Kinesthetic Learning Under the Dome

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BIOGRAPHIES
Tiffany is the Planetarium Lecturer at Ward Beecher Planetarium at Youngstown State University where she coordinates all programs for the over 15,000 annual public and school group guests. She also produces live planetarium content for audiences of all ages and advocates for Cosmosquest, an online citizen science research center.

ABSTRACT
With the stunning visuals produced in planetariums, we are experts in visual teaching. But what about those who learn by doing? In this workshop we will discuss how people learn and how to use kinesthetic practices to engage audiences in a planetarium setting. Examples include introducing planets to 3-year-olds and explaining how we locate black holes to a general audience. Join us if you want to engage your guests in new ways and be ready to get moving with activities of your own creation!

INTRODUCTION
As the planetarium reaches its centennial, today’s thousands of domes across the world continue to provide a unique and immersive experience for guests. With our roots deeply planted in the night sky, the learning potential of planetariums has only grown over time. Stunning visuals, unique and personal experiences with live programming, and the whole universe at our disposal, planetariums are powerful tools for communicating science and inspiring people of all ages and backgrounds. In order properly utilize that learning potential, programming in a planetarium should be as diverse as our audience.

Planetariums easily cater to specific styles of learning, but those methods are not always ideal for our audience. In 1983, Howard Gardner published a book detailing his theory of multiple intelligences. He claims that people have several different ways of processing information and separate them into eight primary categories: Linguistic, logical-mathematical, musical, spatial, bodily/kinesthetic, interpersonal, intrapersonal, and naturalistic. Today, this theory is criticized for its lack of empirical evidence (The Illusory Theory of Multiple Intelligences). In fact, some studies have shown that the theory of multiple intelligences does not hold up (Gardner's Theory of Multiple Intelligences: Myth or Truth?, 2018). Still, this theory changed the landscape of education as it critiques traditional measures like IQ tests. Gardner’s theory shows that there is more than one way to teach and to learn. Other research-supported theories followed Gardner’s theory, such as Constructivist teaching, which places the student in the center of learning (Brooks & Brooks, 1993) and multidisciplinary teaching, which suggests students learn best when approaching new material using a variety of methods (Greeno, Collins, & Resnick, 1996).

I. SCIENCE IS A VERB
Kinesthetic learning, or learning through bodily movement, can be a challenge in planetariums, which are typically dark with seats bolted to the ground. But science is verb; we learn and understand the world through experiment. Kinesthetic learning is a great way to engage your audience and put them in the center of the scientific process.

Some planetarium guests benefit from physical movement more than others. For example, young children learn best when they are using their bodies. David Kolb’s experiential learning theory argues that children need to experience things directly in order to learn (Stice, 1987). Pre-K and kindergarten children in particular are natural explorers who find it challenging (and sometimes frustrating) to sit in a seat for an hour-long planetarium show.

This workshop explores different ways to modify planetarium programs in order engage kinesthetic learners of all ages. From simple tactics like pointing, clapping, and making animal sounds for constellations (Live From the Planetarium, 2013) to scavenger hunts under the dome, we will show that kinesthetic learning can enrich a planetarium show experience.
II. EXAMPLES INCLUDED IN THE WORKSHOP

II.1 Observing Black Holes
During her public lecture “Gasbags and Blowhards: Supermassive Black Holes in the Universe,” Dr. Sarah Gallagher of Western University used a couple of glow sticks and a few volunteers to demonstrate how scientists study black holes when they cannot directly observe them. She placed a glow stick necklace around one volunteer labeling them a “star” and the other the “black hole”. Then, with the all lights down in the planetarium, she asked her volunteers (a married couple she recruited before the show) to hold hands facing each other and spin in a circle. The audience could not see the black hole, but they could see that the “star” was orbiting something.

Figure 1 – Observing gravitationally bound stars around black holes

II.2 Space Shapes
Space Shapes is an hour long Pre-K show offered at Ward Beecher Planetarium broken up into 4 or 5 segments of 10-15 minutes each. It is built for the youngest guests and meant to have them explore the planetarium as they learn. The first segment of the show is the introduction where we discuss the planetarium, how the lights will sometimes be on, sometimes be off, and can be any color of the rainbow. We also discuss what we expect to see and do in the planetarium and introduce the “twinkling star sound,” or a windchime which will signal the end of a segment and a time to refocus on planetarium staff to listen for what comes next. The windchimes are a direct application from the Montessori method and do a wonderful job at refocusing young guests with no dialog or raised voices (Montessori, 2015).
The second segment is a shape scavenger hunt where visitors explore the planetarium to find hidden felt shapes. Once we return to our seats, we discuss shapes, colors, and 2D shapes versus 3D shapes.
The third segment is the 9 minute fulldome show, Space Shapes, produced as an open source show at Ott Planetarium by participants of the 2010 Blender Production Workshop. It is a fantastic, simple introduction to space and the planetarium.

Figure 4 – 2010 Blender Production Workshop planetarium show, “Space Shapes”

The fourth segment is an introduction to the planets where guests build the solar system from Mercury to the Kuiper Belt, learning a movement for each planet. All guests pretend to be the planets by going through each of the characteristic movements. Planet rotation causing day and night may or may not be mentioned.

Figure 5 – Planetarium guests learning about the planets
Figure 6 – Learning Saturn’s characteristic movement

If time allows, the optional fifth segment is a brief star talk with introduction to the big dipper, north star, and possibly moon or planets will be shown. The house lights are never completely down and this portion will typically last no longer than 10 minutes.

III. OTHER EXAMPLES

III.1 Spacetime Simulator

Figure 7 – Spacetime Simulator demonstrates the fabric of spacetime (See References for YouTube link)
IV. CONCLUSION

This workshop is meant to spur creativity in engaging audiences with kinesthetic activities under their dome. Planetariums are impressive education tools and their utilization is only limited by our imagination. Adapting to the learning style of our audience can enrich a planetarium show and create lasting memories for our guests.

REFERENCES


Gravity Visualized. (n.d.). Retrieved from https://www.youtube.com/watch?v=MTY1Kje0yLg

A demonstration of a gravity well with a link to instructions on how to build your own!


A GLPA video project aimed at helping planetarians improve their live presentation skills.


A Pre-K planetarium show that explores shapes, the sky, planets, and more!
