Science demonstrations can make a planetarium program more effective. In a test involving about 1,900 fifth graders, the students who saw both the planetarium program and the science demonstration scored over 19% better than the control group. Furthermore, students from low socio-economic backgrounds benefited more from the science demonstration than other students.

Methodology

Each set of two classes of 5th grade students saw the planetarium program together. Then a randomly selected class moved to another room and took a brief quiz about the moon and moon phases. The class that stayed under the dome used moonballs on sticks to discover exactly why the moon goes through phases and how lunar and solar eclipses occur.

At the conclusion of the moonball demonstration, the two groups reversed...
roles. The class that had the moonball demonstration took the test, while the test-takers participated in the moonball demonstration.

The experiment was arranged as a non-equivalent group design; that is, classes were assigned to either the experimental group or the control group randomly. Generally the last class seated became the “A” group that took the quiz before doing the moonball activity, and the first class seated became the “B” group that took the quiz after doing the moonball activity. It was expected that some groups would receive more instruction in the classroom, and be better prepared than others, and therefore, some sets would show a decline rather than an increase in average scores.

The test itself consisted of 14 questions, including both multiple choice and matching questions, designed so that there would be few perfect scores. Some questions only tested basic recall of facts, such as “How long does it take the moon to go through one full cycle?” Other questions required higher order thinking skills, such as matching a set of moon diagrams to the names of the phases. Still other questions were designed to trap students with common misconceptions: “Why do the astronauts have to wear a spacesuit on the moon?” One of the choices was “There is no gravity on the moon,” a common misconception.

There were two hypotheses that the data could validate or falsify: (1) A majority of sets would show an increase in learning after participating in the moonball demonstration and (2) students from Title 1 schools would benefit more from the moonball demonstration than other students.

Two anomalies were discarded from the data set. In one case an A group included ESL (English as a Second Language) students even though the test was in English. In another case the A group had performed the moonball demonstration in their classroom the day before coming to the planetarium. The final data set consisted of 32 sets (64 classes), for a total of about 1,900 students.

**Results**

The average improvement in scores was 19.48%. Only two sets showed no improvement. The data overwhelmingly showed that the moonball demonstration helped reinforce what students learned in the planetarium program.

To determine whether Title 1 schools benefited more from the moonball demonstration than other schools, the sets were sorted by the percent of increase. A count of Title 1 schools whose percentage of increase was above the median score was compared to the count of Title 1 schools below the median.

Five Title 1 schools were in the group below the median gain, while 11 Title 1 schools were in the group above the median. In other words, more than twice as many Title 1 schools showed large gains than showed smaller gains. The impact of the moonball demonstration on student learning was much greater for Title 1 schools than for other schools.

The planetarium experience has been shown by previous researchers to be a valuable learning environment. The data presented in this study, however, show that whenever possible, planetariums should provide students with live science demonstrations in addition to the planetarium program itself. This study also reinforces the idea that the planetarium is a unique resource for school districts, providing students with learning and laboratory experiences that cannot be obtained in most classrooms.

**Bibliography**


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