

THEMIS—TIME HISTORY of EVENTS and MACROSCALE INTERACTIONS
during SUBSTORMS

2005 GEONS Teachers Workshop

SUBMITTED—August 2005

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BACKGROUND

The THEMIS (Time History of Events and Macroscale Interactions during Substorms) Mission will determine the onset time and location of magnetic substorms of Earth's space environment, a prerequisite to understanding space weather. The nature of THEMIS science holds the potential for inquiry-based instruction at the high school level.

Seizing this opportunity, the THEMIS E/PO is in the process of establishing ten ground-based magnetometer stations each located in the proximity of a rural school in a traditionally under-served, under-represented community. A teacher at each of these schools is responsible for the magnetometer data and system as well as for using the data with students through lessons/activities developed for this purpose.

The network of 10 teachers and their students and magnetometers as well as students who participate using the web is called Geomagnetic Event Observation Network by Students (GEONS)—and GEONS is the centerpiece of the five E/PO activities of the THEMIS Mission...

- GEONS
- Teacher professional development at conferences
- Launch of GEMS site
- THEMIS Web site development
- Northern Lights Planetarium show

A critical part of the GEONS effort is professional development for the ten GEONS teachers. These teachers receive informal guidance and materials (problem of the week) via e-mail and a Yahoo! Group. In addition, more formal training workshops have been held each summer—2004 and 2005—since the project began.

In the Summer of 2004, a two-day training session was held in Berkeley, CA as well as a half-day session exploring Chabot Space and Science Center. A report summarizing the impact of this workshop on participating teachers can be obtained from the THEMIS E/PO team at the Space Sciences Laboratory—*THEMIS—Time History of Events and Macroscale Interactions during Substorms, 2004 GEONS Teachers Workshop, May 2005.*

The focus of this report is to summarize questionnaire data collected from GEONS teachers attending the second of these formal workshops—a two-day training session in Carson City, Nevada in June 2005. The agenda for the workshop included the following presentations and activities...

DAY 1

- Yahoo! Site tutorial
- Mission development and science talk
- New GEONS lessons—Part 1
- Science talk and Q & A
- Observatory presentation
- GEONS teacher presentations

DAY 2

- New GEONS lessons— Part II
- NOVA movie—Earth's Magnetic Field
- Science talk and Q & A
- Student Observation Network (S.O.N.) and GEONS lessons—How to use in classroom
- Discussion on outreach, workshops and plans

In addition to this planned agenda, several other topics emerged and were discussed. These included GEONS lessons as they meet national and state standards and upcoming local and regional workshops of interest to the group.

DEMOGRAPHICS

Nine of the ten GEONS teachers participated in the June 2005 workshop in Carson City, Nevada. These teachers were from Alaska, Michigan, Montana, Nevada, Oregon, Pennsylvania, South Dakota, Vermont and Wisconsin.

The original GEONS teacher from North Dakota has dropped out of the program and was not in attendance. It is anticipated that another teacher from North Dakota will be replacing this teacher in the upcoming school year. Additional attendees to the Summer 2005 workshop included two teachers—one from Nevada and another from Michigan—who are interested in the project, but are not officially GEONS teachers.

Only the nine GEONS teachers attending the Carson City workshop completed the questionnaire at the end of the second day. Neither of the two 'guest' teachers did so.

All nine GEONS teachers attending this workshop reported that they are teaching in a rural setting and have been teaching 15.8 years, on average. Eight of the teachers reported that 30% of the students they teach represent minorities (non-white) and 49% of their students are female.

In January 2005, a subset of seven GEONS teachers was interviewed and extensive demographic data were gathered at that time. Details regarding those interviews, including complete demographic data, are included in the report *THEMIS—Time History of Events and Macroscale Interactions during Substorms, Education and Public Outreach Evaluation, GEONS Teacher Interviews—FY05, March 2005*. Demographic information about GEONS teachers' schools/districts is summarized below...

- Three of the seven GEONS teachers work in high schools (9-12), two teach in middle schools (7-8) and two work in comprehensive schools (K-12).
- The average number of students in GEONS schools is slightly over 600.
- The average number of faculty in GEONS schools is slightly under 40.
- The average school district—for those having districts—is quite small; average size is 3,300 students.

Additional information about the seven teachers' educational backgrounds, teaching experience and current teaching circumstances is presented below...

- Five of the seven GEONS teachers have undergraduate degrees in science—spanning the gamut from basics like biology, chemistry and physics to less common majors like science, earth science, physical science, geology and geophysics. One teacher has an undergraduate degree in mathematics with advanced degrees in biology and chemistry. One teacher has an undergraduate degree in English/French with a minor in microbiology and is pursuing an advanced degree in science education.
- The seven teachers have been teaching, on average, a total of 17 years.
- Six of the seven GEONS teachers have been teaching for their entire careers, while one teacher—the language major—has spent two years of her 16-year career teaching something other than science.
- Four of the GEONS teachers are currently teaching strictly at the high school level, two are working solely at the middle school level and one is teaching students from 6th to 12th grades.

FINDINGS

At the end of the second day of the workshop, GEONS teachers were asked to complete a questionnaire posing questions about the two-day workshop in specific and also about their overall experience with the THEMIS project. GEONS teachers' responses to these questions are presented in two main sections that make up the remainder of this document...

- Teachers' perceptions of the two-day Carson City workshop
- Teachers' perceptions of the overall THEMIS project

Teacher Perceptions of the Carson City Workshop

The end-of-workshop questionnaire presented both quantitative, rating scale items and qualitative, open-ended queries related specifically to the two-day workshop itself. These questions covered the following topics...

- Understanding workshop topics
- Prior knowledge of topics
- Prior use of topics
- Anticipated use of topics
- Perceived barriers to implementation
- Improvement to the workshop
- Dissemination—comfort level with materials

Understanding Workshop Topics

The end-of-workshop questionnaire asked GEONS teachers to use a 4-point scale to rate their understanding of the topics presented in the two-day training session. Their mean responses appear in Figure 1.

THEMIS GEONS Workshop 2005
Ratings of Presentations - Understanding

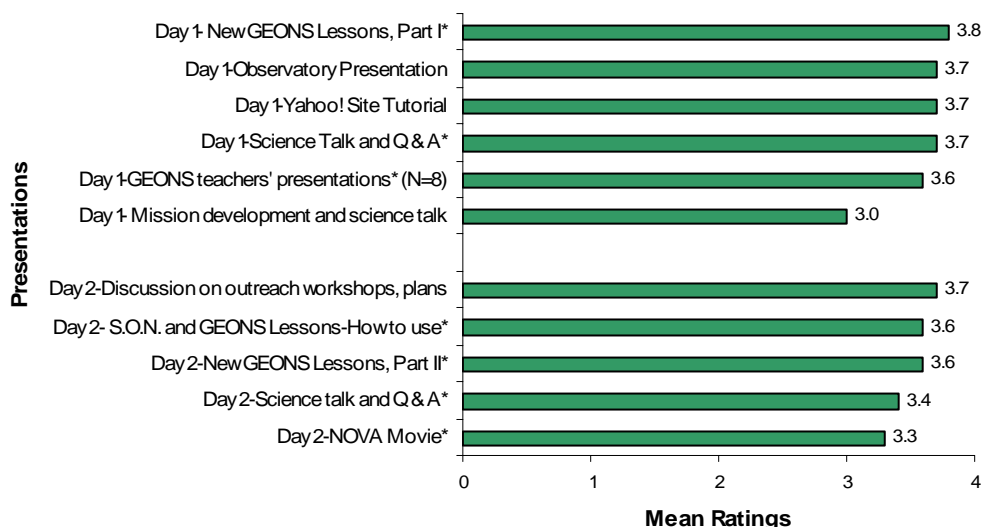


FIGURE 1. THEMIS—GEONS Workshop 2005. Mean ratings of teachers' understanding of workshop topics (4-point scale)—N=9.

*Presentations marked with an asterisk in Figure 1, were also rated for the likelihood that teachers would use these ideas/materials in their classrooms. These ratings follow in Figure 4.

Rating Scale Values

- 1=Not clear at all
- 2=Not clear enough
- 3=Clear enough
- 4=Very clear

Teachers felt that most workshop presentations were quite clear. Teachers' mean ratings for eight out of the 11 presentations were above the 3.5 level. These ratings ranged from 3.6 to 3.8—approaching the 4.0 rating of 'very clear'.

Even the lowest rated presentations were at least 'clear enough'. Even the three presentations receiving the lowest ratings—ranging from 3.0 to 3.4—were still solidly in the 'clear enough' or better range. These presentations were the mission development and science talk (3.0)—a very technical piece, the science talk and Q & A session on Day 2 (3.4) and the NOVA movie (3.3).

Prior Knowledge of Workshop Topics

The end-of-workshop questionnaire asked GEONS teachers to indicate how much they knew prior to the workshop about the topics being presented. They were given four multiple choice options for responding. The percentage of teachers selecting each of these options is presented in Figure 2.

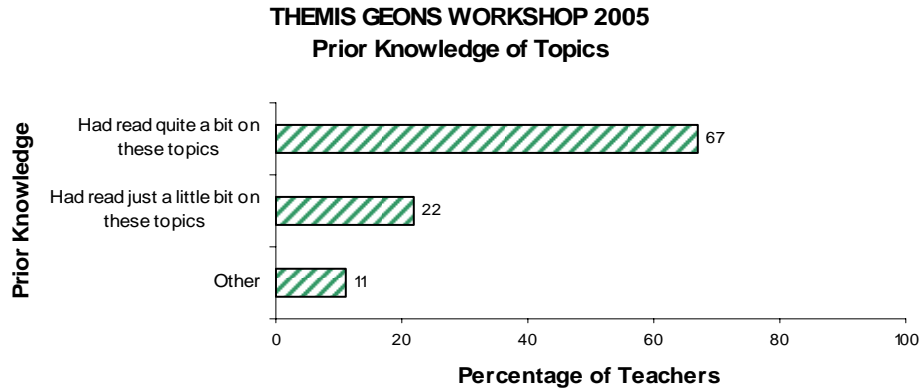


FIGURE 2. THEMIS—GEONS Workshop 2005. Percentage of teachers indicating various degrees of prior knowledge of workshop topics (4 multiple choice options)—N=9.

Answer Options

- Had read quite a bit on these topics
- Had read just a little bit on these topics
- Had almost no knowledge of the topics presented
- Other

Two-thirds of the teachers indicated that they had read quite a bit about the topics prior to the workshop. A total of 67% of the teachers indicated that they had previously read quite a bit about the topics presented at this workshop. This is not surprising since GEONS teachers have been involved with the project for about one year and some already have magnetometers at their schools. All 2005 attendees participated in the 2004 workshop, save one.

Almost one-quarter of the teachers indicated that they had read just a bit about the workshop topics. Teachers indicating that they had read just a little bit on these topics totaled 22%.

One teacher cited her school's involvement as a NASA Explorer School as providing a base of knowledge. One teacher, representing 11% of the teachers, said that her prior knowledge of these topics flowed from her school's involvement as a NASA Explorer School.

Prior Use of Workshop Topics

The end-of-workshop questionnaire asked GEONS teachers to indicate if they had ever used the workshop topics in their classrooms. They were given four multiple choice options for responding. The percentage of teachers selecting each of these options is presented in Figure 3.

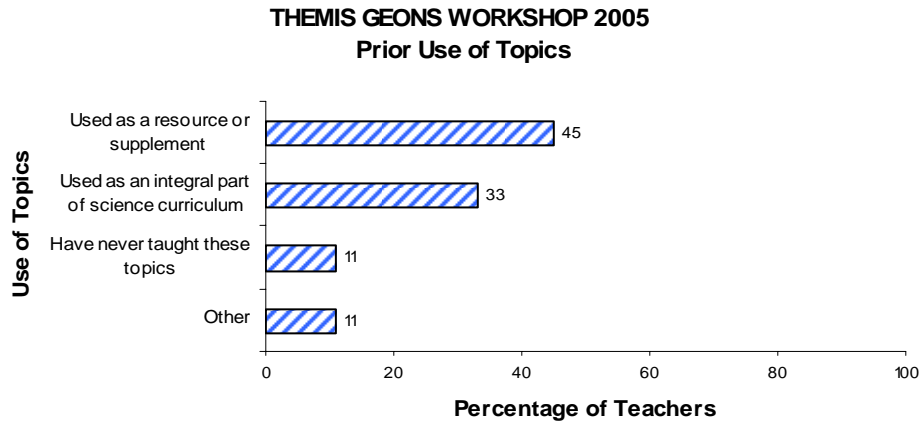


FIGURE 3. THEMIS—GEONS Workshop 2005. Percentage of teachers indicating various degrees of prior classroom usage of workshop topics (4 multiple choice options)—N=9.

Answer Options

- Used these topics as a resource or supplement to my science curriculum
- Used these topics as an integral part of my science curriculum
- Have never taught these topics in my science classes
- Other

Nearly half of the teachers indicated that they have already used these topics in their classrooms as a resource or supplement. Teachers saying that they are using these topics as a resource or supplement to their curriculum totaled 45%.

A third of the teachers indicated that these topics are already being used as an integral part of their science curriculum. Exactly 33% of the teachers said they are using the topics as an integral part of their science curriculum.

One teacher reported using these topics in a variety of ways. One teacher, representing 11% of the teachers, said he is using these topics in multiple ways—as a resource, supplement to and also as an integral part of the curriculum.

One teacher hasn't used these topics yet. One teacher (11%) said that she has not taught any of these topics in her science classes.

Anticipated Use of Workshop Topics

The end-of-workshop questionnaires asked GEONS teachers to use a 5-point scale to rate their intention to use in their classrooms the information that they learned about in the workshop presentations. Their mean responses appear in Figure 4.

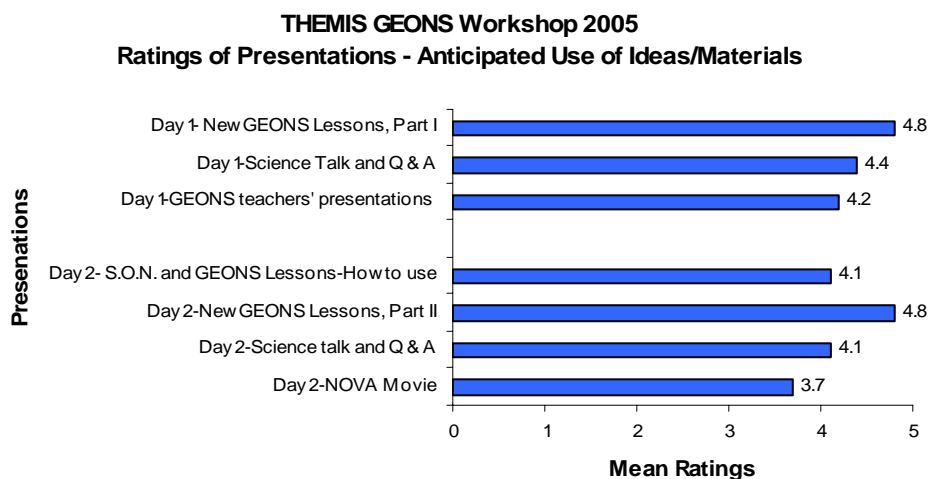


FIGURE 4. THEMIS—GEONS Workshop 2005. Mean ratings of teachers' anticipated use of workshop topics (5-point scale)—N=9.

Rating Scale Values

- 1=Will not use
- 2=Unlikely to use
- 3=Somewhat likely to use
- 4=Very likely to use
- 5=Certain to use

Teachers overwhelmingly agreed that they will be using the ideas/materials from the New GEONS Lessons, Parts 1 and 2. With a mean rating of 4.8 for both Part I and Part II of the New GEONS lessons, teachers have indicated that they are going to be using these materials with near certainty—5.0 being the rating for 'certain to use'.

The likelihood that teachers will use ideas/materials from four of the other presentations is solidly in the 'very likely to use' range. The mean ratings for both days of the Science Talk and Q&A (4.4 for Day 1 and 4.1 for Day 2), GEONS teachers' presentations (4.2) and S.O.N. and GEONS lessons—How to use (4.1) are solidly in the 'very likely to use' range.

The NOVA movie is least likely to be used, but still solidly above the 'somewhat likely to use' rating. Teachers rated the likelihood that they will be using the NOVA movie at 3.7, well above the rating for 'somewhat likely to use' and close to the 'very likely to use' mark.

Perceived Barriers to Implementation

The end-of-workshop questionnaire presented open-ended queries asking GEONS teachers to discuss any barriers they saw in implementing the ideas/materials presented at the workshop. Table 1 summarizes teachers' comments on the barriers they foresee.

These comments are clustered according to themes that emerged in a content analysis. For each thematic cluster, the percentage of teachers offering a comment in that cluster is provided. All nine of the teachers responded with multiple responses resulting in percentages totaling more than 100%.

THEMIS GEONS WORKSHOP 2005 Workshop Specific Perceptions—Implementation Barriers	Teachers (N=9)
No problems/minor problems seen —Integration will not be a problem; I don't foresee any problems; no major roadblocks.	56%
Deciding how to integrate or incorporate THEMIS/ what to eliminate —Deciding what to 'bump out' in favor of this; I can almost always have a semester of THEMIS-base activities—may have more difficulty implementing into other classes depending on subject relation; I plan to use GEONS/THEMIS as a stand alone unit.	44
Finding time for class preparation/dealing with time lag —Finding time to prepare and implement the lessons correctly; 'time' for class preparation; time lapse between the workshop and the beginning of the school year.	33
Serving a diverse student population —Success across the board within a diverse student population is less certain.	11

TABLE 1. THEMIS—GEONS WORKSHOP 2005. Percentages of teachers anticipating various problems in integrating workshop topics into their curriculum—(N=9).

More than half of the teachers said that they do not foresee barriers in implementing the ideas/materials from the workshop. A total of 56% of the teachers said that they did not foresee any problems or foresee only minor problems in implementing the ideas/materials from the workshop.

Teachers were troubled by deciding how to integrate the THEMIS project, in particular, what to eliminate from their curriculum in order to 'fit' it in. More than two-fifths of the teachers, 44%, said they anticipated having a difficult time deciding how to integrate or incorporate the THEMIS project in their curriculum with the greatest concern on what to eliminate from what they are doing in order to make room for THEMIS.

One-third of the teachers cited finding time to prepare and dealing with a time lag as potential barriers to implementation. Finding the time for class preparation and dealing with the time lag between the workshop and beginning of the school year drew the concern of 33% of the teachers.

One teacher expressed concern about successfully implementing the THEMIS materials/lessons while serving a diverse population. One teacher, representing 11% of the teachers, feels that achieving success in implementation within a diverse student population is uncertain.

Improvements to the Workshop

The end-of-workshop questionnaire presented an open-ended query asking GEONS teachers to suggest improvements to the workshops. Table 2 summarizes the teachers' comments.

Again, these comments are clustered according to themes that emerged in a content analysis. For each thematic cluster, the percentage of teachers offering a comment in that cluster is provided. Multiple responses result in percentages totaling more than 100%. All of the teachers responded to this question.

THEMIS GEONS WORKSHOP 2005 Workshop Specific Perceptions—Improvements to Workshop	Teachers (N=9)
Time—Allow more time or streamline content/target to participant knowledge —May need to streamline things a bit or allow more time. So many great topics for only two days; extend possibly to three days not packed quite as full; more time could help—I might be a little less tired and get more out of it and be able to add more to it; maybe ask <u>before</u> the workshop what we need to know and arrange sessions accordingly	67%
Interact/collaborate—Increase time to interact with colleagues/talk through ideas —Have more teacher to teacher time; more time to digest and talk through ideas; we can learn a lot together!	44
Curriculum/activities—Comments about curriculum/activities —If new 'problems' are put into the problem book, again give us time to try them! This part of the workshop was most valuable to me; I appreciate the sequential approach to present activities and lessons; more activities used and shown.	33
Positive Comments —Everything was great; keep up the great job!	22

TABLE 2. THEMIS—GEONS WORKSHOP 2005. Percentages of teachers offering ideas and suggestions for improving the two-day workshop—(N=9).

Two-thirds of the teachers cited improvements to the management of time in the workshop. Increasing the amount of time to cover the material or streamlining what is covered drew the comments of 67% of the teachers who were seeking to get the most out of the time spent in the workshop.

A little more than two-fifths of the teachers mentioned increasing opportunities to interact/collaborate with colleagues. A total of 44% of the teachers would like to see more opportunities to interact with their colleagues and talk through ideas.

One-third of the teachers wanted more activities and time to try them out. A full 33% of the teachers said they are seeking more activities and more time to try them out.

A little more than one-fifth of the teachers offered positive comments in lieu of improvements. 22% of the teachers used this question as an opportunity to say that everything was great and 'keep up the great job'.

Dissemination—Comfort Level with Materials

The end-of-workshop questionnaires asked GEONS teachers to use a 5-point scale to indicate their anticipated comfort level when presenting the workshop topics to various audiences. The questions were phrased by asking if teachers 'knew' enough about these topics to comfortably present them to various audiences. These audiences included students, colleagues in informal settings (chatting in hallways or the teachers' room) and colleagues in formal settings (in in-services or departmental meetings). They were asked the extent to which they 'agreed/disagreed' with these statements. Teachers' mean responses are graphed in Figure 5.

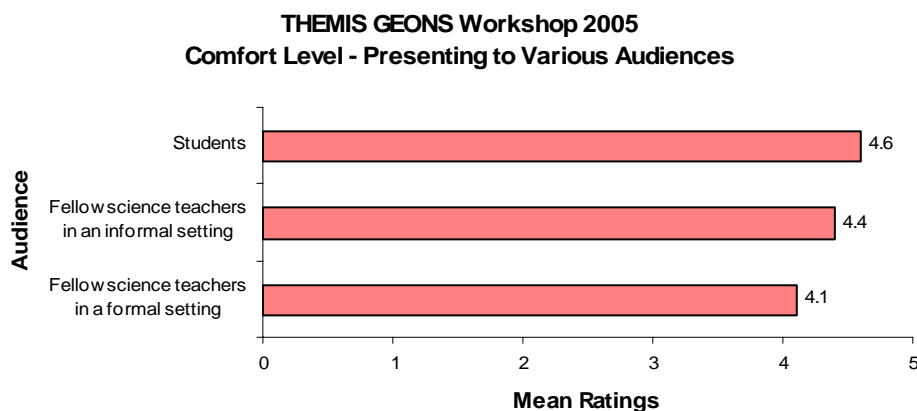


FIGURE 5. THEMIS—GEONS Workshop 2005. Mean ratings of teachers' anticipated comfort levels when presenting workshop topics to various audiences (5-point scale)—N=9.

Rating Scale Values

- 1=Strongly disagree
- 2=Disagree
- 3=Uncertain
- 4=Agree
- 5=Strongly agree

Teachers reported a general level of comfort in presenting workshop topics across all audiences.

Teachers anticipated that they had enough knowledge to feel comfortable presenting the workshop materials in a variety of situations—with students (4.8 or close to 'strongly agree'), informally with colleagues (4.4) and formally with colleagues (4.1).

Teachers claimed most comfort in presenting these topics to students. With a mean rating of 4.8, teachers indicated that they had the knowledge required to feel most comfortable presenting these topics to students.

Teachers reported feeling nearly as comfortable presenting these topics to fellow science teachers in informal settings. Teachers, with a mean rating of 4.4, indicated that they have the knowledge to be very comfortable presenting these topics to their colleagues in informal settings—such as, the teachers' room, the hallway or other casual situations.

Teachers anticipated least comfort in presenting these topics to fellow teachers in formal settings. Although teachers indicated they were least comfortable in presenting these topics to their fellow science teachers in a formal setting, the mean rating of 4.1 still indicates a high level of comfort with their knowledge of the topics discussed. The relatively low placement of their comfort level for this audience may have more to do with the type of setting than their comfort level with the material, since formal settings tend to be more intimidating than informal ones.

Teachers' Perceptions of the Overall THEMIS Project

The end-of-workshop questionnaire presented qualitative, open-ended queries related to the overall THEMIS project—with which these teachers have been involved for about one year. They were selected for the project in the Fall 2003, but most did not begin to implement the curriculum materials until the 2004-05 school year. They will continue their involvement through 2008. The questions about the overall THEMIS project covered the following topics...

- Motivation for involvement
- Use of materials—current use and planned use
- Barriers in implementing materials
- Support needed from the THEMIS E/PO team
- Dissemination—past efforts and future plans

For each topic area, teachers' comments are clustered according to themes that emerged in content analyses. For each thematic cluster, the percentage of teachers offering a comment in that cluster is provided. Multiple responses result in percentages totaling more than 100%. All of the teachers responded to all questions except for the one about current dissemination activities where only seven teachers answered.

Motivation for Involvement

The end-of-workshop questionnaire presented an open-ended query asking GEONS teachers indicate what their motivation was for getting involved in the THEMIS project. Table 3 summarizes the teachers' comments.

THEMIS GEONS WORKSHOP 2005 Motivation for Involvement with THEMIS Project	Teachers (N=9)
Students—Opportunity to motivate and/or involve students in 'real science'; share materials with students —Saw this as a great opportunity to motivate students; the opportunity to share this material with my students was too good to pass up; the students get to be involved in real data/research. . . good stuff!	67%
Personal—Interest in astronomy/space science/ THEMIS project —Always have been into space science; the subjects THEMIS covers are some of my favorites; astronomy interest; general interest in project itself.	44
Personal—Opportunity to learn —The opportunity to learn; great opportunity to re-energized my enthusiasm for teaching.	22
Personal—Opportunity to work with NASA/globally significant project —The opportunity to work with NASA in a research capacity; opportunity to involve students in actual research and fact gathering that has global implications was simply too awesome to pass up.	22
Discussions/sharing with colleagues —Talking to fellow teachers; opportunity to share this material with other teachers.	22

TABLE 3. THEMIS—GEONS WORKSHOP 2005. Percentages of teachers offering various reasons for becoming involved with the THEMIS project—(N=9).

Two-thirds of the teachers cited their involvement as an opportunity to motivate and involve students in 'real science'. A total of 67% of the teachers said they were motivated to get involved in the THEMIS project for the opportunity to motivate their students, share the materials with them and involve them in 'real science'.

From a personal standpoint, more than two-fifths of the teachers cited an interest in astronomy, space science or the THEMIS project itself. Having a personal interest in the subjects of astronomy, space science and the THEMIS project drew 44% to participate in the project.

Another one-fifth of the teachers were motivated by personal desires—they saw an opportunity to learn or to work with NASA on a project of global significance. A total of 22% of the teachers mentioned that THEMIS provided an opportunity for them to learn and another 22% said that working with NASA was a critical motivating factor in their decision to participate.

Again, one-fifth of the teachers were motivated by the opportunity to have discussions or share the material with colleagues. For another 22% of the teachers, having the opportunity to share materials and discuss them with colleagues was their primary motivation for joining the project.

Use of Materials—Current and Planned

Teachers were asked about how they were currently implementing THEMIS materials and how they planned to do so in the future. Table 4 summarizes their comments. They were also asked to indicate at what grade levels and in which courses they were implementing or planning to implement these materials.

The nine GEONS teachers said that they are implementing or planning to implement the THEMIS project in twelve subject areas primarily at the high school level (78%) as well as the middle school level (44%). Some teachers indicated more than one grade level and one subject area resulting in the percentages totaling more than 100%. The subject areas in which the project is being/will be implemented and the percentages of teachers instructing in those areas...

56%	Physical Science
44%	Physics
33%	Science-General, Advanced
33%	Biology
33%	Chemistry
33%	Earth Science
22%	Astronomy
11%	Anatomy-Physiology
11%	Geology
11%	Lab-based Science
11%	Life Science
11%	Technology

THEMIS GEONS WORKSHOP 2005 Overall THEMIS Project Perceptions—Current Materials Use and Plans	Teachers (N=9)
Use opportunities as they arise/persuade others to integrate —Implementing as much as possible. Research projects with magnetometer data, sharing projects with lower elementary students	44%
Integrate into current curriculum —Incorporated unit into my geology and astronomy curriculum called Sun-Earth Connection; eventually integrate fully into the courses; work to integrate into Earth Science and any other class I can.	33
Use GEONS/THEMIS as a stand alone unit/block of time devoted to THEMIS —In a semester-long THEMIS based class for grades 6-12; rather than trying to pick and choose lessons to fit in my curriculum I plan to use GEONS/THEMIS as a stand alone unit.; quarters totally devoted to GEONS/THEMIS activities in LBS (Lab-Based Science)—Earth Science * at the end of the year.	33
Use as supplement to current curriculum —Initially, as a separate supplement to the current curriculum; next year all TESS (Topics in Earth & Space Science)* classes will include GEONS/THEMIS components.	22
Undetermined —With my schedule it is hard to implement things on the fly. This summer will provide the time.	11

TABLE 4. THEMIS—GEONS WORKSHOP 2005. Percentages of teachers offering various strategies for integrating the THEMIS project into their curriculum—(N=9).

*See Appendix.

About two-fifths of the teachers indicated when implementing the THEMIS project they use opportunities as they arise and persuade others to use THEMIS materials. A total of 44% of the teachers said that they use opportunities as they arise and try to persuade other teachers to integrate THEMIS materials into their own curriculum.

While one-third of the teachers indicated they integrate THEMIS materials into their current curriculum, another third said they use THEMIS materials as a stand alone unit. While 33% of the teachers said that they are integrating the THEMIS materials into their existing curriculum, another 33% reported that they use the material as a stand alone unit or devote a block of time to it.

A little more than one-fifth of the teachers plan to use the materials as a supplement to the curriculum, at least initially. A total of 22% of the teachers indicated that they have initial plans to use THEMIS materials as a supplement to their curriculum for this school year, then as an integral component to their classes in subsequent years.

One teacher has not yet determined how he will use THEMIS materials. One teacher, representing 11%, said that he has not yet had the time to determine how to use the materials.

Barriers to Implementing Materials

The end-of-workshop questionnaires presented an open-ended query asking GEONS teachers to indicate problems or barriers they have encountered over the past year that have made it difficult for them to implement the THEMIS ideas/materials in their classrooms. Table 5 summarizes the teachers' comments.

THEMIS GEONS WORKSHOP 2005 Overall THEMIS Project Perceptions—Implementation Barriers	Teachers (N=9)
Developing a comfort level with materials/knowledge issues; dealing with curriculum errors —Comfort level with the material; I was not understanding the magnetometer data; math understanding and small errors or glitches in lessons or activities.	56%
Time constraints —Not knowing where to do it, not enough time; time; time to actively do/to implement things.	33
Technical/computer problems —Problems downloading some documents; several minor technical issues.	33
Magnetometer not yet installed —Magnetometer not installed yet; no magnetometer and no formal instructions.	22
No barriers —None. Staff (special ed.) and administration were very supportive.	11

TABLE 5. THEMIS—GEONS WORKSHOP 2005. Percentages of teachers offering various types of barriers/problems encountered in implementing THEMIS ideas/ materials in their classrooms—(N=9).

More than half of the teachers experienced problems in developing a comfort level with materials and dealing with curriculum errors. A total of 56% of the teachers cited the development of their comfort level with the materials as well as overcoming small errors in the lessons and activities as barriers they have encountered over the past year.

An equal number of teachers—one-third—were bothered by either time constraints or technical/computer problems. 33% of the teachers encountered time constraints and another 33% experienced technical/computer problems as barriers to their implementation.

Two teachers reported that not yet having magnetometers has been a problem. Not having magnetometers has been a problem for 22% of the teachers.

One teacher not only indicated experiencing no problems/barriers to implementation. One teacher, 11%, cited no problems, but rather took the opportunity to say that the staff and administration have been very supportive.

Support Needed from THEMIS E/PO Team

The end-of-workshop questionnaires presented an open-ended query asking GEONS teachers to indicate if they needed additional support from the THEMIS E/PO team. The team wanted to know if they could teach or provide anything more that would assist teachers in implementing the THEMIS ideas/materials in their classrooms. Table 6 summarizes teachers' comments.

THEMIS GEONS WORKSHOP 2005 Overall THEMIS Project Perceptions—Support Needs	Teachers (N=9)
Nothing else needed —Not that I can think of; I feel pretty good about implementing THEMIS this year; I'll let you know as I learn what I don't know.	67%
More of the same —Same great summer in-services; updated press release; more designed projects.	44
Improve THEMIS problem book —Corrected THEMIS problem book; explanatory answer keys?	22

TABLE 6. THEMIS—GEONS WORKSHOP 2005. Percentages of teachers offering various ideas for continued support from the THEMIS E/PO team—(N=9).

Two-thirds of the teachers reported needing no additional support at this time. A majority of the teachers, 67%, either reported that they needed no additional assistance or couldn't think of anything at this time.

More than two-fifths of the teachers wanted current support to continue as is. A total of 44% of the teachers said they wanted to see more of the same support efforts currently being offered—more designed projects, updated press releases and the same type of in-service.

Two teachers indicated that there should be some improvements on the THEMIS problem book. The THEMIS problem book drew the comments of 22% of the teachers who would like to see corrections to it and explanatory answer keys.

Dissemination—Past Efforts and Future Plans

The end-of-workshop questionnaires presented an open-ended query asking GEONS teachers to describe activities they are doing or plan to do that will inform other educators and the general public about the THEMIS project. Table 7 summarizes the teachers' comments about what they are currently doing and Table 8 presents their comments about what they plan to do.

THEMIS GEONS WORKSHOP 2005 Overall THEMIS Project Perceptions—Current Dissemination	Teachers (N=7)
Informal communications —Working with my school's teachers; helping on new teacher with lesson plans; local school meeting with interested teachers.	43%
Formal communications —Presentations at state science conventions; school board presentation; faculty presentation.	29
Use of mass media/Internet for dissemination —Local newspaper; posting information on Web site.	29

TABLE 7. THEMIS—GEONS WORKSHOP 2005. Percentages of teachers offering various responses about current activities for disseminating information about the THEMIS project—(N=7).

More than two-fifths of the teachers indicated that they are currently using informal communications to disseminate information about the THEMIS project. The current dissemination practices of 43% of the teachers include informal communications such as working with other teachers on lesson plans, assisting new teachers and meeting with interested teachers.

Nearly one-third of the teachers are using formal communications to disseminate information about the THEMIS project. A total of 29% of the teachers said they are using formal communications such as making presentations to state science conventions, school boards and faculty.

Nearly one-third of the teachers are using mass media or the Internet for dissemination. The local newspaper and Internet postings are used by 29% of the teachers to disseminate THEMIS project information.

THEMIS GEONS WORKSHOP 2005 Overall THEMIS Project Perceptions—Dissemination Plans	Teachers (N=9)
Formal communications —Presentations at state science conventions, plus intermediate school district workshops; give talks at local, state and regional teacher and science teacher conferences; in-services; hope to present a synopsis at a faculty meeting in conjunction with our installation.	67%
Informal communications —A follow-up on use of materials and more assistance to other instructors; teach 6 th and 7 th grade teachers how to use GEONS/THEMIS activities.	33
Use of mass media/Internet for dissemination —Newspaper; school newsletter; when our magnetometer is installed, I will probably do the same thing again—newspaper articles, program on our local radio station.	22

TABLE 8. THEMIS—GEONS WORKSHOP 2005. Percentages of teachers offering various responses about planned activities for disseminating information about the THEMIS project—(N=9).

For the majority of teachers, future plans to disseminate THEMIS project information involve formal means of communication. For 67% of the teachers, future dissemination plans include using formal communications such as presentations in teacher conferences, workshops and faculty meetings.

One-third of the teachers plan to also use informal communications. Informal communications, such as working with other teachers with the THEMIS activities, is another dissemination method that will be used by 33% of the teachers.

More than one-fifth of the teachers plan to use mass media and the Internet for dissemination. Plans to use mass media and the Internet for dissemination were cited by 22% of the teachers.

APPENDIX

When asked to provide details regarding the use of THEMIS materials in connection with LBS-Earth Science and TESS (cited in Table 4), the teacher from Michigan supplied the following information regarding the unique programs developed at his high school.

The high school teachers' contract allows for their direct involvement in the development of curricula within the district. Through the efforts of a Curriculum Council, the school has developed unique programs within the school's science department. Among those programs are . . .

Lab-Based Science (LBS)

- Full year course for freshman
- Consists of four nine-week components
- Components are:
 - a) LBS-Earth Science
 - b) LBS-Biology
 - c) LBS-Chemistry
 - d) LBS-Physics
- Content built around state benchmarks
- Students learn content through
 - a) Direct instruction (discussion/lecture)
 - b) Hands-on activities using traditional tools (microscopes, measuring devices, telescopes, etc.)
 - c) Technology using Vernier interfaces and probes
- Have a 16-station computer lab for analysis of data collected with 15 mobile eMacs

Topics in Earth & Space Science (TESS)

- Formerly the Earth Systems Science course
- Consists of four semester long components
- Components are:
 - a) TESS—Astronomy
 - b) TESS—Weather & Climate
 - c) TESS—Geology
 - d) TESS—Water on Earth

Incorporation of THEMIS mission science and activities from workshops

- Occurs in:
 - a) LBS-Earth Science
 - b) TESS—Astronomy
 - c) TESS—Geology
- None of these classes use published texts
- Content is drawn from Web resources including THEMIS Web site
- Activities from summer workshop are used either...
 - a) As is
 - b) Adapted to help students develop computer skills (image processing, graphing from spreadsheets)