

# **THEMIS—TIME HISTORY of EVENTS and MACROSCALE INTERACTIONS during SUBSTORMS**

## **2004 AISES Workshop**

SUBMITTED—August 2005

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### **BACKGROUND**

The American Indian Science and Engineering Society (AISES) has as its primary aim to promote careers in science and engineering to under-served minorities, particularly Native Americans and Alaskan Natives. Its annual conference offers an educational component for K-12 teachers, providing professional development opportunities for participants teaching minority students.

The foremost aim of the THEMIS E/PO effort is to reach such under-served minority children. Thus, AISES's annual meetings serve as an excellent forum for providing professional development opportunities to teachers working with these students.

At the November 2004 AISES conference in Anchorage, Alaska, five teachers attended a workshop offered by the THEMIS staff. This workshop focused on teaching magnetism and exploring the Earth's magnetic field. The five participating teachers reported that they would reach upwards of 440 students with these materials and share this information with some 20 other teachers.

All five participating teachers identified the grade levels at which they are currently teaching. Since some participants are teaching students at more than one grade level, the resulting percentages sum to more than 100% in Figure 1.



**FIGURE 1. THEMIS AISES Workshop 2004—Demographics.** Grade levels at which teachers currently teach (N=5).

**The great majority of participating teachers teach at a high school level**—Most of teachers (80%) indicated that they teach in a high school setting.

**Two-fifths of the teachers reported teaching middle school**—Teachers reporting that they teach in a middle school setting represented 40% of the participants.

## FINDINGS

At the end of the workshop, participating teachers were asked to complete a questionnaire that presented both quantitative, rating scale items and qualitative, open-ended queries. These questions covered the following topics...

- Understanding of topics presented
- Lessons learned
- Anticipated use of materials
- Workshop likes and dislikes
- Additional comments

Teachers' responses to these questions are presented in the remainder of this document.

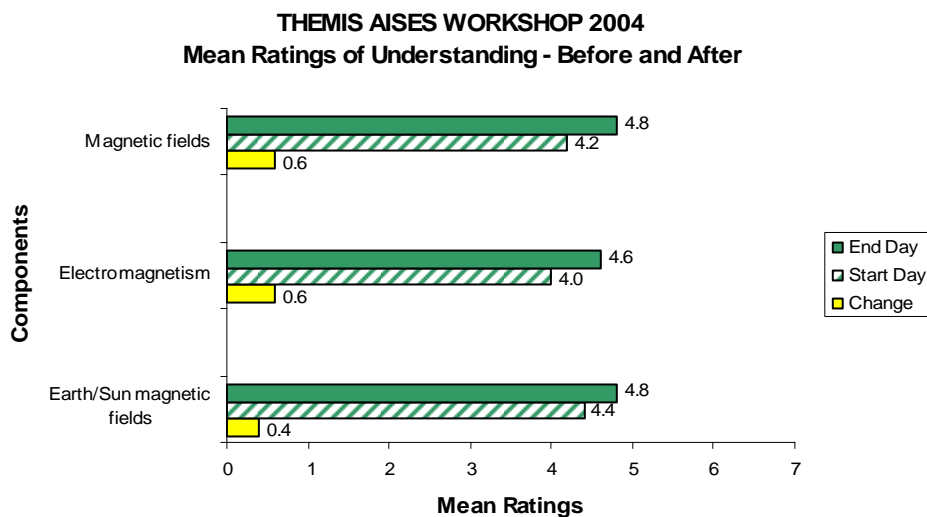
### Understanding Workshop Topics

The end of workshop questionnaire asked participating teachers to use a 7-point scale to rate their understanding of the three topics presented in the THEMIS workshop...

- Earth/Sun magnetic fields
- Electromagnetism
- Magnetic fields

Teachers' mean responses are graphed in Figure 2. Teachers were asked to rate their understanding of these topics both 'before today' and 'after the workshop'. Clearly, the 'before today' question requires teachers to look retrospectively at what they felt their understanding or knowledge level was before the workshop. These responses are referred to in this section as 'start' of the day responses.

Responses reflecting the teachers' understanding 'after the workshop' are described here as 'end' of the day responses. These 'start' of the day and 'end' of the day descriptions are used in the following figure.



**FIGURE 2. THEMIS AISES Workshop 2004—Mean Ratings of Understanding—Before and After.** Mean ratings (7-point scale) for teachers' understanding of the topics presented in the THEMIS AISES Workshop 2004—before and after the workshop (N=5).

**Rating Scale Values Assigned**—Only select points along the 7-point continuums were assigned values...

1=None  
2=Novice  
7=Expert

**Teachers gain understanding in all topic areas**—From 'start' to 'end' of the workshop, teachers gained understanding of each workshop topic—with gains of 0.6 for magnetic fields, 0.6 for electromagnetism and 0.4 for the earth/sun magnetic fields.

**Previous knowledge on workshop topics hovered at the mid-point**—Teachers' ratings of their knowledge at the 'start' of the workshop ranged from 4.0 (electromagnetism) to 4.4 (earth/sun magnetic fields). Since 4.0 is the mid-point of a 7-point scale, these previous knowledge ratings clustered right around the mid-point or 'intermediate' level.

Teachers' ratings indicated that they had the least previous knowledge in electromagnetism (4.0 at 'start') and magnetic fields (4.2 at 'start')—but, interestingly, the gains in these two topics (0.6) were the greatest increases made on any topics. Conversely, for earth/sun magnetic fields which teachers knew most about in the beginning (4.4), they made the least gains (0.4) of all topics.

**End of workshop knowledge hovers close to 5.0**—Teachers' ratings of their knowledge at the 'end' of the workshop ranged from 4.6 (electromagnetism) to 4.8 (for both magnetic fields and earth/sun magnetic fields).

### **Lessons Learned**

The end of workshop questionnaire presented an open-ended query asking participating teachers to list two things they learned in the workshop. Table 1 summarizes teachers' comments.

These comments are clustered according to themes that emerged in a content analysis. For each thematic cluster, the percentage of teachers offering comments in that cluster is provided. Because teachers were asked to list at least two things learned and some listed as many as three, the percentage of teachers who provided responses totals more than 100%. All five teachers attending the workshop answered this question.

<b>THEMIS AISES WORKSHOP 2004 Things Learned in the Workshop</b>	<b>Teachers (N=5)</b>
<b>Electromagnetism</b> —More comfortable with circuits; new information about alternating currents	40%
<b>Earth/Sun magnetic fields</b> —The sunspots themselves have positive and negative ions and maybe magnetic fields between them; eleven year flip of sun's magnetic field is interesting	40
<b>Magnetic fields</b> —Iron filings behave as magnets; Ni, Fe=magnetic behavior	40

**TABLE 1. THEMIS AISES Workshop 2004.** Percentages of teachers offering various responses to an open-ended question about things they learned in the workshop (N=5).

**Workshop information that teachers found most memorable spanned all three workshop topics**—Two teachers (40%) mentioned each of the topic areas as 'lessons learned'—the information that they found most memorable in the workshop.

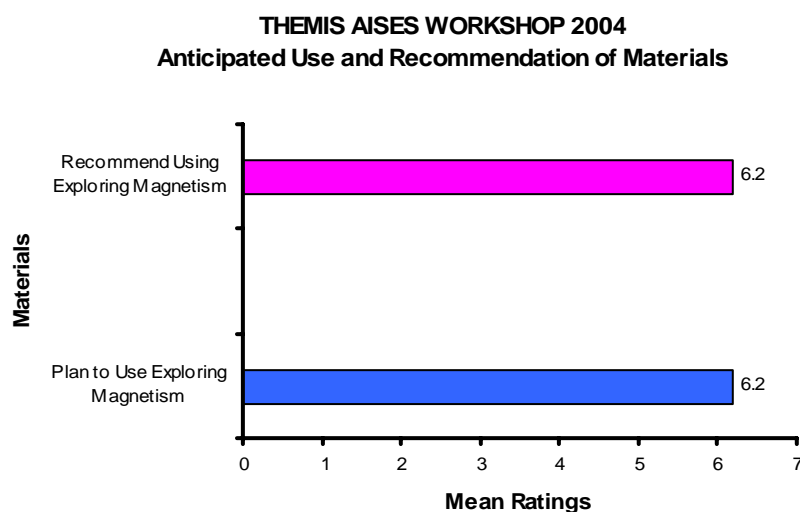
### **Anticipated Use of Materials**

The end of workshop questionnaire presented an open-ended query asking teachers to list the lessons that they felt would be most useful in their classrooms. All five teachers responded, offering comments about lessons and strategies that they thought they might be likely to use in their classrooms...

- Magnetic filings—bottle, tube
- Drawing the magnetic fields and forming magnetic field lines with iron chips
- Tracing the magnetic field
- Electromagnetism
- All the lessons from 'Exploring Magnetism'
- The sequence is important

The interesting thing about their responses is that no teacher mentioned the Earth/Sun magnetic field topic as one he/she might use in the classroom. It is clear that 'hands-on' activities are particularly appealing to teachers for use in their classroom. Teachers may have failed to mention the Earth/Sun magnetic field as useful because it did not appear to have specific 'hands-on' activities related to it.

Additionally, the questionnaire asked workshop participants to use a 7-point scale to rate their intention to recommend 'Exploring Magnetism' and their plans to use the 'Exploring Magnetism' materials in their classrooms. All five teachers responded. Their mean responses are graphed in Figure 3.



**FIGURE 3. THEMIS AISES Workshop 2004—Anticipated Use and Recommendation of Materials.** Mean ratings (7-point scale) for anticipated use and recommendation of materials from the THEMIS AISES Workshop 2004 (N=5).

**Rating Scale Values Assigned**—Only select points along the 7-point continuums were assigned values.

- 1=Strongly agree
- 3=Somewhat disagree
- 5=Somewhat agree
- 7=Strongly agree

**Teachers clearly indicated that they plan to both recommend and use 'Exploring Magnetism'**—Teachers' mean rating for indicating whether they would recommend 'Exploring Magnetism', 6.2, fell solidly in the range of 'somewhat agree—5' and 'strongly agree—7'. Their mean rating indicating their plan to use 'Exploring Magnetism' matched this high rating of 6.2.

### Workshop Likes And Dislikes

The end of day questionnaire presented an open-ended query asking teachers to list what they most liked about the workshop. Table 3 summarizes teachers' comments.

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

<b>THEMIS AISES WORKSHOP 2004 MOST Liked about the Workshop</b>	<b>Teachers (N=5)</b>
<b>Hands-on activities/student participation</b> —Hands-on activities; jumping coils; materials/lessons involve participation by students	80%
<b>Materials to use in the classroom</b> —Lesson packets; the toys; equipment worksheets	60

**TABLE 3. THEMIS AISES Workshop 2004.** Percentages of teachers offering various responses to an open-ended question about what they most liked about the workshop (N=5).

**Teachers cited hands-on activities and activities requiring student participation as the aspect of the workshop that they most liked**—Eighty percent of the teachers mentioned hands-on activities and activities requiring student participation as the aspect of the workshop that they most liked.

**Nearly two-thirds of the teachers said they most liked the classroom materials**—Sixty percent of the teachers commented that the thing they most liked about the workshop was the classroom materials about which they learned.

Additionally, the end of workshop questionnaire presented an open-ended query asking teachers to list what they least liked about the workshop. Table 4 summarizes 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. Only three of the five teachers attending the workshop answered this question.

<b>THEMIS AISES WORKSHOP 2004 LEAST Liked about the Workshop</b>	<b>Teachers (N=3)</b>
<b>No issues</b> —I liked it all; very good—no least liked	67%
<b>Not enough about auroras</b> —Did not discuss auroras specifically very much	33

**TABLE 4. THEMIS AISES Workshop 2004.** Percentages of teachers offering various responses to an open-ended question about what they least liked about the workshop (N=3).

**Two-thirds of the teachers responding said that they had no issues with the workshop so they could not cite what they liked least**—When asked to indicate what they liked least about the workshop, 67% of the teachers took the opportunity to indicate that they could not name anything they liked least, but rather liked everything about the workshop.

**A third of the teachers responding indicated there was not enough about auroras included in the workshop**—Teachers indicating that they would have liked to hear more about auroras represented 33% of the respondents.

### **Additional Comments**

Teachers were asked to share any additional ideas/suggestions they might have about the workshop. Only two of the five teachers took the opportunity to comment. Table 5 shows thematic clusters and percentages.

THEMIS AISES WORKSHOP 2004 Additional Comments from the Workshop	Teachers (N=2)
Positive comments—Thank you for the materials; thanks =)	100%

**TABLE 5. THEMIS AISES Workshop 2004.** Percentages of teachers offering various responses to an open-ended question about additional comments from the workshop (N=2).

**All additional comments from the responding teachers were positive**—Both teachers who responded took the opportunity to share their positive comments and appreciation for the workshop and materials.