her expertise with other teachers in both mathematics and science. Darlene commented, “I will be presenting at the WWEA Convention in February to math and science teachers to demonstrate how math, science and technology can be integrated in the classroom. And I have also helped to train people in the science department in the usage of the TI–82, probes, and CBL (Calculator Based Lab) units.”

First year after Monarch Monitoring Institutes
This school year Darlene had four classes of students participate in the National Public Lands Day. As part of their participation they did prairie restoration work. Darlene credits her participation in the monarch project and the media exposure she had received for getting her name out in the community as someone who knows and is interested in ecological community projects. She said, “With the contacts I’d made, we’ve gotten involved in eradication of exotic species. We were actually contacted by a community member to have students come out to Spring Bank, which is a local area where there’s a lake and residents have cabins. We did eradication of Glossy Buckthorn out there. I guess the way they found out about me was through information that was in the paper, again stemming from the contacts I made while doing my monarch project.”

In addition, Darlene had garnered public support and interest in their monarch research. She stated, “We had a huge project over the summer. We had over 1,300 eggs and reared 700 monarchs. Teachers and students were stopping by and we even had newspaper coverage.”

Darlene’s sophomore biology students reared monarchs this school year (1999-2000). They reared them to adulthood and then released them. With her advanced biology class, she utilized assistance from the University of Minnesota, inviting two of the student researchers to come and work with her students, helping them come up with testable hypotheses. In fact, Darlene was pleased that one outcome of this
monarch research institute was that she now had definite steps that she can use to assist students in
deciding on a research topic. She said, “I want students to do more inquiry. But I often have difficulty
helping them come up with testable research topics. Michelle, Melinda and I came up with some steps
that work in helping students decide on a testable research project.”

Darlene and her two monarch monitoring project students shared their team-generated research project
with all of Darlene’s classes. Darlene had made some slides while they were doing the project and when
students were working on their projects, she would use theirs as an example of how they came up with
their hypothesis and how they came up with the design of the experiment. Darlene said that throughout
the project, “They did just an outstanding job. They were there to help with the butterflies – help me
explain things to the students. There was actually one time when I got called out of my room and I had
my 2 students continue on with the class because we were talking about the monarchs and about their
lifecycle, and I had the girls actually teach the class when I got called out.”

Darlene and her two students found the help from other teachers in the project and the project staff
invaluable. She said, “We e-mail all the time. I communicate with two Texas teams that I’ve been
working with, and I’ve been in constant communication with Karen and Michelle up in Minnesota. . . . I
was e-mailing them probably daily for a while there, until we figured out the design of the experiment.
We had an original plan, but then it seemed like nothing was going right, and so we were in
communication all the time.” Darlene felt that without access to e-mail their project “would have fallen
apart.” For example, “if you’ve got these butterflies that are laying eggs and now the plants are dying,
what do you do? You can’t wait to try and call someone and hope they return your call. You didn’t have
to worry about telephone tag.”

During the 1999-2000 interview, Darlene expressed that the study of monarchs had stirred quite a bit of
interest among students and staff. Other teachers had inquired as to what was going on in Darlene’s
classes. Students were talking about their monarchs in their English, socials studies and mathematics
classes. Darlene said, “Now all of my students have access and knowledge about monarchs. Some
students who did not get involved in school want to help with the monarchs outside of school.”

For some students, studying monarchs served as an external motivator that got them more involved in
school. It was a welcomed occurrence for teachers and parents alike to see students who were once
unmotivated now motivated to learn. Darlene said, “I have teachers and parents voice how much they
enjoy the monarch project and that they detected a change in some students.” The change the parents and
teachers reference was a “positive” change. They saw students wanting to learn and enjoying it.

Darlene felt a bit overwhelmed this year because she and her students were working on their research
project, she had hundreds of pupae at home she was rearing, plus she was trying to get them started in the
classroom, plus trying to start the school year. Darlene planned to do more next year in terms of
extending active research into other science topics or units. When commenting about her future plans for
extending the study of monarchs and use of active research techniques she stated, “I look at this as
ongoing and improving. This year was a lot of learning. Next year my sophomore biology class will do
more experiments.” Darlene added, “This year, I was trying to figure out how to put it all together and
how to organize it and have them rear them and get them familiar with the monarchs and everything
else.”

Second year after Monarch Monitoring Institutes
Over the summer, Darlene did a lot of the work to prepare for the monarch unit. She had had very good
student participation. And students actually volunteered their own time to assist Darlene in doing the
fieldwork. Darlene looked forward to continuing the study of monarchs with her students. She said, “I
thought it was good experience for them to be able to get out in the field and learn to collect the data. It
wasn’t just the same people that had done the original project with me. And I have let my students know that I hope to continue this project for who-knows-how-long and I’m looking for volunteers every summer. So far, I have not been lacking in students volunteering to go with me and collect data in the summertime and put it into the computer to continue our research.”

This school year (2000-2001) Darlene extended active research in her classes, having students observe, record and analyze data. And she has extended the study of monarchs in her classes. Darlene stated, “With my Biology Level 2, which is an upper level biology course, I do have the students do an independent research project. And with the help of Karen and the graduate students I had worked with, we were actually able to come up with a format to help me help students come up with better project ideas.” Darlene thought it went much better this year.

One of Darlene’s goals was to get living organisms into her Biology 1 class because she didn’t feel she was doing enough at that level. She said, “And I can’t imagine teaching Biology 1 without it now that I’ve started it. This is something that I plan on continuing for as long as I can.”

Darlene felt a lot more comfortable doing research. Beyond that, she said, “I think the students also look to me as an expert in the field or an expert in this area with monarchs, so you get a certain amount of respect from them just from having been involved in all of the research. And so that’s been real beneficial.”

Darlene had as one of her goals to have the other biology teachers in her building also working with the monarchs. But she thought, “Before they’re willing to start doing that, they want to make sure that I’ve had several successful years with it. They’re looking at it; they know about the project; it’s been in our school paper. And we talk at department meetings that one of the goals is to get students working more with living organisms, and this is one way to do that. As of right now, I just haven’t quite convinced them that is what they need to do.”

Darlene found that monarchs were living organisms that students liked to work with. She said, “The students are very excited about having the monarchs in the classroom, working with the monarchs, handling the monarchs. I don’t think I’ve met a student yet that doesn’t like butterflies, so that’s been real positive. The kids are excited to come into the classroom, to learn how to handle them, to be able to release them. I’ve never had a student say, ‘no don’t want to release any.’ They’re real interested in the real life aspect of it.”

Darlene found the ongoing contact with the staff at the University of Minnesota helped her learn more about monarchs whenever she ran into problems. She gave examples: “When my monarchs were going into the chrysalis, and they were going into the J and dying . . . I was able to e-mail them and find out. I also found, at first, I was losing a lot of them and some of the monarchs had been parasitized by the fly that lays the eggs into the monarchs, and I didn’t know that. And then they would e-mail me back and they would say, look for the pupae in the bottom of the container and sure enough, it was there. And I just didn’t know to look for that.” She also continued “keeping in touch with the teams from Texas, asking them where they’re at and what they’re doing and if they’re doing anything with their monarchs.”

Darlene continued the monarch monitoring part of the project. She said, “I also am still keeping the data, putting that into the computer and keeping it for myself, because it might be neat to see what happens to the monarch population if I can monitor for 10 or 15 years and have that data to go back to.”

Darlene valued the monarch experience, but she had some challenges. First, she did not have as many eggs as she would have liked for the second year. Darlene has come up with a remedy for that problem, and will simply order more eggs next year. She commented, “Last year, they [University of Minnesota
monarch staff] had the eggs on plants and I had lots and lots of caterpillars. Now this year when they sent them, they cut out the leaves and sent the eggs on the leaf and I didn’t get as many.” Not having sufficient eggs did hinder Darlene in that there were not enough caterpillars to do as many student projects as she would have liked. She had tried to raise her own, but failed, and because buying eggs was not in her budget, she had to pay for them herself.

Second, there was the issue of covering certain amounts of curriculum material in a fixed amount of time. Darlene believed that the monarch unit fit in the curriculum requirements, but there were still a lot of other science knowledge requirements she still had to complete. Darlene stated, “We’re supposed to cover X amount of curriculum and doing active research fits into that. But it still takes time, and so then you’re trying to get everything in. And I don’t have the answer to that one because it seems like we’re always asked to teach more and yet never given more time, and they never want to take anything out. So that, sometimes, can be a problem.”

In spite of these challenges, Darlene felt that the monarch unit was worthwhile and it had changed her and her students. During her summarizing comments, Darlene said, “It’s [monarch training] something that’s changed me and changed the students that have been involved. So it’s not a project that just happened once and it’s over and done. It will be a continuing project for me for many years to come. So I think that this was very valuable for me personally and professionally, to help me with research.”

For Darlene, it was a personally a life-changing experience.

“Almost everybody in town knows, basically, that I have this interest and this love of monarchs, and that anytime anybody sees a monarch or has a question, I get phone calls at home. The monarchs aren’t something I just do in the classroom. This is something I’m looking at all summer. People that know me know that whenever I see milkweed, I’m always looking for caterpillars. When I find them, I bring them home to raise them. I’ve actually got milkweed growing in my yard because I want to see if I’ll get some eggs and caterpillars on it. So it’s become a part of my life. It’s not just used for one unit during the school year and then I forget about it. In fact, my husband and I were talking about a way we can get milkweed in our garden and get some butterflies in there and put a cage around it.”

“People are now always mailing me articles when they find information about the BT corn and how it’s affecting the monarchs. People in the area who’ve seen my name in the paper, that I don’t even know, send me information like this.”

Darlene rated this particular class quite differently than others she has taken to earn credits. She said, “You’re looking for a way to get classes to take, and you always wonder, ‘is this going to be a waste of my time.’ This definitely was not a waste of my time . . . it was not just taking a class and it’s over. It’s something that touches your life and that will be with you forever.”
Group 3
Kate Harlan

Prior to the Monarch Monitoring Institutes
As of 1999-2000, Kate was a veteran teacher of 23 years. She currently teaches in a rural school, grades 5 – 12. This teaching position requires that Kate teach a broad spectrum of science courses. She teaches 8th grade general science, 9th grade biology, and 10 – 12th grades earth and environmental sciences. In addition to Kate’s teaching responsibilities, she is the girls’ softball coach. This school year Kate’s teaching responsibilities expanded to include a media class and grades seven and eight science.

During the 1998-99 school year, her school district became involved in a Wisconsin Advanced Telecommunications Grant. In her application for the Monarch Monitoring Project, Kate wrote:

“This grant has given us money for staff training, prairie restoration, and technology. My 8th grade and high school environmental science students are involved in an original research project of an 89-acre tract of land near our school. We are conducting a thorough study of this land. Some of the aspects we will be researching are local history, soil, water quality, weather, and variety of species. This information will be used to help us restore 5 acres of prairie. We are working with the Madison Arboretum, Local Rotary Club, elementary students, parents, and other community members in this process. Not only will this project allow the students a chance to do original research, but it will also allow students to see how science is used to produce a product which will benefit their community.”

Kate wanted to be part of the Monarch Monitoring Project because she thought the information would be valuable for their prairie project. She said, “Many of the elementary teachers would like to ‘do something with butterflies.’ None of us really know much about butterflies.”

Kate has been a leader in sharing her expertise in technology use and environmental science with other teachers. She stated, “I have taught many staff workshops. Some of these included: Hyper studio, Science Wizard, Clarisworks, Digital Camera and the Internet. As part of a WATF Grant, my students and I will run a summer institute for teachers on prairie restoration and technology use.” Kate’s students involvement went beyond learning about monarchs in class. They have been instrumental in helping Kate share technology uses with other staff. She stated, “I have trained a group of students to assist teachers in using technology. Students from the high school were involved in planning and implementing a summer institute for teachers.”

First year after the Monarch Monitoring Institutes
Kate and her students felt they benefited from learning about monarchs and have shared that experience with others. During the 1999-2000 school year, some students taught classes on monarchs to elementary students. And Kate had done a lot to share her monarch training experience with other staff, students, and the community. She said, “I’m teaching a summer school class for grades three and five on monarchs, just on going out and how you raise monarchs and stuff like that.” Kate has become the community “go-to” person on monarchs. She often receives calls from community members asking questions about butterflies.

The student teams who went to the institutes were totally involved with every aspect of their team-generated research project. The fall of 1999, she had students collecting and raising butterflies from larvae and had them collecting data on milkweed and writing up the research they did. In February 2000, Kate stated, “Our teams have worked well. We made a huge project for ourselves. We just finished last week. My students were so involved.”
The prairie restoration project had been a large undertaking for Kate and her students. In fact, Kate’s field experience and use of active research techniques pre-dates her monarch training. Although Kate was actively doing science with students, she did not believe that she was doing it as well as she could. She commented, “What [monarch training] helped me do was to focus. I always felt I wasn’t quite accomplishing what I wanted to. We’d go out, it was cool, and we were collecting some stuff. I was showing them how to test water, but I wasn’t coming up with an answer to things. And this helped me focus and organize the units, if that makes sense. The techniques they used to set up the research questions really helped.”

Kate has participated in numerous teacher staff development sessions. She said, “For the last 10 years, I have worked with teacher training. I am on the district staff development committee, which plans our teachers’ in-service.” But the monarch training has had the most impact on how Kate now teaches science. Kate’s comments revealed how the monarch training has changed her instruction. She stated, “This project probably affected how I teach more than anything else that I’ve taken. This process of doing science is entwined through all of my classes now. So I set up differently how I present scientific information to kids, making them question more and get more student input to how we study science.” This has changed the way she does all experiments.

Kate was very complimentary of the project staff. “I was just absolutely amazed at how good a job Kate and the grad students did working with the kids and with the teachers.” She explained:

Seeing them interact with the kids that we brought, who weren’t always angels, and then the teachers who were also a pain in the neck to work with, they were just really patient and knew how to explain things, and they modeled everything.” “It’s really easy, as a teacher, to sit back and not do stuff and just watch because you don’t want to look stupid. And they really got everybody involved. It really modeled how we should teach the kids. So it was really easy to bring it back to the classroom, because each time I was presenting it, I was going back to what we did. How did they present it?”

When thinking of one of her colleagues, she thought, “For a super-traditional teacher, it’s almost like they need to go through a program like that – where they have to do it and they have to see it. For me to tell him, he’s not convinced. If he actually had to go muck out and run around and chase monarch butterflies in the woods and do stuff, it would work really well. That kind of training, where you bring kids and teachers together and make them work, I thought really worked well. That whole process, of a teacher bringing two students and seeing how well it worked with those students, was huge.”

Second year after Monarch Monitoring Institutes

The second year after the Monarch Monitoring Institutes, Kate expanded the use of active research methods to various science units and field experiences. She said of her students, “They’re designing their own research questions, usually once in each unit, even if it’s a simple question of what’s more dense, ice or water? They’re designing how we’re going to test it and stuff.” “The high school students did individual and group research projects having to do with monarchs and raised larva in the classroom.”

Kate said she likes to be outside, and she said, “This project has gotten me outside a whole bunch more which makes teaching more fun to me. The kids enjoy it more. I enjoy it more. Sometimes the organizational skills are a little bit much when you’ve got kids doing different stuff. So sometimes everything doesn’t work so perfectly, but I guess that doesn’t bother me. . . . I don’t see that there have been any negatives at all. . . . High school kids – it’s hilarious watching big football players running with nets, chasing monarch butterflies. It’s just fun.”
Kate talked about a class with many special education kids that had a hard time sitting in classes. She said, “Having them out and moving around and actually having to do stuff, is much better.” “AND the fact that they see that they’re doing something that’s worthwhile, for example, if you send data to the University of Minnesota, or we also do a lot with web pages and publish the research we do on our web page. And they’re going and teaching elementary kids, so there’s a purpose to what they’re doing. And it really connects them with the school, and so it’s really been a positive.”

She incorporated active research into a winter environmental research unit. This school year (2000-2001), Kate teamed with the calculus teacher to extend active research into the winter environmental research unit. She stated, “One of the things that came out of this was that we did a winter research project where we had students go out and design questions to research in the winter. And they analyzed the data with Excel, so we did kind of higher end analysis of data.”

Students also did research on water. Kate explained, “We also did a water research project. It’s kind of the same process [referring to monarch study] but just a different subject. So the students are going out and we did a bunch of stuff with water and stream because we live on the St. Croix River. But then, instead of just studying how rivers work, the final thing was that they designed their own questions.”

The use of the Excel program facilitated students’ ability to accurately and efficiently analyze data for a variety of research projects. The middle school students have done different kinds of calculations. Kate stated, “When we did the winter project, we used Excel to analyze data. I have switched over from ClarisWorks with my students. The middle school has done graphing and averaging, but at the high school we have done t-tests and chi-square.”

Kate had found that having students use the computers to analyze and display data to be extremely useful. In fact, the computer was an invaluable resource to the team in completing the required team-generated research project. Kate cited some of the uses. She said, “I sent digital camera pictures to all the teachers in the institute. We e-mailed Kate, and she came out and visited us. I e-mailed work to Lee on something other than monarchs. And we sent our paper back-and-forth via e-mail to St.Croix because we have not been able to get together.”

An unexpected, yet welcome, result of the monarch institute in connection with technology was that Kate’s middle school students created a web page site for their monarch pictures and research. Kate’s students have had substantial experience learning about monarchs, active research, and technology applications. Also, they have done substantial public relations work in the community on monarchs. She stated, “We have sent out the school newsletter including information on monarchs. I have contacted a local group working with prairie restoration and this spring we [Kate and students] will present some things on monarchs. Some students and I went to a cooperative education group (a lot of teachers come together) to present our research. And we get lots of parent phone calls about monarch sightings and they bring in larvae asking what to do with them.”

It was obvious that Kate had been a very busy lady. The biggest challenge for her was getting the research paper done. The students in the project were overly extended with other activities. Kate gave two suggestions, “I would probably not pick students next time who are overly involved in extra-curricula activities. And get more help steering us so that we do not pick such a huge project.”

Although Kate stated two challenges, she was not sorry that she participated in the monarch institute. In conclusion, Kate’s comment summarized her feelings about the monarch project. She commented, “This is absolutely the best I have ever attended. It was just outstanding.”
Group 3  
Serena Sullivan

Prior to Monarch Monitoring Institutes
As of 1999-2000, Serena had taught for 19 years. Currently, she teaches students in grades 9-12 at a rural high school. The courses she teaches include: biology pre-AP, biology AP, aquatic science, and integrated physics and chemistry.

Serena had used an inquiry-based approach to teaching since her experience with Project Wild in her biology classes and Fluid Earth in her aquatic science classes. Her hands-on approach to teaching science included projects using mealworms and various plants. During the study of arthropods (i.e., mealworms), students looked at how they reacted to various external stimuli. They collected, analyzed and graphed the mealworm data using Excel and other graphing programs. During their study of leaves, students examined different types of leaves and their structure variations. They also used t-tests and chi-square tests to complete calculations during their study of genetics. They predicted actual ratios versus expected ratios and collected data using surveys to get information from people. Serena described herself as “[one who is] always looking for new projects to peak students interest in science.” She hoped to actively involve her biology students with monarchs.

Serena was part of a group of five science teachers who created a workshop called “Science on the Floor” targeted to elementary teachers. She said, “Elementary teachers tend to forget science in the myriad of subjects they have to teach because they feel that it is very difficult subject and that it takes tons of expensive equipment. We tried to give them positive lab experiences with inexpensive equipment that they could do even on the floor if they only had slanted desks in their classrooms.” Serena has also co-presented Project Wild workshops. As part of a GTE Gift fellowship, Serena and her math Gift fellow colleague presented how marine science and Algebra II could be integrated.

First year after Monarch Monitoring Institutes
Serena’s student teams shared their monarch learning extensively with elementary grade students. She commented, “We have what is called pick campus. For about three days, students in grades 5 and 6 came over, and the classes explained to them what they were doing. They showed them the butterflies chrysalis and we had a digital camera, and the kids took pictures of the different stages.” The students also set the pictures up on the computer and did a presentation on the various life cycle stages of monarchs. They showed how they were able to conclude that monarch eggs had spores, which greatly impacted their successful in growing the eggs to maturity.

Serena’s student teams have also shared their new learning on how to use Excel program for data calculations and graph presentations. These grade 5 and 6 students had the benefit of having students closer to their age share the many different learning opportunities they experienced during the monarch institute. The monarch institute student teams also provided hands-on learning experiences for the elementary grade students. Serena commented, “We took them outside and showed them milkweed.” Students who participated in the monarch training learned about the importance of having a substantial supply of milkweed and knowing how to identify and secure it as a critical component in the development of the eggs. They shared this very important bit of information with the grade 5 and 6 students. Serena reiterated the importance of having an ample supply of milkweed, “A weakness on our part is that we live in Pleasanton and did not have the milkweed. We had to really scramble to get the food. Any more larvae, and we would not be able to feed them. I did come upon a place that had milkweed which I may try.”

Serena obtained an additional graphical program to assist students in completing graphical analysis when doing their projects. First, Serena still likes to teach students the why and how of the mathematics being used in the programs. Once she had discussed the mathematical why and how, she allowed students to
generate graphs and data results using the computer software. Serena commented, “I had students do everything by hand first. Then I showed them how to let the program do the t-test for them. They almost killed me, but I told them that they needed to understand what they were doing. “

The major disappointment for Serena’s group in terms of their team-generated research project was the discovery of spores on their eggs. Because the eggs had spores, the students were not able to mate males and females. Serena was able to adapt and turn what could have been considered a disaster into a valuable learning experience. She reported, “Students learned about spores which was a good extension. But we did not get males and females to mate. They did not want us to mate those who possibly had infections, But our kids went through the entire life cycle and they were able to work with the milkweed.” Students had the opportunity to experience problems during research that real-world scientist often encounter. They also had an opportunity to study spores more in depth, and collaborate with research scientists on how to best deal with their unwanted problem.

Serena said that her principal fully supported her efforts to expand students’ science learning experiences. She commented, “The principal supports any kind of idea that we can come up with. They would let us go on a field trip, or if I have a crazy idea I want to do something, he will back me, as long as it sounds semi-reasonable, and I am not going to endanger the kids or anything.” Serena felt good and was very positive about the strong support she received at her school.

Serena Sullivan was doing more inquiry in the classroom than she had before, and noted that the focus on standards was making the process more important than it was before. “This fits right in.” She had to rewrite many labs, and noted that kids were getting more out of doing them now. One student asked her, “Why are you making me think?”

Although Serena and her students experienced a detrimental problem to their monarch research, she is committed to continue to do what is needed to complete active science learning. She commented, “We had to find our own sources [referring to the milkweed]. To get elementary kids excited and not be able to find the materials, it [science learning] will die on the vine and that would be a weakness.” Serena concluded the interview expressing her feelings about the monarch institute training, “It was a really good experience.”

*No second year interview*
Group 4  
Bernice Zachary

Prior to the Monarch Monitoring Institutes  
Bernice Zachary teaches seventh grade science in a suburban middle school in Texas. She has a Bachelor of Science in Medical Technology degree and has taught for 24 years. Bernice wanted to be part of this project because she had not really been involved in an extensive research project. Two of her most memorable experiences before this project were studying plants and fungi in the cloud forest in Mexico and studying plants in a desert biome in Mexico.

The only active research projects that she had been doing with her students were the Scientific Methods Fair projects required of all students in her school. She said she did not take her classes and “personally do active research with them.” She said, “It’s an independent project. We teach them the scientific method and then we say, ‘now, they have to come up with one.’” Teachers do not help them during class. Bernice said, “We will do some experiments to show them how to do the format and things like that, [but I don’t] take my kids out and do all these things and then do a project together within the classroom.”

After the Monarch Monitoring Institutes  
Bernice was in one of the last groups (summer and fall 2000), so that at the time of this report, she had only one school year during which to try to implement what she had learned during the Institutes.

One of the outcomes of the Monarch Monitoring project for Bernice and her students was that they completed their team-generated research and went to the science fair in January. The students won first place at their school’s science fair. They went to the Austin area science fair and won first place in the Team Project division. They also won a Discovery Award. Bernice said she was so proud of them and the hard work that was done to accomplish this. She said that she was “extremely busy with the project.”

For both the team research and monarch monitoring parts of the project, Bernice worked with a teacher from another school in another town. The plot they monitored was at the other teacher’s house about 30 minutes away, so she said that that would take a whole day, but she also said, “We made a wonderful day of it.” There was a problem getting the students to the site because the teachers were worried about liability if they took the kids in their cars. Bernice said, “One parent was extremely faithful. She learned so much and she was out there helping us. The other kids—they did what they could do.”

The school district did let Bernice take the school van – they paid for it all – and they went to Point Oransus, which is about a 3-hour trip, to South Texas, to do some of their research. They also went to the wildflower center, and Bernice said, “We set up a booth there with the monarchs, and we were trying to catch our butterflies for our research, try to kill two birds with one stone.”

Bernice talked about some of the difficulty with their research project. Bernice and her students got help from Bill Calvert and Karen Oberhauser and another teacher from an earlier group. So they were able to get the numbers of monarchs they needed through other people.

“For us, what we’d chosen to do was a wonderful idea, but it was really a hard project to do, because I couldn’t leave the classroom to run out and catch butterflies when they were flying. This one lady called me and said, ‘I have all these monarchs.’ Well, I was in class. I couldn’t leave the classroom to run out there. I had friends telling me, ‘they’re there, why don’t you come over?’ I would go out and look when I could. But of course, I was getting mainly the monarchs; I wasn’t getting the larvae. I was able to get some larvae at one of our parks, the parks and wildlife man collected as many as he could.”
In talking about what she did in her classroom, she said, “I really didn’t do a whole, whole lot.” Then she said that she did use milkweed observation as the vehicle for teaching the students the scientific method. She reported, “When I started doing the monarch thing with my class, we would go out, and we would look for milkweed, and we would do milkweed observation, and they kept a little journal. And then in the classroom, I kind of guided them into doing an experiment, and we had to figure out how we were going to set it up. But that was kind of my way to get them going for their own project later on down the road, the one that they have to do.”

Bernice did use the scientific method materials in the University of Minnesota monarch curriculum book for teaching experimental design and things like that. She found these materials very easy to use.

In an interview shortly after school was out, Bernice reflected on the past year, “it was so much work for me that it wore me out. I don’t have the availability of the milkweed so that my kids can go out and get the milkweed. So I was out running around trying to collect milkweed. Fortunately, I was able to get enough, and then some of the kids would bring some.” One outcome Bernice was happy about was, “We all know what milkweed is. Here it is growing in our schoolyard, growing on the median between my apartment and the school. People would laugh at me. I’m running around collecting milkweed. But it’s made people a lot more aware.”

Bernice was torn about whether she could handle the activity again next year. She said, “The kids LOVED it.” What was nagging at her was that one of her students said, “My favorite thing was working with the butterfly.” So she was thinking that she should continue. She said, “I’m still kind of weighing whether or not I’m going to order the eggs because it was big. It was a lot of work. I work two jobs and then doing the other stuff, I was exhausted. But it was such a wonderful, wonderful thing.”

Bernice said her goal for this year was to spend a little more time outside with the kids. She said, “I’m going to be doing a little more going outside, working with them with observations, and coming up with questions. Because we have like 150 students, and you just can’t say, I want to go here or there. So mainly, it’s going outside or me bringing some things in where we can do observations in the classroom.”

Cindy Peterson, a teacher-instructor with her group, came to visit her classroom in the fall to do an activity. Bernice said that the students thought it was fun, and that she was going to do it herself next year. She thought about what she might do to make active research more manageable, “If I can just take one idea and have the kids do something as a class, where we just have one problem, and we just do it all together and do more cooperative learning situations . . . That’s what I would probably have to do. It could not be an ongoing thing the whole school year or anything magnificent. It would just have to be some little things that we can do together as a class, to get them going in the right direction.”

Bernice thought there would be a difference between her second year and the first year.

“I feel like I’ll be able to do more because I won’t be under the strain of other things. I will be able to take something and focus with it. I’m a little more experienced with it. I have a little more knowledge about what we’re doing. So your first year is trial and error, and you don’t really know what you’re doing yourself. I’ve been teaching for 24 years, so I know how to teach and motivate my students. But to actually take a project where we do something magnificent, I have not done that.” “I think it’s going to be better the second year than the first year.”

Bernice would probably be retiring in two years. She was looking forward to being able to do some other things she would enjoy. For example, she was in touch with a person from their Parks and Wildlife Department and would like to go out with him to do further work with monarch monitoring or do other interesting research.
Group 4  
David Peterson

Prior to the Monarch Monitoring Institutes
David Peterson teaches seventh grade life science at a suburban/rural middle school in Minnesota. He team-teaches with another teacher, Rhoda, and together they have about 350 students. He has served as science department head for a number of years.

One “interesting and exciting activity” he had been part of for 12 years was the now defunct Central Minnesota Regional Environmental Education Council. The council organized and supervised/sponsored workshops like Project Learning Tree, Project wild, Project Wild Aquatics, wetlands workshops, and assisted or led Bluebird workshops at the St. Cloud Heritage Center and community education programs.

David was interested in the Monarch Monitoring Institutes to gather a good active study to include in their graduation rule requirements and to continue some work with monarchs started in his district’s elementary school. He wanted his students to have a chance to utilize or even duplicate the type of work that is a real and worthwhile project. He wrote in his application, “It sounds exactly like the type of inquiry experience I have been hoping to find.”

David has always done the scientific method, but he said, “We never did it in depth all the way through until we got the grad rule. The year before last was the first year we had to do it.” He said previously, “We did small experiments, but oftentimes, we more or less set it up as a class, then had a couple groups do a demonstration or something like that, instead of kids doing their own.”

After the Monarch Monitoring Institutes
David and Rhoda did a lot of work after the first institute in July 2000. David said, “We wanted to make sure we had our own caterpillars for the kids to raise. We made cages. My wife was sewing those up, both for our [team-generated research] project and for us to have at school. We got our adult butterflies. We made sure they weren’t in diapause and were laying eggs.” They wanted enough so that each of their 330 or so students would have one to take home and raise all the way to an adult, if possible. They would journal daily on the monarch’s progress. They made some larval cages and a big adult cage.

David described what they did in their classroom at the start of the year. They set up stations like those the university had used at Wilder Forest. He continued,

“It took us a couple of days to get the students through, where we thought it would only take one for them to get enough details. We found it took longer than we thought to get our kids to really focus in and look for specific details. They’re willing to play and push a caterpillar around on the table all day, if you let them. But to actually measure, notice the difference in tentacles, compare differences in color – color of the stripes and things like that. Those are the things we’re trying to get at, and you don’t want to do it for them, either. ‘So, what do you notice about the tentacles and move on to the next group and that kind of thing’. We put on a lot of legwork during labs.”

“After the stations and throughout the thing, we had students, in their journals, come up with their questions. One thing we emphasized at Wilder, and we tried to cover, was to go over what good questions are like. ‘What’s my caterpillar’s name, we don’t need to worry about.” Just the how and the why questions. ‘How is it possible for the caterpillar to do this, or why does it do that, or how often does it?’ – the whys and the hows and stuff that leads to investigation. Then we
would help the kids try to refine those into something that they’d like to test and come up with a
number of ideas much like Karen, Michelle went through with our groups."
“We started with the entire class and then broke them up in groups . . . gave them some
parameters and stuff – what could we actually do and we can get done. And finally, we would get
them narrowed to a particular hypothesis they wished to test. They had to have that okayed by
me. Then we worked through trying to give a little bit of time every couple of days to work with
their group, to be able to do the planning and stuff.”

At the seventh grade, students have to complete a graduation standard in science and show that they had
done the scientific method. David said, “I had every single student, and Rhoda did too, that was
responsible for doing a grad rule project to do it.” David thought they did a good job. “The kids had
more background because they raised their own caterpillars; they kind of knew what to expect, what to
look for.”

When asked whether the work with the monarchs was pretty successful, David chuckled, “Well, we got it
all done. We made some mistakes along the way. We will be a little more in tune this year (2000-2001).”
They were trying to simplify the logistics of having 330+ students doing experiments in groups of four.
They are planning a different way of distributing the monarchs, having the kids raise them from eggs
rather than the teachers. Last year, they ran out of monarchs, and a couple groups had to go with a back
up experiment with mealworms. David also had some ideas of how to guide the students more in writing
in their journals.

David and Rhoda adjusted their fall curriculum to build it around the students’ experiments with the
monarchs. David said they always work with the metric system early in the year because the kids need a
refresher in just measuring in millimeters and centimeters. They do a unit on graphing along with that.
And the graphs proved useful if students do that in their actual write up of their project. David explained
how they taught some curriculum indirectly. “We cut out a full chapter on characteristics of living
things, but we tried to emphasize as we worked with the monarchs that every organism has certain needs
that have to be met and what the characteristics of life are and that sort of thing, work through it that
way. So we weren’t just giving it lip service, but were literally covering it while working with the
monarchs indirectly, I guess, not saying here are the things that you absolutely have to know.” About
their curriculum, Rhoda thought, “It’s tough to try and cover the rest of our curriculum now, and so, that
will be our goal next year – to figure out how we can modify it some more so that we can get everything
else in.”

David gave an example of how monarchs were used throughout the school year when dealing with other
science concepts. For one, “We do things in classification, and we included the monarch classification to
show them how those fit in. I actually have a literature hunt – they go through and find out about this
animal, give descriptions of it, these animals with members of this genus that wind up migrating to
Mexico and are orange and black in color? And they have to find it.” David found referring back to the
monarchs in this way was helpful with other science concepts because “they’re a little more eager to get
into things if it’s something they are familiar with . . . They have read and heard a little bit about that so
that gives them something more to dig into and look for a little more enthusiastically.”

When asked what impact the institutes have had on his teaching, David answered, “I think once you get
your feet into it, it does show you how much it helps to have kids get that actively involved. And even
though at some points, it can get to be kind of a chore, it runs the kids through completely what’s
required and what’s needed – I mean getting through the entire scientific method, using something that’s
not only available, but interesting to work with.” David thought, “Overall anything we did with the
monarchs, I got far better than average participation in it.”
David said further, “One of the biggest, important points that I found out about this was that sometimes I got the whole family involved. Students took their caterpillar home to do the journaling. Parents called me up and said, ‘I was helping the kid with it, and they had that little First Instar and something happened, I don’t know what, but I know I probably destroyed it or stepped on it or whatever. Could we get another one? Or where can I get one or what can we do?’ I had parents involved with that every day. They were just amazed at how much it grew and stuff like that. I tried to stress to them at open house where they can help and make sure that the students complete that journaling work. We got really, really good feedback from the parents.” Rhoda agreed, “Parent-teachers conferences in the fall were the most positive thing I’d ever experienced. The parents were in awe. That’s all they wanted to talk about at conferences. They didn’t want to talk about their kids. It was just incredible, and our principal was just loving it. So it’s been really good for our school.”

Last year David and Rhoda had hopes to do more activities outdoors, but they ran out of time and it got too late in the fall and winter to do population studies. David was looking to the future and said, “I want to get the kids out this year before it gets too late. I hope to get a couple sampling activities in this fall.”

Meanwhile, David and a student or two continue to monitor the site they selected to monitor for the project. He plans to continue to monitor and involve more students during the summers. He would continue doing this as long as he had the energy. He said that a couple elementary school colleagues hesitated to work with monarchs again because “it is too time consuming, and they didn’t feel they had the energy.”

This past summer he worked with Karen Oberhauser again, this time with a new insects study program that was being developed. So as David said, “The old fat guy can still do it a few more years.”
Group 4
Janice Wilson

Prior to the Monarch Monitoring Institutes
Janice Wilson teaches 9th – 12th grade biology at a rural high school. She had taught for 22 years before participating in the Monarch Monitoring Institutes. She is department chair at the high school and also a “key leader” of the National Science Teachers Association. She has presented topics to improve science teaching at both the state and national levels. In February 2000, she and two students learned that a “poster” they had co-authored with a professor at the University of William & Mary and a teacher in Florida had been accepted for presentation at the 100th Convention of the American Society of Microbiology.

Janice wrote in her application for this project that her goal “is to have the students engaged in lab activities at least 50% of the time, using inquiry methods as much as possible.” She said she has always been an “outdoors” teacher; she listed 11 different field experiences she has used on a survey she completed before starting the project.

After the Monarch Monitoring Institutes
Janice was part of one of the last groups to participate in the Monarch Monitoring Institutes (summer and fall 2000). Therefore, at the time of this report, she had only one school year during which to implement what she had learned during the Institutes.

One of the first things Janice mentioned when asked what she did new after participating in the Institutes was that, “One of the things that we did that I know benefited all of our students so much, especially when I came back in October, was that I had a lot better understanding of how to apply statistics to data that’s been collected. And so, with all my students, I required that they run either chi-square or a t-test on all their data for their science fair projects. And that was huge. That really made a difference. In fact, our school . . . won the best school award, and I have no doubt it was in large part because every student ran statistical analyses over their data, and that verified or didn’t verify what their findings were. So that was a huge benefit to me that I couldn’t have gotten anywhere but there. “

Janice identified analysis as one of the biggest problems that teachers who require science fair projects have. She said it usually is “okay now you have the data, what do you do with it?” She felt, “Kids come up with ideas, or I come up with ideas, and they do a fairly decent job of controlling the variables and collecting the data, but then what do you do with it?” She felt the October institute addressed that problem very well.

Second, she thought, “The two students I had with me have benefited personally because they have a lot of confidence now. Both of them were high at-risk students. I purposely target those kinds of kids probably a lot.” Janice added, “They’re very proud of their knowledge. They are big campaigners for students to get involved with this. They’re going to be seniors next year and so next week, they want to have a lunch meeting with a couple of people that they think might be good to sort of work next year to sort of be their replacements for being on the research team.”

Janice felt that the modeling during the institutes of how to teach the scientific method was very helpful to her. She knew the scientific process, but she said. “The way they taught it to us, and the way they applied it to questions that were generated from the audience, is something that I have used, and it has been very beneficial. And so it’s really brought to life a lot of things that were hard for me to do before.”
She had taught the scientific method before: “It’s one of the chapters in our book.” Janice explained what was different.

“But what Karen and her staff did for us is talk about how do we apply the scientific method to how scientists really do their work? And so they said, “Here’s a caterpillar. What are some things that you can think of, that we could ask about this caterpillar?” And they would help us to just generate lists of questions—many, many, many questions. And then we’d look at them, and we’d objectively say, okay, which ones of these CAN we really test? Because if we can’t really do the test, then it’s probably not something that we need to worry too much about right now. And it helped me to be able to explain to my students more clearly how they can apply the scientific method.”

Janice described how the project changed the way she approached field experiences. “Now when I go outside, . . . one of them will say, “Miss Wilson, what is this?” And I’ll look over there, and maybe it’s a gall or maybe it’s a spittlebug. So we’ll talk about it, and I think I’ve learned patience, because instead of just telling them what it is, I get them to inquire and try to figure it out.”

Janice described some of the activities that they did with monarchs this year.

“In the fall, there was some interaction with monarchs because we actually caught some on our way back from south Texas [for the second institute], and we used them. And in the spring, all of my classes have been highly involved. I brought in the first egg I found this spring, and that was “Birthday Baby.” And after we got Birthday Baby, the kids started bringing in more and more. I think we’ve released 17 now, and now I have kids coming from other teachers’ classes – bringing me crazy-looking caterpillars of all these different varieties and kinds, because they’ve heard we’re doing all this fun stuff with caterpillars. So they’re bringing in all their caterpillars, and we’re trying to look them up and see what they are.”

Janice and her two students did their own team-generated research project. Their questions related to migrating monarchs and whether they had any color preferences in flowers and whether their size made a difference in what flowers they would choose. She said it was supposed to be a field project, but, “what happened to us, is while we were in south Texas, they migrated through, and we missed the opportunity to do it in the field.” In fact while they were on their way home from the second institute, Janice said,

“It was so funny. Tiffany is up in the front seat, and she goes, “Oh my gosh! Stop the car!” And the whole sky was just speckled with monarchs, and it was just incredible how many there were. And so our 3-1/2 hour drive took eight because we got out, and we kept catching them. Then we had to go to the next Dollar Store and buy more containers, and then we had to do this and that. Anyway, so we ended up doing [the research] with the migrating monarchs that we had captured. We ended up doing the study in a lab. We’re not satisfied with our data, and we want to do more tests to verify or say ‘oops, what we did wasn’t really accurate.’”

They think they were one of the first groups to complete their research even though they made revisions four times before their paper was accepted. She said, “It was a very interesting process, for my girls especially. That was such a growing experience for them. They thought, ‘Okay, we wrote the paper, we turned it in, we’re through’ because that’s how it works in school. And no, they kept sending it back. And they would kind of get discouraged, and I would tell them, ‘Hey look, look at how much less we have to do this time.’ But they were so proud when it did get posted. A big deal!”

They were even more excited about the international conference they were invited to attend this spring. There were researchers from Australia, Mexico, Canada, and the United States – about 100 participants.
Janice told the two girls, “You’re being thrown into an adult world here, so hang on.” She said the conference was very intense with presentations, but the students did great.

Janice said that she really must do something different with her classes every year to stay refreshed. She talked about how the international conference helped her with ideas.

“When I was at that conference last week, I took I don’t know how many pages of notes. But I had a separate notebook going at the same time, and I have 151 new science fair projects written down now that I got from the conference. And I have the scientists for them to contact to find out more about how they can do these experiments. I wrote down who was talking when an idea came into my mind and the whole bit. And so these are things that keep my teaching vitalized. It keeps it young, I guess. Otherwise, if you just always do the same thing the same old way, you’re going to get bored and tired.”

Janice and her students were continuing the monitoring they began for this project. In April 2001, she said, “We’re doing it now. We get together every Sunday at 7:00 p.m.” The monitoring is actually being done at Janice’s house. They have six-and-a-half acres of prairie that they don’t mow and they don’t break and so “it’s perfect.” Janice found that the monitoring provided an awareness of what’s out there, especially because she’s finding eggs and caterpillars that she never knew existed.

The monarch project had spread to the whole school. Janice said there were four teachers who were in her room at least four times a day. One, a reading teacher, came over one day with a student who was reading about development of a monarch to look at the monarch caterpillars and several chrysalises Janice had in her room. Janice said, “It was so neat because here’s this young man who doesn’t read very well at all, and now he’s actually learning from the reading, and actually seeing what was happening for real. That was awesome. And he would come back every day to check on them. And of course, it gave him a real incentive to not only read that one little book, which is really written on about a fifth grade level, but now he’s excited and interested in doing his own study and research on them.”

Janice was equally excited about a class she had that was about 80% special education. She said, “Those kids are really into it. I have another certified teacher who spends a great deal of time in the room with me, and she’s commented to me several times how this has really gotten the kids’ attention, and that they’re talking about it down in the special ed room. And anything like that that they’ll talk about – I call them “carrots” – are great ways to kind of hook the kids into learning.”

Janice said that she has always been real “lab-based.” But she thought what was different was that,

“I’ve actually had this living lab going on in the room in front of their little eyeballs. One of my kid’s granddads built the cage. So everybody has a little ownership in this project. The kids are excited. They come in every day, and they say, ‘Did anything happen? Are there any changes?’ It’s just like they can hardly wait to come back the next day. And ‘oh, my gosh, this one, it came out 2 days early, Miss Wilson. Now why is that?’ And we talk about, ‘what do you think could have caused that?’ Well, the fact that the air conditioner was off for the weekend, and it was 90 degrees in my room. It’s taking us totally off in another direction that’s so important. It’s just given me so many opportunities to apply what’s happening to what they really need to know, instead of just book facts.”

Janice had not changed her curriculum but had been able to incorporate the monarchs into much of what they must do. They have what they call a discover sequence, and every three weeks they have to cover a certain topic. Janice said, “I’ve been able to cover those topics in totally different ways. How we present the material is totally up to us. We have complete freedom. So that’s what I’ve done. Growth and
development—well, hello! Here’s this butterfly. Growth and development is what’s occurring. And hormones, we’ve talked about hormones. We’ve talked about metabolism. This poor little critter has just given us everything we really need to teach everything.”

Janice concluded that, “It’s the single most important thing I’ve ever been a part of, as a teacher, for myself and for two specific students and for the population as a whole—in my school, even, not just in my room. The school’s so excited. We have a school website; I guess everybody does. And I have butterfly links. These webmaster kids have posted pictures. They come up and use their digital camera, and they take pictures. And they’ve put a link in there so that they can go straight to our paper. It’s a just neat spark for a lot of people. It’s new and different.”

Janice had been doing pretty active stuff with her students all along, but she said, “It’s just given me a fresh, new approach. It’s kind of like going in and having a new make-up put on or something. You just feel so much more energized and enthusiastic, and it’s fun science. . . . So, I guess that’s it. I’m just like eaten up with it right now and the kids are, too. They love it.” “Kids, these days, are just dying for something to believe in and take ownership in, and this has given a lot of them something fun to do that with.”

Janice has kept in touch with teachers she met in her group. She needed butterflies in the fall and contacted Dale and Ruth and they were able to help. She said, “That’s been another great thing is I have this great data base of other teachers. And Beverly Zamponi is in Austin, and I was down at a conference in November, and she came over to the hotel, and we went out to dinner. We’ve really become friends. Beverly and I and a couple of others correspond frequently about what we’re doing. She needed more data on the spores that we were finding in the butterflies. So I shared what we had and she shared what she had, and Tiffany integrated her data into Tiffany’s project. It’s just all about how we’re all working together and it’s for a good purpose.”

The follow-up mentoring part of the Monarch Monitoring Project was very important to Janice. She said, “It’s really not the butterfly—but it sort of is. One of the things that’s probably been really, really beneficial for me, as a teacher, is having professionals—like especially higher education professionals—that I can depend upon to be a mentor, not only to my students but to myself. And of course, Karen and Michelle and that whole group—they’re wonderful.”

Janice compared her relationship with the University of Minnesota staff to someone she contacted three years ago. She reported, “I was reading an article in a science teacher thing and it was talking about safe use of bacteria in the classroom. It didn’t tell me where to buy the bacteria it referred to. So I looked at who the author was, and I saw he was a professor at William and Mary. I got on the Internet, and I contacted him. He and I talked about how teachers need these resources. Since then, he’s developed this huge website and has turned into the teacher’s teacher, basically. That was good for me. And then Karen and her staff took it one step farther because they’re more specialists for me. He’s a real generalist and he can plug me into wherever I need to go. And he also works with my kids one on one.”

About this type of professional development, she concluded, “Karen and her staff provided me with a lot more support that I needed to have the confidence to be successful with this program. I guess that’s the bottom line. Sometimes we train and we train, and we send them home, and we never talk to them again, and I’m guilty of that, too. And that’s not very good. That’s poor practice.”
Group 5
Daniel Hanson

Prior to Monarch Monitoring Institutes
Daniel Hanson teaches science to grades 6 thru 8 in an urban, year-round K-8 school in Minnesota. Daniel has taught science methods at Bellarmine college in Louisville, Kentucky, in 1997, and math methods and assessment in 1998. He participated in Operation Pathfinder in Duluth, MN, this past summer working with 30 science teachers from the five state areas. He collaborates with the science teacher at Chiron Middle School. In addition, he is a candidate for the National Board for Professional Teaching Standards, 1999-2000. He also mentors a future science teacher in the school of education at the University of Minnesota. All of these activities involve working and sharing with other science teachers.

Even before the project, Daniel had been doing some inquiry activities with his students. Daniel wrote in his application for this project, “I require all students to do one inquiry-based study each quarter. I keep track of their portfolios and advise them through the research process. They must show the steps they took to arriving at a question, searching the question and everything they do to arrive at a conclusion.”

Monarchs had been a project each year at his school by other teachers, and Daniel wanted to know more about habitat and life cycle.

After the Monarch Monitoring Institutes
For Daniel, the most important outcome from the Monarch Monitoring Institutes was how he went about teaching the scientific method. What he does now is “deliberately and intentionally teaching the scientific method, step by step, rather than dictating it and saying, “This is it and now let’s do it.” It wasn’t something that I thought needed to be taught before, but now I see the need to really teach it and help kids understand and digest it.” Daniel’s said, “I am using a lot of the material in terms of teaching the method and going through the questioning and forming a hypothesis and really taking a look at the idea that students may suggest doing projects that are undoable.”

Daniel described further what he does now:

“Then we’d discuss, if this is the question we were going to do, how were we going to do it. In the past, I would basically say, ‘That’s what you’re going to do? Go do it.’ . . . I learned to take my time and allow the students to really decipher, how do you do this? And then even model it so that they would see, if you do it this way that we agreed on, it’ll work.”

“And so, using the scientific method . . . made how that class went and how my other classes go, much more doable, clearer for the students, clearer for me. My lesson plans have changed because I’m a little more methodical now.

Daniel felt the project affected everything that he did in his classes. He said, “So when I began to see how teachable it was, then it was a matter of reinforcing it, every time I got a chance. It doesn’t work if I use it for monarchs, and I don’t use it for water study, or if I don’t use it for chemistry. It’s got to fit everything. And it does.” He joked, “The only part that hasn’t worked, is in nutrition, with the idea that human fat is made from the extra carbohydrates we eat and not from the fat passing through our body that we ingest. It hasn’t carried over because my hypothesis was, I would lose weight.”

Daniel also added some fieldwork to his classes and found it was successful. “The 8th graders went out and collected insects and then were able to find the orders. That was something that we did at Wilder, and they became very good at it. That was the first time I had ever done that. I had always heard about it, I’ve always read about it, but to actually DO it was kind of fun. I became fun for the kids.”
Daniel fit the team-generated research project into his regular science class over the summer. Being a year-round school meant that they were in session starting in July. The two students selected four additional students from the class to be part of their team. Daniel felt that the scientific method allows students to pick and choose their own interest area. Consistent with this, Daniel said, “And then I had another couple of students who wanted to do something just on their own. Then there were students who wanted to use the scientific method to research bacteria. And we had a team researching different kinds of bugs. It branched out. My thing was, I really don’t care WHAT you do, as long as you do it according to [the scientific method].” He ended up with eight different projects going on that were student-led. This fit into his curriculum, which was to teach the scientific method.

Karen Oberhauser from the University of Minnesota visited his class. She helped the students critique their projects, helped them ask questions and to see if it was really feasible. Daniel gave one example:

“There was one project where the kids wanted to measure the speed of a monarch butterfly and the question was, ‘how do you do that?’ And, of course, we don’t have the technology for that right now. However, this year we may have. But they shared many different ideas about it, how they would do it. And I just told them right out that we released monarchs, and they flew up over the building before we could get to the other side of the building. They were out of sight. They’re pretty fast. If we let it go in the building, they would go down the hall; we could measure it. But because it’s enclosed, they may not go the speed they were normally go. So there were all kinds of pros and cons. We had a big discussion. And eventually the kids said, this is not doable.’

By mid-July, Daniel and his two students found a site that they could monitor for the Monarch Monitoring Project. It was at a nearby library that has always had a nature area, and Daniel said, “It was loaded with milkweed.” When they went to the first site they choose at a nearby cemetery, it was under two inches of water. Daniel said, “The black flies were biting so bad, they ran us out of there.” At the library, Daniel and his students found five to six plants per square meter. He said, “And in June, they would cut the grass and the milkweed would grow. I would have loved to have gone back this year, but they tore up all that and put a parking lot in.” Daniel thought the monitoring “set the discipline. It got us into the habit of doing something. It was hot. It was sweaty. The kids got bit by bugs. It was nutty sometimes. But we wanted to do that.”

But when it came to doing our own research, they wholeheartedly agreed to do something in the classroom. In the classroom, they were able to control the climate for the butterflies. Daniel and his students completed their research, and Daniel reported how successful it was for the students:

“The kids liked it because it set them apart . . . they were doing a research project, and they knew they were doing REAL RESEARCH. And so, they were scientists and the whole school knew it. And some of the classes would come up and the teachers would say, ‘Can we walk through the lab and see what you’re doing and have you explain it to us?’ And the kids had their white jackets on and their lab stuff on, and they would say, ‘Yeah.’ And they really shone.”

Daniel thought it was “very important” to have the students in the project because, he said, “I began to see how the students learn. And I began to see how far you could push them.” He said that he learned, “That I can put a lot more ON the students than I thought. I can demand a lot more than I had been demanding. So I can add that ingredient of a higher standard but also make it fun.”

For all the students in his classes, Daniel said, “Class participation hasn’t been better. . . . I think they’re just enjoying it.” Daniel also talked quite a lot about the impact of the project on the two students who went to the two institutes.
With the young woman, Daniel said, “She was having a real personality issue. And the issue with her was, ‘well I know I’m right, and everybody else is wrong, but they don’t listen to me. She had very little patience for people who didn’t understand it. . . . The project helped her come out; it has helped her become more patient more people. . . . Whereas before, she was so frustrated because, ‘I know, and nobody listens to me.’ But now, it’s, ‘I can show you that, if you want me to.’ And so she was asking people to listen to her rather than kind of bullying people . . . So that was a big growing thing for her and her personality has blossomed.”

For the young man who went to the institutes, Daniel said, “He was doing basically nothing – not knowing that he had capacity to do any of this. His first feeling, the first couple days, ‘this stuff’s over my head; I don’t want to do this.’ And then, Michelle sat down and spoke with him and said, ‘You need to take notes. You need to do this.’ But Michelle kind of turned him on, got his interest, and all the sudden he got into it and started liking it. So it took that to make him quit telling everybody what he DOESN’T know and for him to start discovering what he DOES know.”

At the end of April 2001, Daniel was working on plans to take a group of students to Texas in October during their intersession (kids are out of school). He said, “We are going to be doing our own monarch research projects, since there’s no more grant. I am raising money to do the research projects here. I’m expanding it to 30 children, rather than just two. We’re working on the money to take the kids to Texas to follow the monitoring survey down to Texas, and we’re looking at the possibility of two weeks rather than one week.” He would be using basically the same curriculum as the Institutes.

Daniel would begin with a field study during the intersession before school started in July. He had chosen the top 20 8th grade students – about a third of the class – to work with him on a field survey. He described further, “And when the summer semester starts in July, we’ll continue the field survey, hit the scientific method with the whole 7th and 8th grade hard – that’s part of the curriculum – and then, those kids that qualify will go to Texas. And we want to take 30. And then that will give them something to base their scientific research on for the rest of the year, whether it be in Earth Science, Life Science, or Physics, so that we understand the model. Monarchs are a good research issue. It’s fun. It gives us some focus. And it allows the kids to know that we’re connected with the university – that they are doing real research.”

Daniel will continue to be in contact with the University of Minnesota. He said, “We’ll continue to send in information and we’ll continue to glean [Karen] for everything we can get. We will be the mosquito that bugs her.”

Daniel’s school has been very supportive financially of his work. He said, “I was very pleased that the school purchased some items that were spendy. We needed to weigh the larvae, and we didn’t have a scale that was sensitive enough. Those digital scales that are sensitive to air, wind blowing over them, are close to $1,000. And there was no hesitation to purchase that. I think that was one of the things that made our research more complete, was that we were able to weigh the larvae at an earlier stage and be consistent with it.” The principal also asked him to submit an application for the President’s Award. Daniel said, “Had I not gone through this experience and adapted some of this stuff to my teaching, I don’t think I would be the Minnesota selectee.”

Daniel said he had a lot of other things going on. He said that he likes to have a culminating event for his classes so that the things that he wanted the kids to remember would stand out in the child’s mind as important. He and the other science teacher were about to hold a school-wide science fair for students to show what they had learned that year.
He also described an upcoming event for the 7th grade course in nutrition and anatomy. They will have a cook-off to show what they have learned about how their body works and what are the vitamins and nutrients they need for healthy bodies. Saying a little about the content of the course, Daniel said, “We go way down to the roots. We talk about the nine essential amino acids, and we talk about the balanced meals. We talk about how to prepare food and the bacteria. It’s a culmination of everything we’ve been talking about all year long. And then we have judges come in and take a look at their menus and see if their menus are balanced. You have to work together as a team, demonstrate cleanliness. It’s important how the food looks, and if it’s done. And if it’s supposed to be hot, is it hot? And if it’s cold, is it cold?”

Last year was the first time we did that here and it went so well that the principal came to me and said, “You know, this is now an annual event.” This year a hotel is sponsoring the event and is sending three of their chefs and some of their executives out to be judges.

Daniel wanted Karen and her staff to know that even the little things done during the Institutes, like giving the participants each an award, had an impact on teachers’ future work. Daniel said that after the kids did the bug identification project. “I had the strange idea of giving out these dorky little certificates, and the kids loved it.”
Group 5
Donna Bloom

Prior to Monarch Monitoring Institutes
Donna Bloom taught 7th grade life science in a relatively large (almost 1400 students), rural middle school when she applied for the project. She was moved to teaching 8th grade during 2000-2001 due to changing enrollment numbers at the school and would be going back to 7th grade in a couple years. She is science department head in her building and mentors their new science teachers. She is chair of Eisenhower funding for her district. She is a member of the Minnesota Science Teachers Association and was chairperson for this past spring’s convention held in her area. Additionally, at the state level, she is a Best Practices teacher (Department of Children, Families, and Learning) and Key Leader for the Building a Presence Program (National Science Teachers Association).

Donna wanted to become part of this program so that she could become more knowledgeable about monarchs and become a better science teacher. She felt there were not a lot of advocates for monarchs in her area and wanted to see her school get something going to further research and understanding in her part of the state.

One of the regular field experiences Donna gave her students was to take them outside to the school’s SNAP area (School Nature Area Project). Another type of field experience she did was for astronomy. Donna said, “We went outside and just took a look up at the sky and talked about why you don’t see the stars during the day. And we talked about luminosity and temperatures of stars. Now you’re at the point in the year where you can actually see the moon in the afternoon – in the daytime.” Another example was, “We went outside and did a whole thing on camouflage and changing of the seasons and talking about why the leaves fall off.”

Because of graduation standards, 7th graders in Donna’s school have been required to do direct observation and an independent research project for three years before this project. Every year, they also have “the largest Science Fair” in their area – 500 sixth, seventh, and eighth graders participate.

After the Monarch Monitoring Institutes
One of the first things Donna said about the benefits of the Monarch Institutes had to do with the participation of students. She wrote, “I have come to know more about students and monarchs than I ever anticipated.” She thought it was totally a different experience working with kids. She said, “I probably learned as much from watching those kids and working with those kids, as I did with just doing the stuff that was there.”

About expectations of students, she said, “I can honestly tell you that there were a lot of things I thought were out of reach and just too overwhelming to do. I have seen that kids are capable, sometimes, of a lot more than we think they are.” Donna described how she changed her thinking:

“I’m not saying that necessarily my expectations of the students were low, but I anticipated their minds were like a blank slate and I needed to create everything that they needed to learn. But the kids really know. With all the opportunities they have nowadays, so many of them know a lot of the information. I hate to say as teachers that we don’t excite them and we bore them. But sometimes, because we don’t realize how much knowledge they already have, we spend a great deal of time going over information that they already know. And if we could just quickly review that and move on, we could capture their attention and their excitement much more.”

In retrospect, Donna might change how she selected the students to go. She said, “I’ve picked kids that I knew would be successful. But now I’m a little more open to, ‘if these kids really enjoyed it and gained so
much of an experience, there are kids out there who probably aren’t the best “A” students and write the
best papers, that would really benefit as much if not more, because this is right up their alley. They’re in
doing the touchy feely, hands-on, experiencing science right on the front lines kind of a deal. It was such
an eye-opener to go down there with those kids."

She described what happened during the Institutes to change her thinking.

“Right away Liz told us, ‘Now if they need some help, then offer some suggestions.’ And
normally, I wouldn’t even start with some suggestions. I’d say, ‘Okay, today we want to learn
about caterpillar behavior. Here are some suggested areas.’ And we didn’t do that and those
kids came up with some of the greatest things. And I think we stifle some of their creativity
because we say, ‘Here’s what we want you to look at.’ And just because we’re adults, we don’t
necessarily know everything either. So I really learned to be a lot more of an exploring type of
teacher.”

So whenever Donna starts a lesson now, she will start with, “What do you know about this particular
subject? When you were little, what did they tell you?” We get a lot of good humor. And I think teachers
sometimes forget to have humor in their lesson. I asked the students ‘When you were little, your mom and
dad probably told you to go out into the back yard and dig a big hole, and if you dug it deep enough,
where would you end up?’ Well, what do you suppose most of them told me? They all said ‘China!’ We
laughed and laughed for a good 5 minutes over that one because every one of them came up with China.
And I said, ‘Now, how realistic is that?’” Now, Donna tries to find out what they know and what
misconceptions they may have.

Working with her students outside her school building seemed to have brought about a big change in
Donna’s thinking about her future interaction with students.

“Taking my kids down to Texas was probably the biggest thing I’ve ever endured as a teacher.
After we were accepted, I was kind of a little bit shocked because I knew I had to spend a week in
Minnesota with them and a week in Texas. They weren’t my students anymore because we spent
every waking moment together. It’s really opened my eyes to all the opportunities there are
outside of just the regular classroom teacher-student orientation. We’re looking at, now, setting
up with Bill [Calvert], our school sending some students down to Mexico, and I would have
never, ever dreamed in a million years of doing something like that without the success that the
institute has had.”

Another thing that was important to Donna was how beneficial it was for the students – not just the travel
and the learning how to do research. She said, “The two students who went with me both said because of
the experience they had, they’re both looking at careers in science. So it opens more doors and more
opportunities in science-related areas, even if it’s not necessarily research or monarchs.”

Donna learned that when doing scientific research was that an experiment does not have to have noticeable or statistically significant results. She said that since she did “Monarchs in the Classroom”
and the Monarch Monitoring Institutes, she no longer makes a student do an experiment over if they do
not have noticeable or statistically significant results. She realized that, “When you look at scientific
research, sometimes you’re not going to get a noticeable change or sometimes your variables end up
having the same results of your controls.” Donna added, “And so this year, as we’re doing science
projects, even if a kid tests something where the results aren’t real slap-you-in-the-face kind of results,
that’s going to be okay, and we’re going to teach them why that’s okay.”

Even though Donna moved from 7th to 8th grade and was not teaching life science, she had her students learn about monarchs. In October 2000, she said, “I’ve got a whole bunch of larvae, about 120, in my
room right now. They just turned into chrysalises. Now that we know so much about monarchs and their whole life cycle, what other kinds of things are we interested in?” She did tie monarchs to her unit on meteorology in the spring. They used the “Journey North” program and watched the migration. She said, “What was so cool about Journey North is [you can learn that] the butterflies were moving slower because there’s a cold front and there’s this coming in and there’s this wind or that wind. So the kids could see how meteorology was tied right in with the whole migration of the monarchs. It was so cool because it just worked perfectly.”

Donna said that her approach to having students do active research was different.

“Before, I’d always been very structured and gave kids a guideline and said, ‘here’s an example of topics, choose one; here’s the structure I want you to use and here’s an example of what your end product should be. I’d take something and show them a simple experiment and show them how easy it is to set something up. And then I’d take something like what we did with the monarchs and the acid rain and show them what a real, in-depth, involved project looked like. I showed them hard and easy, and I would say, ‘Here’s your objective. Here’s what it looks like. Go out and do something just like what I’ve done.’”

This year she said she restructured the whole way she did active research projects.

“I gave them some ideas of what might be difficult and what might be hard. But I really opened it up, and I didn’t say, ‘here’s what you start with and here’s what you end with. I said, ‘the ball’s in your court, YOU decide.’ And that made things a lot different, after seeing what the kids were capable of at the institute.”

The kids she worried most about were some of the special education kids, she said they did better than some of the others. She said, “The kids that struggled the most were my top-notch kids – those A+ kids that are always saying, ‘just tell me what page and I’ll do the problems. Give me the worksheet and I just want to get it done and work on my own.’ Those were the kids that wanted more guidelines. They wanted you to say exactly how many paragraphs and how long the experiment should take and how much time should be put into it.” Donna said that when you tell them to develop their own problem and then think about the results, “that really throws them for a loop.”

Donna said it was difficult for her too, “At first it was hard because I am what you would consider a very controlling teacher – strong discipline, and it’s kind of my way or the highway.” Donna said “it was great.” Although some of the kids maybe struggled a little bit more, Donna said, “They were much more proud of the end product because it wasn’t a goal that I had set for them. It was a goal they set for themselves.”

One field activity they did this school year was a trip to the Minnesota Zoo that fit the 8th grade curriculum and also brought in the monarchs again. Donna said, “Most of her kids were interested in different kinds of wildlife and some of the oceanography-type animals like dolphins or whatever. To fit with what they had done with the butterfly larvae, the zoo set up a lab for them to see some exotic species of butterflies and moths and different life cycles. They would then talk a little bit about some of the ocean animals that migrate because they had been hitting migration a lot with the monarchs.” In addition, the zoo trip helped students meet the graduation standard of “direct observation.” Donna said, “The Minnesota Zoo has come out with a curriculum that involves completing some of your grad standards, like direct observation stuff right there.”

Donna and her students have done a number of things to share monarchs with the school and community. She has talked to different community organizations and service groups in the town about the whole migration experience. The two students with Donna and Michelle had 4 rooms set aside in the school and
they had 418 sixth graders rotate through all 4 rooms. Donna described the activity, “We each did a different subject on monarchs. Michelle had a group looking at scales and microscopes. And then the students each took a different topic that had to do with monarchs and their migration and talked to the students. I showed all the pictures and slides from when we were down in Texas. So all day long, we pumped those 6th graders through those stations.”

Donna and the students also went out to the kindergarten center and did a couple of presentations. She said, “We hung chrysalises from the ceilings in some of the kindergarten rooms. You can’t imagine the squeals and the screams and the smiles on those little kindergarten faces when the butterflies emerged.” Donna was making plans to teach some classes at a science center in her area.

Their local paper came out, followed the whole story, and did a big spread in the paper. There was a story on the local TV station. All through the year, the kids went out to different classes and talked about how the experience had changed them and the active research they had done and how they had had to write papers. Donna said, “I had kids coming up and saying, ‘Mrs. Bloom, are you taking kids to Texas again next year because I want to be involved.’ So the whole school is really excited.”

Donna described an experience that led her to conclude that going to Texas was an important part of the project:

“There’s no way it would have been the complete experience it was, without going to Texas. On the third day, when they gave us some time in the evening, I took a bunch of kids, and we climbed up one of the hillsides. We saw the monarchs start flying over, and they were going to Mexico, one right after another. And we laid there on a hillside for 45 minutes and watched butterflies. You look back, and you think, 45 minutes and all we did there was lay there. It was such an awesome experience. Some of those kids will never ever have that, ever again. We can’t have that same experience here in Minnesota because they don’t migrate through our state as they do when they come through Texas. You can’t set a dollar amount on something like that. That was a priceless experience.”

Donna and her school are looking for money with which to support an ongoing monarch program. Donna said, “The Legion Club in our town does pull tabs and they have, every year, about $100,000 to give back to the community from these pull tabs. But that’s what we’re looking at right now, is going to some of service-oriented groups like the Knights of Columbus and the Lions’ Club, at least getting some matching funds.”

Part of the duties or responsibilities of project participants was to do the larvae monitoring and monitor the milkweed. Donna and her two students did it this year, and she’s going to continue with some more students. Donna said, “We are truly going to try and continue the experience and the students are going to break in some new kids, and we’re going to use the same site we used last year out at the state park. Our state park puts out a little monthly newsletter, and it gives the information that we find and they take our pictures. Sometimes when we’re out there, there’ll be people walking through, wondering what we’re doing with the measuring sticks. So we show other people how to look for larvae and milkweed and talk about the different kinds of plants and when it’s in bloom and stuff. So we are trying to expand what we’ve learned for our entire community.”

Donna and her student researchers, as well as project leaders, Karen Oberhauser and Bill Calvert were very excited about their team research project. They are actually going to replicate their experiment in fall 2001. They worked with a scientist from the university in their town. Donna described their project, “We simulated acid rain and we took a diluted sulphuric acid rain recipe. Basically, we replicated acid rain and we used spray bottles or those atomizers and then we sprayed them on
the caterpillars and the leaves and whatever. The scientist that was working with us at the university says, “Donna, I don’t want to say anything to your students, but 3.5 is actually pretty strong, pretty acidic. You’re just going to kill those caterpillars.” And what we found out was, the caterpillars that had the strongest acid rain came out the largest. My daughter happened to be a part of the science group, and I asked ‘why do you think that acid rain didn’t kill those caterpillars?’ In two seconds, my daughter says, ‘Mom, that’s easy. Those caterpillars get rid of their skins every other day when they molt. The acid probably didn’t even have time to hurt them.’ Maybe, if anything, it built up their immune system so they ate more and they were hungrier. As an adult, I would never have dreamed of that. And here, my 6th grade daughter – Miss Ph.D. in acid rain.”

“Karen and Bill – all of them – were just flabbergasted, because all the other kinds of testing that’s been done says that acid rain retards growth, makes things weaker, smaller, deformed. And by far, these were the biggest caterpillars, and they were the biggest butterflies when they emerged.”

They have been asked to replicate the study because they did not monitor the monarchs once they emerged as butterflies. Donna explained, “We probably should have kept some to see if they had a shorter lifespan or whatever, and we didn’t. Because even if they’re big, what if they die after a week because – who knows?”

Finally, they are putting in a butterfly garden at the school because they don’t have any milkweed right on school property. Donna said, “We have this SNAP area, and we have all these really neat things, but we don’t have any milkweed. So we’re putting in a butterfly garden and we’re going to try a couple different varieties of milkweed and hopefully, be able to attract some monarchs to our site.”
Diana English

Prior to the Monarch Monitoring Institutes
When Diana English started the Monarch Monitoring Project, she taught in a rural, grades 6 thru 12 school in Texas. She taught 6th and 7th grade general science and 9th grade integrated physics and chemistry. The 6th grade science curriculum included some of all of science, e.g., biology, life science, geology, etc. Diana heard about the project through a newsletter she received from the Science Museum of Minnesota.

Diana was motivated to apply for the Monarch Monitoring Institutes for two reasons. She has a geology major with certification in earth science. She felt weak in biology. She also said, “To me, studying butterflies seemed like a better way for me to teach biology than having to do something really icky, like cut open a fetal pig or something.” The second reason was to give an opportunity for two students from her little community to do something really special so they might be motivated to go to college.

Diana described her teaching before she joined this project as, “Most of it was straight-out-of-the-book type of work. Here’s the lesson, here’s how you do the lab, answer the questions. I really didn’t have the kids do anything independent. It was pretty canned.”

She talked about the facilities in her school. “We have a fairly decently equipped chemistry lab, but we’re not terribly well equipped with things dealing with physical and earth science. We’re equipped pretty well if you want to dissect something, but not if you want to look at plant stuff.” She said this probably reflected the interests of teachers before her; it was her first year in this school.

Diana had been out of teaching for 20 years, being an accountant. What brought her back in was, “Going through my son’s homework. I was always very involved with HIS science homework and trying to help with HIS projects, helping him with HIS science stuff, wanting to look at HIS book and see what his notebook looked like. I was driving him crazy pretty much.” She was interested in science, and she felt she had a better handle on how to deal with children that she did when she first started out. She said, “I wasn’t very prepared when I first started teaching, and it only lasted two years. With twenty years of raising kids under my belt, I felt like I knew a little bit more about children.”

After the Monarch Monitoring Institutes
During the summer between the two institutes, Diana and her two students attempted to monitor a field for monarchs. She said that they had actually gone beyond the one field. “Each of us kind of has our own field now. What we found around here was not a heavy growth of milkweed, so to get a lot of it we went to different sites.” The students were less willing to help once school started up. She thought, “Had this been a more northern state where you had butterflies or eggs or the caterpillars earlier in the summer, their interests would have been strong. But we spent the whole summer not seeing anything because monarchs aren’t here yet.” Diana’s team didn’t see a monarch until late September. The days were very hot, and enthusiasm died because monarchs could not be found. The new sixth grade was not involved in monitoring.

Diana and her students also had a problem with their team research project. In September 2000, she said,

“That was a bust. We were supposed to get our eggs, and we had an experiment designed where we would test them. In our laboratory, we would raise them under different conditions. The first set of eggs that were sent to us arrived on the day when it was 110 degrees. They were not delivered until 4:30 in the afternoon, so they had been in a Federal Express truck all day. Out of the 90 eggs shipped, I had something like 20 eggs that survived. A little over a week later, we got
the second shipment. They also were shipped Federal Express to [my rural town]. I had asked that, if we were going to get a second shipment, they contact me so I could give different instructions. When you’re a little town, Federal Express doesn’t promise priority delivery; again, it was 4:30 when they arrived and we lost most of them. So we scrapped that totally. We decided that we’d come up with something else to do. We thought we’d try to do ours based strictly at looking at monarchs out in the fields, and so far, we haven’t seen them yet.”

Diana did get a third shipment that went to a place that was able to get morning delivery, and she picked them up. But, they continued to have problems. They hit another really big stumbling block in their research project. She said, “It was something that no one had anticipated, really. The whole building was on one temperature setting, and we couldn’t keep the classroom warm. Our research depended on thinking it was still spring. So that was a flaw in the research. The methodology and what we learned from going through the exercise, that was very helpful.”

Diana was delighted with how much her two students learned and retained from the two weeks of institutes. In another teacher’s class called “research and development,” they applied what they learned about researching problems and developing experiments. Diana said, “You could tell that that’s where it came from because the course itself did not involve some of the statistical things that they learned. But when you looked at the posters and their papers, I know that they were doing that because we went through all of it with this project. What was so surprising to me was that they retained so much.”

Diana was pleased with what she was able to do in her class fall of 2000. She said, “That has been the successful part of this deal. The eggs that did survive each trip, I did manage to farm out to my students, and they are actively raising their caterpillars, so that is working. They’re not at the point to design an experiment themselves. The fact that some of them are being responsible enough to find milkweed and bring it in to their caterpillars is a major plus.” She had 95 students. At the start of the year, she had two students per caterpillar, so out of 140 eggs or so, she ended up with less than 50 that survived. In some cases she had three people taking care of one caterpillar. When she got her third shipment, every student had their own monarch to raise.

Diana definitely used monarchs in her teaching. At the end of the 2000-2001 school year, she reported, “We started around the 10th of August and literally went through October 31st or so, doing nothing but monarchs. And we did the whole gamut of biology, ecology, environmental sensitivity – the whole nine yards. So I got a good 3 months out of that. Because even before our eggs got there and our NEXT shipment of eggs got there and all of that, we were already doing monarchs. We were talking about the biology and seeing films and doing worksheets. Before their eggs got there, they actually knew a good bit.”

Diana reported that the kids did understand the responsibility that comes with rearing monarchs. They had learned the life cycle and recorded daily observations and did journaling. They were not able to create experiments or make graphs. They did not develop questions or hypotheses to test. Diana said, “I had started out the unit by having them list things that they’ve always wondered about butterflies. And we would tick it off as we came to something that answered that question. Because they kept journals, they were able to go back and say, yep, answered that one; answered that one; answered that one.”

The Institutes did have an impact on Diana’s teaching, both in her own background knowledge and in her approach to teaching. It helped strengthen her biology background. She said, “This was a real introduction to bugs, insects, that sort of thing, that I was able to apply to curriculum. We’ve changed the way we teach, and in the middle school grades you teach some of ALL of it. So that was a very helpful thing to have a biology component that I could bring in.”
With regard to her approach to teaching, she said, “It was a whole different perspective on some things. Research was always kind of straight line. You ask the question, you come up with the hypothesis, you do the experiment, and you write the conclusions. And I never deviated to what could have changed your results a little bit? Why did you get this result? If you had put the plant somewhere else in the room, would you have gotten different results? I had never been exposed to that, really.” In addition, she said, “I had not been that aware of all of the things that could taint your research and be a bias. That was not anything I ever thought of. And so everything we did the rest of the year, we tried to talk beforehand about, now what could bias this set-up? And in fact, we’re still doing it this year in my new school.”

**Second year after the Monarch Monitoring Project**
Diana has moved to a new school for school year 2001-2002. She did not start out the year using monarchs. She decided to “do them in the spring.” She thought it would be nice to “do plants beforehand so that we could raise our own milkweed instead of having the students go out and gather it. Because I had 95 little kids out gathering their milkweed every morning before they came to school.”

Diana was trying to work out the problem of getting eggs in the spring. It is not a good time for the University of Minnesota because they don’t have a lot at that time. She had found, “A Texas-based topics website where there were quite a few people who were really into monitoring the monarchs. And they’re down on the coast where it’s warmer, and they have kind of a year-round supply. I’m kind of thinking that maybe that’s what I need to do is try to contact someone and offer to pay them if they’ll go gather some for me. The commercial people here in Texas charge an exorbitant amount that’s really not affordable.”

Diana had won a grant from a local electric company to buy a flat cage so that students would have a place to put their butterflies once they emerged and keep them until they get ready to release them. “So I’ve got my cage!”