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**Vol. 11 No. 1** First Quarter, 1982
PLANETARIAN

Vol. 11, No. 1
Publication Date: September, 1982

The PLANETARIAN ISSN 0090–3213 is published quarterly by the International Planetarium Society under the Publications Committee, © 1982, International Planetarium Society, all rights reserved.

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THE PLANETARIUM CONNECTION:
A Letter of Introduction

by Jordan D. Marche' II

I'd like to take a few moments and introduce myself, in my new capacity as Executive Editor of the Planetarian. My name is Jordan Marche', and I am currently the Program Specialist at the Fleischmann Atmospherium/Planetarium, University of Nevada-Reno.

As all of you are undoubtedly aware, this past year has been a trying time for our publication. I wish right now to publicly thank Bill Peters, I.P.S. President, who stepped in voluntarily as Acting Chairman of the Publications Committee, and Ron Hartman, Editorial Manager, for their extraordinary recent service. Without such help, our Society's journal would probably have fallen irrevocably behind schedule.

Nor are we completely out of trouble by any means yet. This first issue of 1982, even as I am writing, is already seriously delayed. Yet, I will try and do everything within my power to bring our publications back onto schedule, hopefully even within this calendrical year. It will take all the support and encouragement that our Associate Editors, and contributors, can give me in the near future.

Both my background, and present career opportunities have been primarily directed towards planetarium education. I am a graduate of the Master of Arts for Teachers Program formerly offered by Abrams Planetarium, Michigan State University, and also the holder of an undergraduate degree in astronomy from the same institution. My work in Reno centers around the production and presentation of school planetarium programs, and occasional public programs as well. More recently, I've elected to start a newsletter for the Pacific Planetarium Association, the Panorama, which contains the proceedings of that organization's bi-annual conferences.

Our journal is now approaching its tenth anniversary, in June of this year. Many of you who read this now were also its charter subscribers, and you have watched the Planetarian grow and change throughout its first decade. Like the profession it reflects, our publication will continue to serve as a medium for discussion; of the issues that face us, and the breakthroughs of information and technology that will affect us in the 1980's. I'm pleased to be at the forefront, along with you, in this exciting challenge. The Planetarian, then, can hopefully be your planetarium connection, as we look ahead together.

This issue, which you now have before you, seeks to explore some of these new trends in detail. I will always be willing to receive your feedback, on the job that I am doing, and on suggestions for improvement.

I must close for now, and with an often-heard request — that you speedily begin sending me your articles and letters for consideration. Address all correspondence @ Fleischmann Atmospherium/Planetarium, University of Nevada-Reno, Reno, NV 89557. Enough said. It's time for the authors to speak for themselves.
EDITOR'S NOTE:
Mike Ryan is the Director of this 6.1-meter facility in the heart of Central Florida. As president of the Southeastern Planetarium Association, he authored the following article in the March, 1982 issue of that organization's newsletter, Southern Skies. With his permission, it has been updated and reprinted here.

I guess this is the season for everyone to take pot shots at planetariums or, at least, for members of the profession to air publicly differing opinions re: the philosophy of planetarium operation. First, there was the article in the December, 1981 issue of Astronomy Magazine, "The Planetarium, A Cultural Dinosaur." If you were dismayed enough by that, then you were sure to be totally disheartened by an article which appeared in Science Digest, "Battle Under the Dome."

I even went to the extent of authoring a rebuttal which took the form of a dialog interchange between myself and my star machine with the intent of having it published in the Southern Skies, and with the outside chance that it would be considered by the two respective publications mentioned above.

The article was never sent, even to our journal. It suddenly crossed my mind that, regardless of how eloquent I though my work was, such a venture would not resolve a thing. If anything, it would simply fuel the fire of a conflict which has been going on for years and is hardly going to be resolved by any one individual's opinion.

So let's change the subject and talk about something else — like survival. Every year we hear about so-and-so's planetarium being shut down, or serious consideration of same by the powers that be. We perhaps feel a slight tinge of remorse, but nothing much more that that because (we tell ourselves), 'It could never happen to me.' I know that's the way I felt.

Well, my dear friends, let me clue you in. IT CAN HAPPEN TO YOU. It almost happened to me. The question then is this: Is there anything you can do about it, or do you just sit back and wait for something to happen?

Here in Lake County since last August there were the usual rumblings about not having enough money to give teachers a decent pay raise; that programs were going to have to be cut to do the same. There were even reports of some school board members speaking to local civic organizations advocating the closing of a number of centers including 'that plant-growing place'.

I've heard all of that before, and paid little attention to it. After all, I knew I was doing a good job. Then came the kicker! The school board ordered the administration to conduct an in-depth evaluation of every program beyond basic education with the intent of seeing what could be eliminated in the future.

Committees of administrators, teachers and laypersons were established. And wouldn't you know it. A decision was made to pick on those programs that do not generate state funds through pupil attendance (i.e., the star theatre) FIRST. My committee was scheduled to invade the theatre in December with a final report to the administration and school board due sometime in January.

Before going any further, I will say that I had the luxury of knowing in advance that such was forthcoming.

The first thing that I decided was that there was absolutely no way for a group of people unfamiliar with planetarium operation to absorb and have an appreciation for the entire scope of our activities based on a meeting that would last perhaps an hour. They needed to be armed with information in advance, so that when the questions came, they would be intelligent ones.

After a month of in-depth research, I prepared a 28-page, typewritten report: Planetarium, Lake County School's: A Self Study. Each copy was bound in a transparent plastic cover with embossed names for each person to receive: Superintendent, Assistant Superintendent, and committee members.

If any one wishes to receive a copy of this report to use as a basis for a similar study, please get in touch with me. I shall not go into detail here as to contents other than to list the topics presented in the report.
I. General History
II. Operational History
III. Current Operation
IV. Attendance Figures (broken down by (1) school participation and (2) grade-level participation)
V. Funding
VI. Cost per individual receiving planetarium services
VII. Professional equipment on hand
VIII. Accomplishments
IX. Drawbacks in (1) curriculum and (2) facility

The one thing which I believe most impressed committee members was a chart prepared for section III: Time and Cost Analysis for a Typical 40-Minute Planetarium Program (In-House Production). It impressed me! The chart showed thirteen steps toward show completion and included a cost estimate for professional service, were the work contracted out. Labor cost (my salary): $1,562.00; materials: $34.00 vs. professional costs for same service: $4,205.00.

In case you are wondering what the amount was for section VI, this modest/one-man operation cost $1.83 per person last school year.

Did my report help? Well, the committee met in December (I was not asked to be present). Their findings were presented to the administration the third week of January (once again I was not there -- too many second-graders funneled through the theatre). What eventually got back to me was that the theatre came out smelling like a rose. Apparently, mine was the only program that bothered to publish such findings.

What really made me feel good was when the superintendent came out this way and told me to disregard anything that I might see or hear in the media. The planetarium was on good ground and he had no intention of closing the place down.

To be honest, I should relate to you the phone call which I received from the committee chairman. “Mike, I thought that you wanted to know what we said. We decided that the theatre was a waste of taxpayer’s money; that the programs were terrible; that no one wanted to come; and we are recommending that when funds become available that your dome be expanded to thirty feet!” Heart attack time.

Let’s be honest. I’m not completely out of the woods. The report has yet to go to the school board: an organization that has meetings so political, they are more fun to watch than Howard Cosell on Monday Night Football. What was the famous saying Mark Twain coined decades back?: “First God created idiots. That was just for practice. Then he created school boards.”

My advice, then, is as follows: If you hear that something like this is about to confront you, evaluate yourself first. In other words, do their work for them.

EPILOGUE

The above material was written during the last week of January, 1982. As I sit in front of my typewriter now, we are closing in on the end of April and much has happened in the interim.

Evaluation committee reports were presented to the school board during workshop sessions in the month of February. The board adopted most of their recommendations and the theatre survived. Other programs within the school system were not as fortunate. Teacher allocations were cut back; the teacher-aide program was eliminated; driver’s education flew out the window; and funding of various athletic programs was reduced. Also lost was our three-year-old Outdoor School, a program in which sixth graders were in residence at a 4-H camp for five school days for an intensive environmental experience.

I suppose that I should have felt relieved that the planetarium survived. However, this has not been an easy period for education in our district, and I felt the pain of the loss of many positive programs, some of which we pioneered.

What I did not realize was that in early March, events were taking place without my knowledge – events which would ultimately put the star theatre back in front of the school board for possible elimination.

Feelings of sour grapes were being expressed back on school campuses; the ‘me first’ syndrome was replacing what had previously been a forward-looking, progressive attitude. Principals were telling their faculty that because the planetarium survived, they would be saddled with higher class counts and no aides to assist them. In other words, they were unjustly comparing a $40,000 per year operation (the planetarium) to $1.2 million in school center reductions.

It was inevitable that phone calls from elementary teachers to school board members would follow. “Every time I take my class to the planetarium, I see the same old program.” – a statement which on the surface appears damaging, until you consider the mode of operation of the theatre. We track our students K-5 to avoid duplication of presentations (as most planetariums do). It follows that teachers who stay within a given grade level for a number of years will see the same program, even though the material is new, for the kids.

I was informed on March 12 that the school board was possibly going to drop the axe on the planetarium in less than two weeks. I was also told by the administration that if I wished the program to continue, I would have to drum up support before ‘D-Day’.

Those people who know me well understand that basically I am NOT a political animal. But now my back was against the wall and SOMETHING had to be done. It may be conceited on my part to make this suggestion, but I honestly do not think that the board was prepared for the onslaught of support which was dumped onto them!

In what a local newspaper was later to term an ‘orchestrated move’, phone calls and letters backing our operation came from prominent local citizens. The most priceless comment from one person was as follows: “Do we have to throw out the baby with the bathwater?”

Yes, it was orchestrated, and even to the extent of asking my peers in the southeastern region and elsewhere for letters of support. The letters came in droves from all areas of the country; support for which I am eternally grateful to those who thought enough to respond.

The ultimate decision came at the board meeting on April 13. The planetarium survived by a 5-0 vote!

So what is to be learned from this chronicle of events?

(continued next page)
Was the preparation of a 28-page self-study document worth the effort? This is hard to say. It perhaps was of importance to the administration. And yet it meant nothing to a policy-making body who is more prone to react to outside pressure than to make decisions based on past performance and levels of professionalism.

As far as the general future is concerned, one notion bothers me. It used to be an unwritten axiom that the most secure planetarium positions were those tied to a school system. That concept may no longer be valid.

In an era when federal support dollars for education are on the wane, more and more school districts may be looking for 'frill' areas to cut, and it is conceivable that our hallowed domes may dwindle in numbers. I dearly wish that I had a solution to this prospect, I pray that I am wrong. All I can say is that, THIS time, I was lucky.
The Planetarium/Spatial Orientation Ability Connection

Mark S. Sonntag
Education Director
Hansen Planetarium
Salt Lake City, Utah

EDITOR'S NOTE –
Mark Sonntag has recently received his Ph. D. in Astronomy Education from the University of Colorado, Boulder. This paper is an edited summary of his thesis research, and its important implications to all planetarium educators.

Previous research studies that have examined the problem of comparing planetarium to classroom teaching situations have shown mixed and somewhat confusing results. Of the eleven comparative studies reported in the literature, four have favored the planetarium, two the classroom, and five showed no statistically significant differences between the two methods (see Figure 1). These discordant findings may be partially explained by noting that each study used different teaching techniques in both the classroom and planetarium, each attempted to teach different concepts, a wide variety of grade levels were used (grade 2 through college), and astronomy achievement was defined differently for each study done. The success or failure of each method was also greatly affected by the research design utilized and additional variables not controlled. All (except Ridky 1973) were single-factor experiments, and each utilized the planetarium teaching method over a relatively short period of time, thus reducing the potency of the treatment. The effect of both of these considerations was to reduce the statistical power of showing potential differences between teaching methods, and the single-factor experiments also failed to identify possible interactions between teaching method and student personological variables (Hopkins, 1973).

<table>
<thead>
<tr>
<th>STUDIES</th>
<th>GRADE LEVEL</th>
<th>N</th>
<th>SIG. LEVEL</th>
<th>COG. DOMAIN</th>
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<td>64</td>
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<td>.05</td>
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<td>237</td>
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<td>P</td>
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<td>6th</td>
<td>400</td>
<td>.05</td>
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<td>.05</td>
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<td></td>
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<tr>
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<td>48</td>
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<td>P</td>
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<tr>
<td>Sunal (1972)</td>
<td>2nd</td>
<td>1,750</td>
<td>.05</td>
<td>O</td>
<td>P</td>
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<tr>
<td>Reed (1973)</td>
<td>college</td>
<td>159</td>
<td>.05</td>
<td>O</td>
<td>P</td>
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<tr>
<td>Ridky (1973)</td>
<td>8th</td>
<td>100</td>
<td>.05</td>
<td>O</td>
<td>P</td>
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</tbody>
</table>

FIGURE 1. Previous planetarium vs. classroom comparative studies and results.

N = Number Sampled
Sig. Level = Significance Level
Cog. Domain = Cognitive Domain
Affec. Domain = Affective Domain
P = Planetarium favored
C = Classroom favored
O = No significant difference

(continued next page)
In a related field of research, astronomy educators have shown two aspects of spatial orientation ability (the ability of a person to imagine straight-line projections in space and the view of objects from various perspectives) to be relevant for consideration as another factor in a planetarium vs. classroom comparative study. First, it has been shown that this construct correlates positively with achievement on positional astronomy tests, and that it is a better predictor of success in this area than traditional measures of school achievement and intelligence such as grade point average and I.Q. (Bishop, 1980; Kelsey, 1981; and Schatz and Lawson, 1976). These recent findings suggested that this construct would be a logical choice for a second factor in the planetarium vs. classroom study. That study was undertaken, and furthermore utilized a multi-factorial approach. Such a design thereby enlarged the statistical power of the experiment, and also permitted the investigation of possible interactions between teaching method and spatial orientation ability. This type of design had not previously been utilized in planetarium education research.

The purposes of this study were: a) to investigate the relative effectiveness of the planetarium, classroom, and combination planetarium/classroom teaching techniques; b) to investigate how spatial orientation ability affects the learning of positional astronomy topics; c) to determine which concepts in positional astronomy can be taught most effectively in these teaching situations and spatial orientation ability groupings; and d) to identify any interactions between teaching method and spatial orientation ability across all concepts of positional astronomy.

METHOD. The subjects used in this experiment were 76 senior-level elementary-education students enrolled in Teacher Education 423 at the University of Colorado, Boulder, during the Fall Semester, 1980. The students in this class were randomly assigned to one of three sections by inserting special procedures into the registration process at the University. The sample consisted of 70 female and 6 male students. This distribution is consistent with typical enrollments in elementary-education classes. The mean grade point average for this sample was 3.21 (where 4.00 is equivalent to an “A”), and 65% of the students had taken no previous astronomy classes in college. These characteristics are also typical of pre-service elementary school teachers at the University of Colorado.

This study used a two-factor, posttest-only experimental design. The two independent variables were: a) Teaching Method (Planetarium, Classroom, and Planetarium/Classroom); and B) Spatial Orientation Ability (Low, Medium, and High). The three spatial orientation ability groups were defined from scores achieved on the researcher-constructed Spatial Orientation Ability Test (SOAT), which students took prior to the start of the experiment. Those students scoring in the top one-third were assigned to the High group; those scoring in the middle one-third were assigned to the Medium group; and those scoring in the bottom one-third were assigned to the Low group. The SOAT was deemed to have construct validity by a group of education experts, and its reliability using the Spearman-Brown Formula was found to be 0.801.

Each section of the course experienced four hours of instruction covering the same positional astronomy concepts (celestial sphere, diurnal motion, time, and seasons). Only the teaching method was allowed to vary across sections. The Planetarium section used the capabilities of that teaching device to demonstrate the positional astronomy concepts. A celestial globe was utilized in the Classroom section, and the Planetarium/Classroom section received one two-hour lesson with each tool. All sections were shown the same series of the slides to supplement the instruction.

The dependent variable in this experiment was the researcher-constructed Positional Astronomy Achievement Test (PAAT). This 60-item multiple-choice exam was checked for content validity by a group of astronomy and education experts, and its reliability (using the Spearman-Brown Formula) was found to be 0.831. The PAAT was administered after all treatments (teaching techniques) were finished, and the scores on this test were used to make all group and section comparisons, and to look for interactions between independent variables.

RESULTS. Analysis of covariance was used to test for the statistical significance between group and section mean scores on the PAAT and its four subtests (Celestial Sphere, Diurnal Motion, Time, and Seasons). Grade point average (GPA), previous number of college astronomy credit hours, and class attendance were used as covariates. The results of these analyses on both main factors and their interactions are tabulated in Figure 2.

These data show that there were statistically significant differences ($p \leq 0.05$) between teaching methods as measured on the total PAAT, but not on any of its subtests. The Newman-Keuls multiple comparison procedure showed that the classroom teaching method was superior to both of the other two methods, but only significantly better ($p \leq 0.05$) than the Planetarium/Classroom section. There were no statistically significant differences found between the Classroom and Planetarium teaching techniques.

Highly significant differences were found between the spatial orientation ability groups, not only on the total PAAT, but on three of its subtests (Celestial Sphere, Diurnal Motion and Time). Only the Time subtest showed no significant difference between spatial orientation ability groups. The Newman-Keuls multiple comparison procedure was also applied to these significantly different means. Spatial orientation ability was thus confirmed to be extremely important for successful mastering of all but one of the concepts in positional astronomy (i.e., time concepts).

Significant ($p \leq 0.05$) interactions between teaching method and spatial orientation ability were found on the total PAAT (Figure 3) and two of its subtests (Celestial Sphere and Seasons). Students in the Low and Medium spatial orientation ability groups did significantly better if they were in the Planetarium or Planetarium/Classroom sections. But students in the High spatial orientation ability group did significantly better if they were in the Classroom. Although two of the subtests (Diurnal Motion and Time) did not show statistically significant interactions, similar trends were found on these tests also.
FIGURE 2.

<table>
<thead>
<tr>
<th>TEACHING METHOD</th>
<th>TOTAL</th>
<th>CELESTIAL SPHERE</th>
<th>DIURNAL MOTION</th>
<th>TIME</th>
<th>SEASONS</th>
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<tr>
<td>Planetarium</td>
<td>25.17</td>
<td>4.02</td>
<td>7.63</td>
<td>4.66</td>
<td>0.75</td>
</tr>
<tr>
<td>Classroom</td>
<td>28.02</td>
<td>4.38</td>
<td>8.61</td>
<td>5.62</td>
<td>9.59</td>
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<tr>
<td>Planetarium/Classroom</td>
<td>23.31</td>
<td>3.87</td>
<td>6.88</td>
<td>4.84</td>
<td>8.11</td>
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<tr>
<td>Statistical Significance</td>
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<td>0.480</td>
<td>0.079</td>
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<tr>
<td>Low</td>
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<td>3.31</td>
<td>5.81</td>
<td>4.27</td>
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<tr>
<td>Medium</td>
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<td>3.96</td>
<td>7.98</td>
<td>5.40</td>
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<tr>
<td>High</td>
<td>29.59</td>
<td>4.89</td>
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<td>9.93</td>
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<td>Statistical Significance</td>
<td>0.000</td>
<td>0.002</td>
<td>0.000</td>
<td>0.131</td>
<td>0.012</td>
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<td>Statistical Significance</td>
<td>0.001</td>
<td>0.007</td>
<td>0.106</td>
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<td>0.002</td>
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Group Mean Scores on Positional Astronomy Achievement Test (PAAT) and Subtests and Statistical Significances across Teaching Method, Spatial Orientation Ability Groups and Significances of Interactions.

DISCUSSION. The results of this experiment have important implications for all astronomy educators planning to include positional astronomy topics in their course. This applies to planetarium educators in particular, because of the large amount of time spent developing these concepts in the planetarium.

Under the conditions of this experiment, when the teaching factor alone is considered, the Classroom method was found to be significantly more effective than the Planetarium/Classroom method. However, Classroom/Planetarium differences are uncertain. It appears that, when just teaching method alone is considered, our understanding of the teaching potential of the planetarium is quite limited.

The fact that spatial orientation ability groups showed significant differences on all tests except the Time subtest confirms the prediction made prior to this experiment of the importance of this construct in the achievement of positional astronomy concepts.

Our suspicion of the profound impact of this factor is dramatically supported when spatial orientation ability is used as a covariate. Under this condition, the effect of teaching method is completely cancelled, and differences between methods cannot be distinguished from random variations ($\alpha = 0.475$).

Spatial orientation ability is not to be confused with traditional measures of achievement or intelligence. In this experiment, this construct had a low correlation ($r = 0.10$) with grade point average. However, spatial orientation ability is a better predictor of achievement in positional astronomy ($r = 0.46$ with the PAAT) than GPA ($r = 0.24$ with the PAAT).

This study also confirmed the results of Schatz and Lawson (1976), Good (1977), and Kelsey and Brockway (1980), which all found that a high percentage of college students have some measured difficulty in spatial orientation concepts. The average difficulty (percent answering wrong) on each item of the PAAT was 33.09. This might be roughly interpreted to mean that about one-third of the students have difficulty with these concepts.

Previous studies comparing planetarium and classroom instruction have based their conclusions upon a single-factor analysis of teaching methods alone. The first part of this experiment did the same, as has already been described. However, by adding a second factor to the analysis, an entirely new and less ambiguous set of conclusions may be drawn. Apparently, in previous single-factor experiments, the very high scores achieved by students with high spatial orientation ability in the classroom situation skewed the scores enough to either favor the classroom or show no significant differences between teaching methods.

(continued next page)
FIGURE 3.

Interactions between Teaching Method and Spatial Orientation Ability (Cell Mean Scores) on Positional Astronomy Achievement Test (PAAT).
CONCLUSIONS. We have seen how the consideration of a second factor (spatial orientation ability) produces variable results over teaching method alone. This type of analysis has provided the planetarium educator with a new, and I believe more appropriate, technique of evaluating positional astronomy teaching methods. The results can also be applied to prescribing the best type of instruction for students whose spatial orientation abilities have been measured. Based upon this study, the Diurnal Motion and Time concepts may best be taught in the classroom. This is particularly true for the Time concepts, which were the only ones that did not show significant differences across spatial orientation ability groups. This study also strongly suggests that whenever students’ spatial orientation ability can be determined, it should be done. Students in the bottom two-thirds of the construct should receive a heavier dose of planetarium instruction, whereas those students in the upper one-third should receive the bulk of their instruction in the classroom.

Although the results of this research have helped to answer some long-standing questions in planetarium education, they have also raised a number of new questions. What other factors affect planetarium instruction? Are the results of this experiment generalizable across different age levels and populations of students? What affect might gender have on positional astronomy achievement when added as a factor? Why did the Planetarium/Classroom section appear to do so poorly? What is the most effective blend of planetarium and classroom instruction? How is the teaching of other astronomy concepts affected by the factors considered in this experiment?

Multi-factor analysis of planetarium teaching and student personological variables has now been shown to be a fruitful research methodology. I urge that this technique be expanded upon in future research efforts, as we continually strive to understand the nature of the planetarium as a teaching device.

REFERENCES


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Most planetariums give a “Star of Bethlehem” show at the end of each year. For a small planetarium, the attendance at this one show can exceed that of all other shows given during the year. Seasonal shows directed to specific groups in the community are one way of meeting the task of making your planetarium a recognized part of the community. It is certainly to be encouraged, even if the planetarian does not share the group’s opinions and beliefs himself.

A planetarium can be a unique setting for the transmission of information to members of a group from their recognized leaders. By creating an atmosphere and a state of mind under the darkened dome, the planetarium can be made an unequalled medium for transmitting cultural and historical information. I am speaking of the information which defines, identifies and propagates the group, its history and values. A book of such information is often unread; a lecture in a stiff room is often unlistened to. But beneath the dark dome with the stars brilliant above, an audience’s attention can be awakened and gently directed to this information, which is of cardinal importance to transmit. The purposes of this article are to report such a venture, and hopefully to stir you to try something similar yourself.

On December 21, 22, and 23, 1981, we gave a show entitled, “The Festival of Lights” at the Buckstaff Planetarium. The show was prepared by myself, a student of mine, Rob Nixon, and by Rabbi Steve Mason of the Temple B’nai Israel in Oshkosh. To avoid misunderstandings, let me say that I have also successfully given Star of Bethlehem shows. When I gave these shows, I was neither a Jew nor a Christian, just a physicist past forty and respectful of other’s beliefs. This show’s purpose was to convey some information on the historical background and significance of the minor Jewish festival of Hanukkah. It was directed to the Jewish members of the community, though all were welcome to attend and the show was advertised in the media.

I have long wanted to do a Hanukkah show. At the biennial I.P.S. meetings in Washington, D.C. and in Chicago, I talked with many other planetarians. A number were interested in the possibility of such a show though none knew of anyone who had done one. I think the major reason for this is that no one had worked out the concept of what such a show should consist of. If one gives a Star of Bethlehem show, one really should give a Hanukkah show also. It establishes the planetarium’s neutral position on religious questions.

But how on earth does one give a Hanukkah show? Just exactly what would make a planetarium setting appropriate for such a show? How would the community at large respond? How would the Jewish members of the community respond?

First some information. Hanukkah is not a Jewish version of Christmas. It is entirely unlike it. Christmas is a major occasion to the Christian; Hanukkah is a minor festival for Jews. Hanukkah is for children. It is the Festival of Lights. What more appropriate setting can there be for a Festival of Lights than the darkened theatre of a planetarium with the stars twinkling above? Hanukkah commemorates an historical event, the time when four centuries of foreign rule were ended by successful rebellion and a Jewish monarchy was established in Israel. Beginning in the second century B.C., Jewish kings ruled for the next century and a half. The rebellion was sparked by a religious outrage. The Syrian-Greek King, Epiphanes, violated the sanctity of the Temple in Jerusalem. He ordered a statue of Zeus to be placed in the Temple, and pigs to be sacrificed in its precincts. The face of Zeus in the Statue was modeled on Epiphanes’s own. When the rebellion succeeded, Judah Macabee, the Jewish leader and new king, caused the Temple to be purified. Candles were lit for eight days — to celebrate several eight - day religious festivals that Epiphanes had banned. Jews today still light eight candles to remind themselves of this event. It is a joyful occasion.
One candle is lit for the first night, two the second, and finally all eight, by the eighth day. In the Jewish home children's games are played by candlelight with a spinning die called a Dreidal, for raisins and nuts.

There are many more than eight stars in the planetarium sky. How can a planetarium be fitted, then, to suggest the eight lights of Hanukkah? With the sky set for the night of the show (Hanukkah began on December 21 in 1981), first set the sun. Sunset is the start of the day in the Jewish calendar. Just coming up over the horizon is our constellation of Orion. Two thousand years ago, Jews called it Shemhazi. Point this out to the audience, raising Shemhazi to the meridian. You may also want to set the latitude at +31° N., the latitude of Jerusalem. Now point out to the audience the eight bright stars around Shemhazi: our Sirius, Procyon, Castor, Pollux, Capella, Aldebaran, Betelgeuse and Rigel. Here are eight lights in the sky for Hanukkah.

There is not enough space in this article for the full script from our show, but I would be pleased to send a copy to any of you who wish one. It is twenty-two pages in length, typed double-spaced, and with text on the left three-quarters of the page. Slide notes appear on the right quarter. We used approximately one hundred slides; your audio-visual department could easily duplicate them as we took most from just six readily available books. About a dozen of the one hundred slides, however, were personal photos taken by the Rabbi in Jewish homes of the community. This was a most appreciated feature of the show. I will recommend it to any planetarian who has not tried it. An audience dearly loves to see themselves projected onto the dome. It would even be possible to use our script without these slides. We did tape our show and used a half-dozen musical passages as background, plus several songs in foreground roles. About half of the one-hour show was concerned with astronomy and star mythology, while the other half was on the revolt, and the significance of Hanukkah. For this part of our script, we used material prepared by the Institute of Creative Judaism.

How did the community respond? The community newspaper put large announcements and articles in several editions of the preceding week. Newspapers from several surrounding towns contacted us to do interviews. The attendance was rewarding. At one show there were two or three times the number of people who were seen at Sabbath services the week before. More than that, many people who didn't come to the show later mentioned to us how good a production they had heard it was, and were anxious to know when our next such venture would be. We are also preparing a Passover Show.

I invite you to examine our “Festival of Lights” script, and consider it as a possibility for your planetarium next December. There are now a hundred people in Oshkosh who had never been in our planetarium before, and who are eagerly awaiting our next show!
TEACHING OBSERVATIONAL ASTRONOMY TO PARENTS AND THEIR MIDDLE-SCHOOL CHILDREN

Eugene Gennaro, Dennis Brinkman, Rodney Nerdahl and Patricia Heller

INTRODUCTION

The advent of the Space Shuttle, probes to the outer planets, and science fiction films have provided both parents and children with the motivation to become better informed in astronomy. Interested families often visit informal science centers such as museums, observatories, and planetariums to satisfy their curiosity about the objects and events that are observed in the night sky. However, researchers have found that in addition to this desire to learn, a prime motivation for families to visit an informal science center is the social aspect of “doing things together”. One of the predominant themes emerging from this research is the visitors’ need for interaction with other members of their family.

Most museums and planetariums offer short courses for adults or for children, but rarely do they offer courses for parents and their children to take together. At the University of Minnesota, with the support from the National Science Foundation, we have developed and taught an introductory course in observational astronomy designed specifically for parents and their middle-school aged children (ages 10-14) to take together. The activities in the course were designed to achieve the following goals:

1. To strengthen family interactions through a shared parent/child learning experience.
2. To promote positive attitudes in both parents and their children toward observational astronomy.
3. To increase the knowledge as well as observational and interpretive skills of both parents and children with respect to the night sky.

Why middle-school aged children? We thought it would be difficult to teach observational astronomy in a manner that is both interesting and profitable to young elementary school children and their parents simultaneously. Many high school students interested in astronomy have jobs in the evenings and on weekends or already know considerably more astronomy than their parents. Hence, middle school children seemed a natural choice.

DESCRIPTION OF THE COURSE

The Nighttime Astronomy course was taught twice in the last year at two different planetarium facilities – the Como Planetarium and the Minneapolis Planetarium (operated by the Science Museum of Minnesota). The former institution has an automated Spitz Model 512 planetarium instrument and the latter a Spitz Model C (without automation). The sessions were team taught by Dennis Brinkman, the Director of the Como Planetarium, and Rod Nerdahl, the Program Assistant of the Children’s Center and Planetarium.

Each course was five sessions long and met for two hours on a weekday evening from 7:00 p.m. to 9:00 p.m. Some families registered as one parent and one child, some as two parents and one child, and still others as two parents and two children. Class sizes ranged from eight to twelve families (20 to 30 participants). Home activities were provided for parents and children to do together.

Each session of the course is composed of two segments, one in the planetarium and one in a nearby classroom or outside for nighttime observation of the sky. To promote family interactions during the planetarium segment, each family was given a red-filtered flashlight, pencil, prediction or observation sheets, and a lap board (when planetarium seating lacked desk tops). Families were periodically given time to consult together and record their predictions or observations. For example, in one planetarium segment families recorded and predicted the consecutive monthly positions of Mars and Jupiter on an unmarked star map, and in another segment, families predicted and recorded the successive daily shape and position of the moon on a horizon map. The classroom segments were used for modeling the observations made in the planetarium or for building observational instruments. In addition, families were given home activities to complete together each week.

A brief synopsis of each of the five sessions follows:

Session One: Families are introduced to the night sky. Initially, most families view the night sky as a disorganized collection of stars. They are given an unmarked star map which also, at first glance, appears disorganized. Through projected constellation figures and a pointer, families learn how to divide the sky into easily recognized constellations. In their home activities for the week, families are encouraged to spend time outside locating and identifying constellations. They use parts of their hands to estimate the angular distance between the stars and experiment with astrophotography using 35 mm. cameras.

Session Two: Families build a mental model of the celestial sphere by observing how the rotating earth affects the apparent motion of the stars. They first look at examples of astrophotography slides. These slides lead to a discussion of the cause of star trails. In the planetarium, families predict and record how star trails look when a camera is pointed in different directions, north, south, east, and west. They also predict and record what star trails would look like at three other locations on the earth, the north pole, the equator, and the south pole. Families are then introduced to the
Students
Building an Astrolabe

Simulating the Zodiac

Mother and Son Building
an Astrolabe
concept of altitude and azimuth angles in the planetarium. In the classroom, they build an astrolabe and learn how to use it. For the home activity, families use their astrolabe to measure the altitude and azimuth of some bright stars.

Session Three: Families pretend they are ancient astronomers watching the heavens over a period of several months. They discover that not all of the “stars” remain fixed with respect to one another. These “wanderers” are the planets. By recording the changing position of Mars, Jupiter, and Saturn on a star chart, families discover that the planets move through constellations known as the zodical constellations. In the classroom, family members act out a model of the solar system in order to better understand the motion of the planets through the zodiac. The home activity prepares the participants for the last session by having them observe and record the position and shape of the moon at sunset.

Session Four: A field trip to a local observatory offers families an opportunity to observe celestial objects through a telescope and talk to a professional astronomer. For the home activity, families build and use a small, hand-held telescope. They are introduced to the advantages that larger telescopes have over a small homemade instrument, while also discovering the surprising number of objects that can be seen with a relatively small telescope.

Session Five: Families observe and predict the position and shape of the moon in the planetarium over several consecutive days. The observations are first made at sunset (waxing moon), and then at sunrise (waning moon). In the classroom, families use illuminated ping-pong-ball models of the moon to observe and record the phase of the moon when it is in different positions in its orbit around the earth.

We found teaching parents and their children observational astronomy to be an exciting and rewarding experience. It was not unusual to find some children far more literate in astronomy than their parents. However, children’s knowledge and enthusiasm was generally quickly reinforced. It was not unusual to find some children far more literate in astronomy than their parents. However, children’s knowledge and enthusiasm was generally quickly reinforced. It was not unusual to find some children far more literate in astronomy than their parents. However, children’s knowledge and enthusiasm was generally quickly reinforced. It was not unusual to find some children far more literate in astronomy than their parents. However, children’s knowledge and enthusiasm was generally quickly reinforced. It was not unusual to find some children far more literate in astronomy than their parents. However, children’s knowledge and enthusiasm was generally quickly reinforced. It was not unusual to find some children far more literate in astronomy than their parents. However, children’s knowledge and enthusiasm was generally quickly reinforced. It was not unusual to find some children far more literate in astronomy than their parents. However, children’s knowledge and enthusiasm was generally quickly reinforced.

Since the activities in the course require families to work together to solve problems and learn new skills, both parents and children have the opportunity to act as the “teacher”. In some instances, the children were the first to visualize a concept, and in turn, helped their parents. In other situations, the opposite occurred. In some circumstances, children interacted with their parents as educational equals and could share their knowledge with their parents in a new and different way.

EVALUATION

Based on evaluations completed by 49 parents and children, the Nighttime Astronomy course was very successful. The course was rated 4.8 on a five-point scale (1 = not very enjoyable to 5 = very enjoyable). All of the partici-pants said they would recommend the course to a friend. When asked to comment on a particularly rewarding experience they had as a result of the course, parents tended to list “sharing a learning experience with my child” and “learning to observe and identify things in the sky”. Children, on the other hand, gave responses that dealt solely with particular activities, such as the trip to the observatory or building the astrolabe and telescope.

To the question, “Did you like taking this course with your child/parent?”, both parents and children all responded positively. When asked “Why?”, parents made comments like “It is not very often we get to learn with our children.”, “It’s fun to realize there are so many areas and levels we can both share and learn about and not be a ‘parent’ or ‘child’, but students!”, “It was enjoyable to see her enthusiasm and provide another avenue of communication.” Typical child responses were, “I enjoy learning about the stars and so does my dad.”, and “It used to be no one listened to me when I talked about astronomy.”, “I have seen things I never saw before.”, and “One night I took a pillow out on our deck and leaned back and watched the sky for an hour.”

Since parents and children often exchange teacher and learner roles, both gained insight into the level of knowledge and learning behaviors of each other. Comments like “He (my son) is an even deeper thinker than I thought—he is very committed to his opinions and conclusions.”, were common. Using a pre-and post-test, we also found that both parents and children made considerable gains in their understanding of the course content.

CONCLUSIONS

Teaching a Nighttime Astronomy course to parents and their middle school children may be an effective and enjoyable method for increasing scientific literacy about astronomy of two different age groups. A course similar to the one we developed could be offered through community education programs in many school districts which have a school planetarium, or with the cooperation of a local science museum or planetarium.

We have a comprehensive teacher’s manual for the course, complete with marked and unmarked sky maps, constellation diagrams, and worksheets. If you are interested in starting a Nighttime Astronomy course for parents and children in your community, please write to Gene Gennaro, Project Director, Out-of-School Science Experiences, 370 Peik Hall, University of Minnesota, Minneapolis, Minnesota 55455.

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The Strasenburgh Planetarium Internship

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EDITOR'S NOTE

This is the second article of a series begun in the last issue to examine contemporary training programs in planetarium production and education. It is hoped that these summaries can provide essential information (through the personal experiences of their authors) for prospective trainees entering this field.

One of the most established training programs in the planetarium field today is the internship of the Strasenburgh Planetarium in Rochester, New York. I was privileged to be an Intern of that program during the 1976-77 year. I've been asked by the Editor to describe this program, and jot down some of my impressions of it.

The Strasenburgh Planetarium is one of the most renowned and progressive planetariums in the country. Since opening its doors in 1968, it has pioneered novel and polished planetarium shows of the highest quality. It was the first to use computerized automation and is known for its innovative “specials”, such as the first play ever produced in a planetarium: Bertolt Brecht's “Galileo”, produced in 1969. To my knowledge, Strasenburgh was also the first planetarium to hire a full-time musical composer to create and record original scores for its soundtracks. The Planetarium houses a Zeiss Mark VI Projector with a Gray MC-10 automation system. Surrounding the theatre are a projection gallery, offices, lobby, gift shop and exhibit area. On the roof is a well-equipped observatory containing 12.5 and 8-inch reflectors for public and class observing. Complete art and multi-track sound studios are located in the basement, along with a darkroom, technical shops, and a large storage space.

The Internship Program, begun in 1971, is a twelve-month period of 'learning by doing'. There is no formal approach, so that the Intern is allowed to pursue personal interests along with a variety of assignments in such areas as script writing, show production and presentation, audio engineering, photography and special-effects construction. The Intern gives school shows on a regular basis to all grade levels, and occasionally writes or rewrites these programs. He also aides in the production of public shows, from offering script input and audio assistance to the construction of some of the special effects. The Intern is usually asked to produce one short-length show in its entirety, from writing and recording the narration to photographing the visuals and constructing any effects required. All of this is intended to give the Intern a wide range of experience and training in the various disciplines involved with the operation of a major planetarium.

To make the most of this program, the Intern should be highly self-motivated. There is very little 'leading by the hand'. If you are looking to have the sum total of all planetarium knowledge and skills served up on a silver platter, then this program is probably NOT for you. The more the Intern explores and becomes involved in the planetarium's operation, the more he or she will gain from the experience.

I found the Strasenburgh staff to be most talented, friendly, and helpful professionals. The experience and knowledge gained while as an Intern have been invaluable to me. I recommend that anyone seriously interested in a planetarium career consider applying for the Strasenburgh Internship. The program currently carries a stipend of $8,000., which can be supplemented by additional teaching through the Rochester Museum and Science Center's School of Science and Man. For further information on applying please contact:

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THE SOUND EXPLOSION

Digital, Direct-to-Disc, Half-Speed Master Recordings — you are seeing more and more of these every day. Spurred by a number of adventurous small companies, great advances in sound are becoming more and more evident in commercial recordings. Good news for classical fans is that much of this new technology is being applied to classical recordings. There's a good reason for this application of technology. Classical and jazz may have far more dynamic range than rock. This makes them much more appropriate vehicles for the super clean recording techniques.

First, in the pop field, Brad Miller's Mobile Fidelity Sound Lab has obtained excellent master tapes from several companies. Artists like Steve Miller, Manhattan Transfer and the Mystic Moods Orchestra are featured on high quality pressings. Unfortunately for us, probably only the latter are of much interest to planetaria.

Another approach involves the use of specially encoded discs and a DBX decoder. The discs are from VOX, Desmar, Sine Qua Non, Orion, Desto, and Chalfont. DBX dealers will be handling these in addition to record stores. A sampler of this material reveals an awesome revelation. There is simply no noise in playback of these records. But, they will not play, in any usable form, without a DBX unit. This drawback may prevent the major label commitment that would make them more than just a curiosity. Keep an eye out for the first releases. Two of special note are:

- The Art of Laurindo Almeida SS 3003
- Strauss Family Gala . . . . . . . . . . GS 2006

If you have the decoder give them a try. I plan to experiment and report on the music.

Meanwhile, we have two recording techniques being widely used which are giving us spectacular new recordings. Direct-to-Disc recordings are just that — records pressed directly without a tape recording step. They can't be edited. By making the process pure and simple it is hoped that noise and distortion will be minimized. And it works. Leaders in Direct-to-Disc recording include Sheffield, Crystal Clear, Discwasher and the Japanese wing of RCA. Another variation of this technique has been employed by American Gramophone in their "Fresh Aire" albums. Due to the economics of recording, early Direct-to-Disc albums featured soloists or small groups; however some major orchestras are now presented. Check out:
CRYSTAL CLEAR

Fiedler/Boston Pops — Tchaikowski: Capriccio Italien
Rimsky Korsakov: Capriccio Espagnol
Virgil Fox — Bach: Toccata and Fugue in D minor, etc.
— Stunning Organ, Brass and Percussion Recordings
— Richard Morris, organ; Atlanta Brass Ensemble

Volume One: Copland-Fanfare for the Common Man, etc.
Volume Two: Fanfare from Also Sprach Zarathustra, etc.

SHEFFIELD

Leinsdorf/Los Angeles Philharmonic — Wagner
Includes Forest Murmurs, the Death of Siegfried, etc.
This is one you must hear for the sound of a real orchestra. The tendency is to turn up the volume because the dynamics are magnificent. Watch out — I fear a lot of people are going to blow speakers with this record.

As you can see, we have some fairly conventional material here, newly recorded. Is it worth it (all these records carry premium price tags of $15 and up)? The performances are good. The answer seems to boil down to your equipment and critical ear. They sound good on any equipment. However, many cartridges may not be up to tracking the loudest passages cleanly (more about that later). The pressings are usually done in Europe, and are beautifully quiet. This is something you will really appreciate on repeated playings. For background music, forget them. These are foreground showpieces — great for climaxes and title music.

Direct-to-Disc will probably remain a small portion of the record business. They are expensive to produce and — there are no retakes! It's successor is digital recording. Within a few years we may see the takeover of all major recording studios by digital technology. These studios are now receiving delivery of Pulse Code Modulated (PCM) recorders produced by a Salt Lake firm: Soundstream, Inc.

In PCM recording, the electrical analog of the sound pressure variations being recorded is sampled at fixed intervals. Soundstream equipment samples the waveform every 20 millionths of a second (50,000 Hz) and assigns a number to each value sampled. Pulses defining these numbers are coded on magnetic tape. The characteristics of the tape are eliminated. Comparing digital to our conventional analog recorders is comparable to the practice of assigning telephone numbers to phone subscribers rather than trying to locate them by a description of their physical characteristics. The loudest sound of a full symphony orchestra is over 30,000 times as loud as the softest sound it can make. This represents a dynamic range of over 90 dB. Modern analog recorders barely exceed 60 dB (a range of about 1000 times). Digital recording can deliver that full range — and with literally no distortion. How can you distort a number?

Enough of this number business. What does it sound like? The first digital discs are out and they are great. Because of the major label support in most cases, we will not see the large increase in price associated with Direct-to-Disc recordings.

Again, classical recordings and jazz will be at the forefront of the revolution. On Telarc (and unfortunately high priced at $17.98) we have a real contender. Lorin Maazel conducts the Cleveland Orchestra in Moussorgsky's (arr. Ravel) "Pictures at an Exhibition". This music has all the fire power you would expect, and the digital technique reveals every detail as you've never heard it before (on a record, that is).

I feel that an even more important step is the first "Red Seal" digital from RCA: Eugene Ormandy conducting the Philadelphia Orchestra in Bartok's Concerto for Orchestra. I say this because we now have a major label and a major artist showing a commitment to the new technology. This bodes well for our future. The record is priced at only one dollar above conventional Red Seal releases ($9.98). Using 26 microphones, every detail of the Philadelphia's marvelous playing has been captured with the utmost clarity. It takes a good system to play this record. In one stereo store we found only two cartridges that could track it cleanly through the loudest passages. This is not to say that you can't play it on your school's turntable, only that you cannot really appreciate the full experience this recording provides.

What does this mean for the planetarium? First, it means that the public is going to have its sound values uplifted. Correspondingly, we should be more aware of our own values.

And secondly, the new technology only serves to highlight the quality of the music we select in our programs. Digital sound will not save poor use of music; it will only make it worse. I hope you will investigate these new recordings (I thought you should be aware of them). And, I hope you will continue to study and listen to older analog recordings. With either kind of technology, our goal is to make that trip to the starry chamber a more memorable, rewarding experience.

END
Sigh! I've just finished my third graders. For the rest of the year, it's all downhill; 6th graders and (ugh) 9th graders. Why is it that the older they get, the less I enjoy them? Is it them or me?

Why do I like third graders? It's hard to explain. Perhaps I'll let them explain.

Scene: approximately 25-30 third graders enter my planetarium with their teacher. They aren't sure what's going to happen. Even before they are seated, their eyes are drawn upwards to the domed ceiling. They know they are someplace special. Their impressions:

"I like this room!", "I think the ceiling is going to open because I see the lines (seams)", "Somebody dented up your ceiling!", "My feet hurt", "I'm in the sky!"

My introduction: "This is a special room that we can use to talk about many things. Let's start with planets. Does anybody know anything about planets?" Answer: "You have to water them every day."

Using a hand-held orrery, I identify the nine planets and show each revolution around the sun. "Now I'm going to show you some pictures of the planets, in order, from the sun. Here is a picture of Mercury. What do you see in this picture of Mercury, taken from space?" Answer: "Spots", "Critters (craters)", "Holes". "Are there any questions about Mercury?" Answers: "Do the holes let air into Mercury?", "What makes it look so bumpy?"

"Here's a picture of Venus. What do you see in the picture?" Answer "Fur" around Venus. "No, they're clouds. Any questions?" Answer: "What happens if those clouds come off?"

"Earth, taken from space. We see clouds, oceans, land, in this picture. Any questions?" Answer: "Why doesn't the globe over there in the corner look like the picture?", "Do you have a picture of an orbit?"

"Mars, the Red Planet. Any questions?" Answer: "Mars has a lot of spots (craters) on it, "It looks like it has a rash!"

"Now, Jupiter, one of three planets which has rings around it. In fact, the three largest planets: Jupiter, Saturn, and Uranus have rings. Any questions?" Answer: "It looks like wood", "Any people in Jupiter?", "Are the rings rewards for being the three largest planets?", "Why did they put that circle around it?", "What would happen if it breaks?", "What's that ring for?"

"Saturn, here's a picture of Saturn. Let's look at the rings up close. We can see that Saturn has many rings, maybe thousands of rings. Any questions?" Answer: "Why does it look like a record?", "Did ya'll have to go out into space to get them pictures?", "Where did you get all that stuff to make all that stuff?"

"Now that we've seen pictures of planets, I'd like to show you something else. Let's pretend that the ceiling of the room is the sky, at night. As the sky darkens, pretty soon we can see . . . the stars! Aren't they pretty? Just look around at all the stars, all around you. Any questions?" Answer: "What is the stars?", "Do stars have names?", "If the sun is a star, does it go up at night to be with the other stars?", "I wish I could count 'em", "Is there such a place as the Milky Way?", "Why do the stars make pictures?"

"As time passes, all night long, the sky seems to move, and then the sky changes; what's happening to the sky?" Answer: "It's getting morning!"
To start things off this time I would like to tell you that I have moved! Any correspondence about this column should be directed to my new address here at The Adler Planetarium.

The L-5 Society is looking for members. The L-5 Society was formed in September of 1975 following the first Princeton Conference on Space Settlements. Since then a growing number of people have banded together with a common goal — to see a city built in space. The Society has among its members, the Honorable Senator Barry Goldwater, Sr., Robert Heinlein, Science Fiction Author, Dr. Thomas O. Paine, President, Northrop Corporation, just to mention a few. Dues are $20 per/year and include the monthly magazine, L-5 News. If you are interested, write the L-5 Society at 1620 North Park, Tucson, Arizona 85719.

For those of you in the market for a new planetarium projector in your medium-sized facility, Carl Zeiss of West Germany has announced the newest of their line. The M-1015 is a “unit construction system with provisions for optical complementary systems to achieve the most sophisticated future state of the art, along with azimuth motion, automation, and much more in a 10-15 meter (30-50 foot) dome.” The basic price of the unit is $263,000, complete with basic features and motions. For more information you should contact Anthony F. Jenzano, Planetarium Counselor, One Zeiss Drive, Thornwood, New York 10594.

Joan and Joe O’Connell of 2136 South Yukon Street, Denver, Colorado, 80227, are offering ‘Out of this World Lithographic Prints’ of the Saturn/Voyager missions. For more information about these prints and current prices, contact them.

Having trouble with your slide file? 20th Century Plastics, Inc., can offer you a solution. Their TL20 (top loading) vinyl sheet protector and their TLC20 each hold up to 20 2x2 slides. The page then fits into a standard 3-ring notebook. The difference between them is the TL20 is frosted and the TLC is clear. If you like side loading they can offer you the JV20 and C20. 20th Century Plastics, Inc., 3628 Crenshaw Blvd., Los Angeles, California, 90016.

For the small to medium planetarium facility that does not have the production staff to produce that ‘certain special touch’ to your show such as art, music, special effects and controls or production itself, you should like Mediatech. Mediatech, P.O. Box 11782, Memphis, Tenn., 38111, is a group of professional planetarians who are offering their talents, for a fee, to help you put that special show together. They can write the script for you, or do the artwork, create original music, build special effects, in short, do the things that you might not have the time or staff to get done.
ANSWERS

1) good planetarium window; 2) eclipse of planetarian, as star ball swings to the equator; 3) fantastic slide of UFO landing on the moon, unfortunately visible only in edge-on position; 4) one of those darned black holes; 5) planetarian as seen by ant peering out a hole in the star sphere; 6) hole o’gram (hologram).
DOME DROODLES

A. Santa and his reindeer searching for an opening in a dome . . . Rudolph made it in somehow; B) 3-D planetarium; C) planetarium building with solar heating (poor planetarium design: people who work in glass buildings shouldn’t stow domes); D) dome reject; E) sugar dome igloo for ants . . . “dome, sweet dome”.

ANSWERS
Hale Observatories – Photo