

MTU GRADUATE TEACHING FELLOWS IN COPPER COUNTRY SCHOOLS

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ABSTRACT

As part of a relatively new NSF program “GK-12 Teaching Fellows”, each year local K-12 teachers have been paired with 10-12 Michigan Tech graduate students from engineering, mathematics, and the sciences to assist them in developing age-appropriate activities to enhance mathematics and science learning. This NSF assisted program has been in existence for the past three years in the Copper Country Schools of the Upper Peninsula of Michigan. This paper describes the Michigan Tech “GK-12 Teaching Fellows” program, its goals, objectives and activity themes and the varying levels of their accomplishment. Also check out the program’s web site <www.math.mtu.edu/gk-12> in order to download lesson plans for your own classes.

1. INTRODUCTION

Preparation of students for the future is one of the principal goals of educational programs at all levels (*Project Impact*, 1994). Reaching this goal, however, means keeping courses current and nowhere is that more difficult for educators than in the fast moving areas of science, mathematics, engineering and technology. As K-12 educators seek ways to transform old courses in these fast moving areas into new state-of-the-art courses, the focus is on three tasks: changes in course content, improved pedagogy, and the use of technology (*Principals and Standards for School Mathematics*, 1998). Course changes often mean including new topics, sometimes interdisciplinary ones, and reducing the amount covered in order to allow for better learning. Improved pedagogy usually translates to one or more of the following: active student participation, a constructivist approach, the use of writing, and more projects. With increased use of technology comes a greater emphasis on visualization, the use of calculators, computers, and other equipment. Such technological tools, if properly utilized, can allow students to actively explore material and can extend learning opportunities to a wider variety of students. As K-12 teachers attempt to implement these changes so that their programs and courses are in harmony with state and national standards, the tasks at hand sometimes seem overwhelming. Thus, the climate is right for forming partnerships between universities and local schools for the purpose of improving K-12 mathematics and science programs.

Michigan Technological University (MTU) is located in Houghton at the heart of the Keweenaw Peninsula. The peninsula juts out into Lake Superior; consequently, the region receives much lake effect snow--an average of 216 inches/year over the past ten years. In the fall of 1998 MTU enrolled 5,411

undergraduates and 637 graduate students. Michigan Tech is one of the state's four leading research universities. It has graduate and undergraduate programs in the usual areas of science (biology, computer science, chemistry, and physics), mathematics, and many areas of engineering (chemical, civil, electrical, environmental, geological, mechanical, metallurgical, and mining). MTU also has a relatively new undergraduate program in technology. Michigan Tech is located in the center of the Copper Country Intermediate School District (CCISD), so named because of the impact of copper mining on this region years ago. The CCISD includes 13 public school districts and one private school in Keweenaw, Houghton, and Baraga counties of Michigan's Upper Peninsula. The schools in the CCISD serve 7,793 students in the grades kindergarten through 12.

In the summer of 1998, Michigan Tech received an NSF grant for \$1.14 million to set up a Graduate Teaching Fellows Program in K-12 Education. This is a three-year program (fall 1999-fall 2002) that links higher education with local primary and secondary schools. Currently, Michigan Tech is in a one-year extension of this program and therefore the program will officially end in August 2003. In the Michigan Tech program each year non-education graduate students work with classroom teachers and their students to devise new, more authentic ways of learning science, math, engineering, and technology. To qualify as a GK-12 teaching fellow, students must be 1) a citizen, national, or permanent resident of the United States, 2) a full-time graduate student at the university during the year of participation in the program, 3) majoring in mathematics, a field of science, engineering or technology, and 4) have their own car. All teaching fellows spend a minimum of 10 hours per week providing direct assistance to teachers in a local school and up to 5 hours per week preparing outside the classroom.

2. ACTIVITY THEMES OF THE PROGRAM

Activity Theme I: (K-6) The development of mathematics and science experiments (or labs) for the purpose of enabling students to actively engage in doing and learning the subject area.

(1999-2000) Nine teacher fellow pairs were supported working on projects related to this activity theme.

(2000-2001) Nine teacher/fellow pairs were supported working on projects related to this activity theme.

(2001-2002) Eight teacher/fellow pairs were supported working on projects related to this activity theme.

A few exemplary titles of projects are given below.

“Exploring Math and Science through Data Collection”

“Science Outside Your Door”

“Science Literacy through Inquiry-Based Instruction”

“Developing an Advanced Biology Curriculum”

“Alignment of Science Curriculum with Michigan Curriculum Frameworks”

“Science Lab Units Development”

“A School Forest”

“Mysteries of Matter and First Graders in Motion”

Activity Theme 2: (K-6) The development of family math, family science and family computing programs.

(1999-2000) This academic year Family Science nights were held at 13 elementary schools of the CCISD with a total of 1,111 students and 754 parents attending. This year we held Family Math nights at 3 elementary schools with 234 students and 196 parents attending. Family Computing nights were designed and piloted at two elementary schools. These events are very popular in our community. It is clear that the Family Math nights are here to stay but the long term existence of the Family Computing nights is uncertain.

(2000-01) This academic year Family Science nights were held at 13 elementary schools of the CCISD with a total of 1,104 students and 743 parents attending. This year we held Family Math nights at 3 elementary schools with 125 students and 192 parents attending. It is our intention next year to combine the Family Math and the Family Science nights at each school, so that math sessions will be held the same evening as science sessions rather than on separate evenings.

(2001-02) This academic year Family Math & Science nights were held at 18 different elementary schools. With a total of 1,150 students and 1040 parents attending. This year we also held Family Forest nights at 2 schools with 125 students attending and 92 parents attending. This program has been very popular. The family computing program was not workable due to differences in technology from school to school.

Activity Theme 3: (K-12) Helping teachers apply the tools of technology (e.g., computers, graphing calculators, CBLs, spectrophotometers, and multimedia software) in their classrooms.

(1999-2000) Six teacher/fellow pairs were supported working on projects related to this activity theme.

(2000-2001) Four teacher/fellow pairs were supported working on projects related to this activity theme.

(2001-2002) Five teacher/fellow pairs were supported working on projects related to this activity theme.

A few exemplary titles of projects are given below.

“Sacred Heart School on the World Wide Web”

“Integrating Calculator Based Labs into the High School Math & Science Curriculum”

“Implementing Computer Standards in the Elementary Curriculum”

“Multimedia Students--meeting their needs”

“Automated Technology”

“Utilizing Computer Technology in Biology, Chemistry & Physics Labs”

Activity Theme 4: (7-12) Sharing of special interests and career options within the MTU student's major field.

(1999-2002) Each GK-12 fellow presents a career talk during the fall semester at his/her assigned school. The purpose of the talk is to inform 7-12th grade students about careers in math and science and to motivate them to consider such careers. A GK-12 fellow is naturally a role model for these secondary students. During the spring semester fellows presents a talk about a topic from their major which they think will stimulate interest in their major.

3. PROGRAM GOALS, OBJECTIVES AND ASSESSMENT

The goals of the Michigan Tech GK-12 Teaching Fellows project are 1) to improve the K-12 mathematics and science programs of schools in the Copper Country Intermediate School District (CCISD), and 2) to develop the professional talents of the participating graduate/undergraduate students and the participating teachers, and 3) to disseminate the best ideas and practices to K-12 mathematics and science teachers both regionally and nationally.

Project objectives supporting the overall goals of the project are listed below. Please note that evaluation work for the 2001-2002 academic year for Objectives 2-6 is not complete yet.

Objective 1. For schools and students directly affected by the program, MEAP scores in the areas of mathematics and science will improve over the three-year period.

MEAP stands for Michigan Educational Assessment Product. The mathematics MEAP exams are given in the 4th, 7th and 11th grades, and the science MEAP is given in the 5th, 8th and 11th grades. Each school district's scores are summarized with the percent of students who score in three possible categories: satisfactory (%SAT), moderate (%MOD) and low (%LOW). In the CCISD there are 13 public schools who participate in the MEAP testing program. Three of these schools have such small student numbers that their results are not reported. The scores that are reported below are for the spring of 1998 (which was before the GK-12 program began) and for the spring of 2001 (at the end of the GK-12 program). A z-test was used to determine whether the percent of student scores in each category had changed significantly ($p < .10$) over the three year period of the program. Only school districts with data where statistically significant changes occurred will be reported in the tables below. Statistically significant z scores are indicated with an asterisk.

Table 1: 4th Grade MEAP Math Scores

| District | Year | %SAT | %MOD | %LOW | Student Numbers |
|-------------|------|------------------------------|------------------------------|----------------------------|-----------------|
| Adams | 2001 | 82.5 | 12.5 | 5 | 41 |
| | 1998 | 64.3 <i>z</i> = 1.68118* | 28.6 <i>z</i> = -1.61317 | 7.1 <i>z</i> = -.35425 | 28 |
| Baraga | 2001 | 50 | 33.4 | 16.7 | 42 |
| | 1998 | 23.9 <i>z</i> = 2.62232* | 39.1 <i>z</i> = -.55699 | 37 <i>z</i> = -2.21761* | 46 |
| Calumet | 2001 | 83 | 8.9 | 8 | 112 |
| | 1998 | 69 <i>z</i> = 2.49335* | 23.9 <i>z</i> = -3.10521* | 7.1 <i>z</i> = .25550 | 113 |
| Chassell | 2001 | 90.9 | 4.5 | 4.5 | 22 |
| | 1998 | 57.1 <i>z</i> = 2.72150* | 38.1 <i>z</i> = -2.92630* | 4.8 <i>z</i> = -.04668 | 21 |
| Hancock | 2001 | 81.8 | 13.6 | 4.5 | 66 |
| | 1998 | 87.2 <i>z</i> = -.88936 | 12.8 <i>z</i> = .14117 | 0 <i>z</i> = 1.76350* | 78 |
| Lake Linden | 2001 | 69 | 26.2 | 0.48 | 42 |
| | 1998 | 88.9 <i>z</i> = -2.33140* | 11.1 <i>z</i> = 1.83160* | 0 <i>z</i> = 1.45521 | 45 |
| Stanton | 2001 | 58.3 | 25 | .167 | 12 |
| | 1998 | 93.8 <i>z</i> = -2.29659* | 6.3 <i>z</i> = 1.34555 | 0 <i>z</i> = 1.55105 | 16 |

Note that in most schools where significant changes occurred that these changes were improvements in MEAP performance (i.e., a higher percent of students moving into the satisfactory category and a lower percent of students occurring in the moderate and/or low categories).

Comparisons between the 7th grade math MEAP scores before and after the GK-12 program are impossible to make because the state decided to change the content of the test and administer the new test at the 8th grade level rather than the 7th grade level.

In the 11th grade math MEAP test, each school district's scores are summarized with the percent of students who score in four possible categories, Levels 1-4. Levels 1 and 2 are considered proficient

and Levels 3 and 4 are considered not proficient.

Table 2. 11th Grade Math MEAP Scores

| District | Year | %Level 1 | %Level 2 | %Level 3 | %Level 4 | Student Numbers |
|----------|------|------------------------------|---------------------------|----------------------------|------------------------------|-----------------|
| Baraga | 2001 | 8.1 | 43.2 | 29.7 | 18.9 | 37 |
| | 1998 | 37.8 <i>z</i> = -3.24705* | 25 <i>z</i> = 1.68264* | 14.3 <i>z</i> = 1.62736 | 22.9 <i>z</i> = -.42365 | 37 |
| Calumet | 2001 | 32 | 59.2 | 5.8 | 2.9 | 103 |
| | 1998 | 37.8 <i>z</i> = -.85748 | 44 <i>z</i> = 2.23976* | 8.3 <i>z</i> = -.71321 | 10.1 <i>z</i> = -2.16459* | 109 |
| L'Anse | 2001 | 25.9 | 43.1 | 20.7 | 10.3 | 58 |
| | 1998 | 7.7 <i>z</i> = 2.54073* | 41 <i>z</i> = .20562 | 25.6 <i>z</i> = -.55790 | 25.6 <i>z</i> = -1.90115* | 39 |

Note that in the Calumet and L'Anse districts the significant changes are improvements. Calumet significantly increased the percent of students in Level 2 (a proficient category) and significantly reduced the percent of students in Level 4 (a not proficient category). L'Anse significantly increased the percent of students in Level 1 (a proficient category) and significantly reduced the percent of students in Level 4 (a not proficient category). In the Baraga school district there is a significant loss in the percent of Level 1 students and a significant gain in the percent of Level 2 students. Although this is not the desired direction of a shift, Level 2 students are still considered proficient in the subject matter by the state.

In the 5th and 8th grade science MEAP tests, each school district's scores are summarized with the percent of students who score in three possible categories, %proficient (%PROF), novice (%NOV) and % not proficient (%NOT/PROF).

Table 3. 5th Grade Science MEAP Scores

| District | Year | %PROF | %NOV | %NOT/PROF | Student Numbers |
|----------|------|------------------------------|----------------------------|---------------------------|-----------------|
| Baraga | 2001 | 9.8 | 78 | 12.2 | 41 |
| | 1998 | 28.6 <i>z</i> = -2.24415* | 66.7 <i>z</i> = 1.16096 | 4.8 <i>z</i> = 1.21646 | 42 |

| | | | | | |
|-------------|------|-----------------------|--------------------------|--------------------------|----|
| Houghton | 2001 | 65.2 | 31.5 | 3.3 | 92 |
| | 1998 | 54.2 $z = 1.54760$ | 43.8 $z = -1.75544^*$ | 2.1 $z = .50663$ | 96 |
| Lake Linden | 2001 | 44.2 | 55.8 | 0 | 43 |
| | 1998 | 29.7 $z = 1.35932$ | 56.8 $z = -.08992$ | 13.5 $z = -2.40303^*$ | 37 |
| L'Anse | 2001 | 38.6 | 61.4 | 0 | 57 |
| | 1998 | 30.2 $z = .93131$ | 58.5 $z = .31022$ | 11.3 $z = -2.59846^*$ | 53 |

Note that in three out of four of the districts the significant changes are improvements; however, in the Baraga school district there is a significant loss in the percent of proficient students in 5th grade science scores.

Table 4. 8th Grade Science MEAP Scores

| District | Year | %PROF | %NOV | %NOT/PROF | |
|----------|------|--------------------------|-------------------------|------------------------|-----|
| Houghton | 2001 | 30.6 | 59.5 | 9.9 | 111 |
| | 1998 | 29.6 $z = -1.90505^*$ | 53.6 $z = .85743$ | 3.1 $z = 2.03802^*$ | 97 |
| Osceola | 2001 | 5.9 | 76.5 | 17.6 | 17 |
| | 1998 | 60.7 $z = -5.04785^*$ | 39.3 $z = 2.69207^*$ | 0 $z = 1.90554^*$ | 28 |

In both of these two schools where significant changes occurred, the shifts were in directions of declining performance. In defense of the GK-12 program, it is important to report that there were no fellows requested or assigned to either of these two schools in K-8 science during the three years of the program.

In the 11th grade science MEAP test, each school district's scores are summarized with the percent of students who score in four possible categories, Levels 1-4. Levels 1 and 2 are considered proficient and levels 3 and 4 are considered not proficient. A z-test was used to determine whether the percent of student scores in each category had changed significantly ($p < .10$) over the three year period of the program. Only school districts with data where statistically significant changes occurred are reported in the table below. Statistically significant z scores are indicated with an asterisk.

Table 5. 11th Grade Science MEAP Scores

| District | Year | Level 1 | Level 2 | Level 3 | Level 4 | Student Numbers |
|----------|------|----------------------|------------------------|-----------------------|------------------------|-----------------|
| Adams | 2001 | 6.3 | 41.7 | 31.3 | 20.8 | 48 |
| | 1998 | 7.9 $z = -.28533$ | 55.3 $z = -1.26437$ | 34.2 $z = -.28434$ | 2.6 $z = 2.84292^*$ | 38 |
| Baraga | 2001 | 2.5 | 32.5 | 32.5 | 32.5 | 40 |
| | 1998 | 16.7 | 41.7 | 12.5 | 29.2 | 37 |

| | | $z = -2.14838^*$ | $z = -.83793$ | $z = 2.17694^*$ | $z = .31362$ | |
|----------|------|------------------|---------------|-----------------|------------------|----|
| Chassell | 2001 | 3.8 | 73.1 | 23.1 | 0 | 26 |
| | 1998 | 13.0 | 52.2 | 21.7 | 13 | 23 |
| | | $z = -1.15695$ | $z = 1.54028$ | $z = .11740$ | $z = -1.85386^*$ | |
| Houghton | 2001 | 20.6 | 60.8 | 12.4 | 6.2 | 97 |
| | 1998 | 8.8 | 60.4 | 19.8 | 11.0 | 91 |
| | | $z = 2.32847^*$ | $z = .05609$ | $z = -1.38255$ | $z = -1.17270$ | |
| L'Anse | 2001 | 11.8 | 47.1 | 17.6 | 23.5 | 51 |
| | 1998 | 0 | 35.9 | 30.8 | 33.3 | 39 |
| | | $z = 2.61211^*$ | $z = 1.07842$ | $z = -1.44814$ | $z = -1.02060$ | |

Here the results are mixed with Houghton and L'Anse showing gains in the percent of students in the proficient categories (Levels 1 and 2). Chassell shows a significant decrease in the percent of students in Level 4 (a not proficient category). In contrast, Baraga shows a significant decrease in the percent of students in the Level 1 proficient category and a significant increase in the percent of students in the Level 3 (a not proficient category). Adams shows a significant increase in the percent of students in Level 4 (a not proficient category).

In summary, significant change(s) in the percent of students within a MEAP math or science test score proficiency category occurred at some grade level 21 ($7+3+4+2+5=21$) different times for the schools of the CCISD. That is to say, for 4th grade math MEAP scores, seven schools had significant z scores, for 11th grade math MEAP scores three schools had significant z scores, for 5th grade science MEAP scores four schools had significant z scores, for 8th grade science MEAP scores two schools had significant z scores and for 11th grade science MEAP scores five schools had significant z scores. Twelve of these instances reflect improvements in performance and nine of these instances reflect declines in performance. As they say in stock market reports, advancers led decliners by a 4:3 ratio. I am also pleased to report that for the academic year 2001-02, Houghton High School received the most MEAP awards statewide among all class C schools. It is important to point out that there are many other factors (e.g., inservice teacher training, student effort, school curricula, parental guidance, ...) which may also influence student MEAP score performances.

Objective 2. For courses directly affected by the program, courses will more fully align with national and state mathematics and science standards.

(1999-2000)

Twenty participating teachers completed an end of the year evaluation form. On Part A of this form teachers were asked to check off the Michigan Mathematics, Science and/or Technology Content Standards that their project addressed. There were 15 standards listed for mathematics, 15 for science and 6 for technology. Of the twenty teachers who responded, 17 checked one or more mathematics standards addressed by their projects, 18 checked one or more science standards being addressed by their projects and 16 checked one or more technology standards being addressed by their projects. Across all 20 teachers responding, the average numbers of math, science, and technology standards reportedly being addressed were 5.25, 4.2, and 2.25, respectively.

(2000-01)

Seventeen participating teachers completed an end of the year final evaluation form. On Part A of this form teachers were asked to check off the Michigan Mathematics, Science and/or Technology Content Standards that their project addressed. There were 15 standards listed for mathematics, 15 for science and 6 for technology. Of the seventeen teachers who responded, 11 checked one or more mathematics standard addressed by their projects, 14 checked one or more science standards being addressed by their projects and 9 checked one or more technology standards being addressed by their projects. Across all 17 teachers responding, the average numbers of math, science, and technology standards reportedly being addressed were 2.88, 6.94, and 1.71, respectively.

(2001-02)

Fourteen participating teachers completed an end of the year evaluation form. On Part A of this form teachers were asked to check off the Michigan Mathematics, Science and/or Technology Content Standards that their project addressed. There were 15 standards listed for mathematics, 15 for science and 6 for technology. Of the fourteen teachers who responded, 9 checked one or more mathematics standard addressed by their projects, 13 checked one or more science standards being addressed by their projects and 13 checked one or more technology standards. Across all 14 teachers responding, the average numbers of math, science, and technology standards reportedly being addressed were 5.00, 3.79, and 3.21.

Objective 3. Participating graduate and undergraduate students will improve their communication and teaching skills and become more aware of ways they can contribute professionally to local schools.

During the Communicating Science course, GK-12 fellows were pre- and post-tested on a self assessment measure designed by the PI and the instructor of the course. Students were asked on a scale from 1=strongly disagree to 5= neither agree nor disagree to 10=strongly agree to respond to 13 different statements measuring desired course outcomes.

Question 1. I am confident in my current ability to effectively communicate what I know to K-12 students and the community.

(1999-2000)

The pretest average on this question was 7.0667 and the post test average was 8.6667. The average gain score (n = 15) of 1.6 was statistically significant (t = 3.511) at the level $p < .005$.

(2000-01)

The pretest average (n=12) on this question was 7.46 and the post test average (n=12) was 8.67. The average gain score (n=11) of 1.18 resulted in a paired t value of 1.63 which was not statistically significant ($p < .10$). However, it is encouraging to note that on a scale from 1 to 10 the fellows' average scores indicate strong support of this statement both before and after the Communicating Science course experience.

(2001-02)

The pretest average (n = 12) was 7.42 and the post test average (n = 12) was 8.25. The average gain score (n = 12) of .83 resulted in a paired t value of .94 which was not statistically significant ($p < .10$). There was one fellow who rated his confidence significantly lower after the course than at the beginning of the course. It is not clear if he was confused on the questionnaire or if he really felt that way, but it certainly minimized the positive gain scores of the 11 other fellows.

Question 3. I enjoy teaching.

(1999-2000)

The pretest average on this question was 7.1333 and the post test average was 8.7333. The average gain score (n = 15) of 1.6 was statistically significant ($t = 3.595$) at the level $p < .005$.

(2000-01)

The pretest average (n=12) on this question was 8.83 and the post test average (n=12) was 8.50. The average gain score (n = 11) of -.45 was not statistically significant at the level $p < .10$. Once again, both the pretest and post test scores are quite high on a scale from 1 to 10, indicating strong support of this statement. It is also worth mentioning that one GK-12 teaching fellow has decided to pursue a Ph.D in mathematics education as a result of his experiences in this program.

(2001-02)

The pretest average (n = 12) on this question was 8.42 and the post test average (n = 12) was 8.75. The gain score (n = 12) of .33 was not statistically significant at the level $p < .10$. It is worthy of mention that yet another GK-12 teaching fellow has decided to pursue a Ph. D. in mathematics education as a result of his experiences in this program.

Question 2. I believe it is an important civic responsibility to help educate children and adults in the local community about the relevance of science in their everyday lives.

(1999-2000)

The pre-test average was 8.7333 and the post-test average was 8.6000. The difference in these two averages (n = 15) was not significantly different from zero. However, it is encouraging to note that on a scale from 1 to 10 the fellows' average scores indicate strong support of this statement both before and after the Communicating Science course experience. It is also worth mentioning that one GK-12 teaching fellows has decided to become a K-12 science teacher as a result of his experiences in this program.

(2000-01)

The pretest average (n=12) on this question was 7.25 and the post test average (n=12) was 8.50. The average gain score (n = 11) of 1.273 was not statistically significant at the level $p < .10$.

(2001-02)

The pretest average (n = 12) on this question was 6.67 and the post test average (n = 12) was 8.08. The average gain score (n = 12) of 1.53 was not statistically significant at the level $p < .10$.

Question 11. As a professional, it is important for me to have good oral and written communication skills.

(1999-2000)

The pre-test average was 9.6429 and the post-test average was 9.7143, indicating strong support of this statement by the fellows. The average gain score on this question was not significantly different from zero ($p < .10$).

(2000-01)

The pre-test average (n=12) was 9.42 and the post-test average (n = 12) was 9.17, indicating strong support of this statement by the fellows. The average gain score on this question was not significantly different from zero ($p < .10$). The high pretest and post test averages on this question confirm that our GK-12 fellows this year believe strongly in the value of good oral and written communication skills.

(2001-02)

The pretest average (n = 12) was 9.50 and the post-test average (n = 12) was 8.92. There was one fellow whose gain score on this question was negative, which accounted for the lowering of the post-test average relative to the pretest average. The average gain score on this question was not significantly different from zero ($p < .10$).

The average gain scores on the remaining 9 statements on this self assessment measure were not statistically significant.

Objective 4. As a group the participating teachers will become more knowledgeable about both the content and applications of science, engineering, and technology.

Teachers were specifically asked on Part B of the final evaluation form about their increase in knowledge in content areas and about applications. These two questions and the number of teachers responding to each option are shown below. Selected examples from part b of each question are also given.

Question 2. Have you as an individual become more knowledgeable about a content area as a result of the GK-12 teaching fellow's work in your school?

| | | | |
|-------------|----------|--------|-----------------------------|
| (1999-2000) | yes (15) | no (5) | uncertain (0) |
| (2000-2001) | yes (15) | no (2) | uncertain (0) |
| (2001-2002) | yes (9) | no (1) | uncertain (0) no answer (2) |

a. If yes, please indicate the general area of knowledge increase.

(1999-2000) mathematics (1) science (10) engineering (2) technology (5) other _____ (0)

(2000-01) mathematics (1) science (13) engineering (1) technology (6) other _____ (0)

(2001-02) mathematics (0) science (1) engineering (1) technology (8)

b. If yes, please give an example (or examples) of the new content knowledge which you have acquired.

Teacher Examples---

(1999-2000)

(science) 'I now understand the content standard on Ecosystems.'

(science) 'More knowledge about DNA lab procedures.'

(technology) 'I have become more proficient in the use of the CBL, the TI Graph Link and using the graphing calculator in combination with the CBL and Graph Link.'

(2000-01)

(technology) 'Using the CBL and the computer together.'

(science) 'I have gained knowledge especially in presenting the use of the scientific method to fourth graders.'

(technology) 'How to use the internet more comfortably.'

(2001-2002)

(science) 'I have a clearer understanding of the scientific method and how to apply it.'

(technology) 'I was able to expand my knowledge of GIS software.'

(technology & engineering) 'The use of IDEAS software in engineering.'

(technology) 'I am able to collect, organize, and analyze data using a Pasco probe software system.'

Question 3. Have you as an individual become more knowledgeable about application as a result of your GK-12 teaching fellow's work in your school?

(1999-2000) yes (12) no (3) uncertain (5)

(2000-01) yes (11) no (1) uncertain (4) no answer (1)

(2001-02) yes (7) no (2) uncertain (0) no answer (3)

a. If yes, please indicate the area of the applications.

(1999-2000) mathematics (3) science (7) engineering (1) technology (6) other _____(0)

(2000-01) mathematics (1) science (9) engineering (2) technology (3) other _____ (0)

(2001-02) mathematics (1) science (4) engineering (1) technology (2) other _____ (0)

b. If yes, please give an example (or examples) of the new applications with which you are now acquainted.

(1999-2000)

(engineering) 'Applications of DC circuits.'

(math) 'Applications of the Calculator Based Ranger (CBR) to precalculus and advanced algebra problems.'

(technology) 'Applications of the Netscape composer.'

(2000-01)

(engineering) How sound and engineering are applied together in the auto industry where Joe worked this past summer.

(engineering) About the 'packaging of products.'

(technology) 'We have used iMovie extensively this year.'

(2001-02)

(engineering) 'ground water treatment'

(technology) 'GIS and mapping the environment'

(mathematics) 'How using even a crude instrument, you can estimate the height of something.'

(science) 'I have a better idea of tree identification.'

Objective 5. A greater number of professional development opportunities for local teachers will be made available through the university as a result of increased communication between MTU faculty and CCISD teachers.

(1999-2000)

A week-long workshop titled Computing in the Classroom for K-8 teachers was offered this summer

(June 19-23). Twenty-six teachers were in attendance.

One teacher attended a 2-day Family Math training program in Ann Arbor, Michigan this past spring with the Communicating Science instructor.

A second teacher attended the NSF GK-12 PIs conference in Washington D.C.

A third teacher visited Malaysia participating in the global component of the GK-12 teaching fellows program.

During the summer of 2000, twenty-five teachers gave talks at the MTU summer conference (July 23-24, 2000).

(2000-01)

A participating teacher attended and gave a talk at the National Science Teachers Association (March 22-25, 2001) in St. Louis, MO.

Partially as a result of requests from participating teachers in this program, PI Baartmans and Co- PI Sorby spearheaded a movement resulting in the first master's program in education at MTU. The new master's degree is a Master of Science in Applied Science Education and the first class (15 secondary science teachers) will start course work in the program on July 30, 2001. The development of this new master's degree was a major job this academic year, but long overdue. On March 5, 2001, PI Baartmans conducted a 2 1/2 hour workshop for about 10 secondary mathematics teachers from the CCISD titled 'Introduction to Geometer's Sketchpad.'

(2001-02)

A participating teacher and her GK-12 fellow attended and gave a talk at the Michigan Computer Users Laboratory (MACUL) conference in Grand Rapids, Michigan and later gave a second talk at a WebNet conference in Orlando, Florida.

A second teacher attended the NSF GK-12 PIs conference in Washington D.C.

Objective 6. Best ideas and practices from this project will be disseminated regionally through a summer workshop for Upper Peninsula K-12 mathematics and science teachers and nationally through mathematics and science education conferences.

(1999-2000)

The Daily Mining Gazette (Sept. 21, 1999) 'Tech students in K-12 classrooms'

The Daily Mining Gazette (Sept. 29, 1999) 'Math, science program a terrific idea'

The Daily Mining Gazette (Feb. 18, 2000) 'Family math nights debut in Baraga, Houghton counties'

Chadde, Joan and Shawn Oppliger. 'A University-Math/Science Center Partnership to Deliver K- 6 Family Science Programs.' NSTA Midwestern Area Convention (Detroit, MI and Windsor, ON), Oct. 21-23, 1999.

(2000-01)

A summer conference was held July 23-24, 2001 and over 70 teachers participated. The program contained 17 sessions for elementary school teachers, 16 sessions for secondary teachers and 8 general sessions. Our web site <www.math.mtu.edu/gk-12/gk-12web.html> for disseminating activity and lab materials that have been developed by participating fellows and teachers was featured at the conference. Another highlight was the slide show and talk titled 'Cultural Differences and Educational Practices in Malaysia' by the teacher, Kathleen Lewandowski and fellow, Elly Bunzendahl, who participated in the international component of this program in the summer of 2000.

Some of the state and national talks which have been presented this year are listed below chronologically.

Ureel, Leo. 'High School Computer Programming--Now in Amazing 3-D.' MACUL (Detroit, MI) March 14-16, 2001.

Petrelus, Joan and Leo Ureel. 'We Made the Mistakes So You Don't Have To!' MACUL (Detroit, MI) March 14-16, 2001.

Chadde, Joan and Janet Larson. 'Developing a K-12 Forestry Education Program Across the Curriculum.' NSTA (St. Louis, MO), March 22-25, 2001.

Chadde, Joan and Shawn Oppliger. 'Family Science Nights Benefit Everyone!' NSTA (St. Louis, MO), March 22-25, 2001.

Chadde, Joan, Shawn Oppliger and Janet Larson. 'Using Your School Forest to Implement an Integrated K-8 Curriculum.' NSTA (St. Louis, MO), March 22-25, 2001.

Baartmans, Beverly and Gerald Dunifer. 'GK-12 Teaching Fellows in Michigan's K-12 Schools.' MACTE spring conference (Pontiac, MI), April 6, 2001.

Sorby, Sheryl and Beverly Baartmans. 'The Role of Engineering in Pre-College Education.' ASEE national meeting (Albuquerque, NM) June 24-27, 2001.

Sorby, Sheryl, Beverly Baartmans and Shawn Oppliger. 'Engineering Graduate Students in the

K-12 Classroom.' ICEE (Oslo, Norway) Aug. 6-10, 2001.

(2001-2002)

Schaefer, Steve. 'Congressman Stupak Visits Copper Country.' Michigan Tech Lode (Houghton, MI) April 10, 2002, p. 5A.

Some of the state and national talks which have been presented this year are listed below chronologically.

Petrelus, Joan and Leo Ureel. 'Putting a Small School on the Web.' Webnet Conference (Orlando, Florida) October 23-26, 2001.

Petrelus, Joan and Aric Asti. 'Teaching Teachers, Oh Yuck!' MACUL Conference (Grand Rapids, MI) March 6-8, 2002.

Asti, Aric and Joan Petrelus. 'Techie Night 2002.' MACUL Conference (Grand Rapids, MI) March 6-8, 2002.

Chadde, Joan. 'Family Science Nights Benefit All!' NSTA conference (San Diego) March 29, 2002.

4. CONCLUSIONS

The GK-12 teaching Fellows program at Michigan Tech and the Copper Country Intermediate School District has been a wonderful program in assisting local teachers in their development of activities and labs for their mathematics and science courses. Please look at our web site <www.math.mtu.edu/gk-12> to view and download some of the best materials which have been generated from the efforts of those participating in our program. We plan to have the North Central Eisenhower National Clearinghouse provide a link from its web site to ours in order to increase dissemination of our products to teachers. Teachers have benefitted from the technological help of graduate students at our university and have integrated technology into their own math and science curricula in many new and exciting ways. Overall, significant changes in MEAP math and science scores have resulted in more students being classified as proficient. Most students who have participated in the program feel that they have improved their communication skills. They have also have a clearer understanding of how professional scientists can assist local schools and teachers. The family science, math and forest programs have drawn parents more actively into the math and science education of their children and is expanding to include a greater number of elementary schools each year. Dissemination of project activities has occurred regionally through newspaper articles and a summer teachers conference. Nationally, dissemination has occurred through talks at professional meetings, through journal articles, through conference proceedings and through our web site. In conclusion, the program has been a benefit to both the local schools and to Michigan Technological University.

5. ACKNOWLEDGEMENT

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6. REFERENCES

Principles and Standards for School Mathematics. Reston, VA: National Council of Teachers of Mathematics, October 1998.

Project Impact: Disseminating Innovation in Undergraduate Education (conference proceedings). Arlington, VA: National Science Foundation, May 31-June 3, 1994, p.2.