

THE SCIENCE PLACE

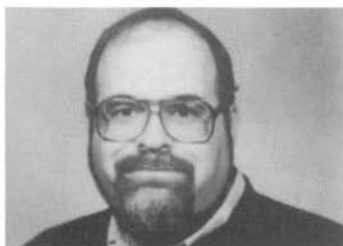
Teachers seem to find science centres such great motivators for pupils (and themselves), that a school seems a good location for such an activity. In the search for such a project to include in this book we obviously hit on the right people. Glenn Leto and Christopher Chiaverina responded quickly to our request for information and have highlighted the value of constructing interactive exhibits as a problem solving exercise for students. Words like 'intrigued' and even 'obsessed' describe the students' zeal.

The development of exhibits to unlock creativity in pupils is seldom mentioned and yet it must be a powerful tool for a teacher to have at his or her disposal. Leto and Chiaverina draw freely from exhibits described in the Exploratorium's Cookbook to provide the basic ideas from which the exhibits were made, but they emphasise the need for problem solving with these exhibits. Other groups have started in this way; somehow knowing beforehand that there are exhibits which work and to which the visitor responds, gives a great boost to a project and injects confidence to branch out and develop new ideas.

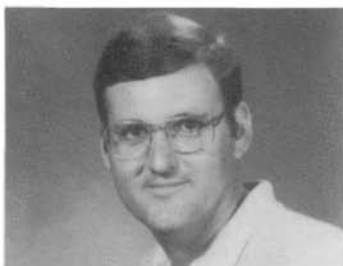
Location:	Currently setting up new location. Originally sited at Woodland School, Carpentersville, Illinois 60110, USA
Date opened:	November 1981
Floor area:	250sq m
Number of exhibits:	75
Number of staff:	2 permanent 2 part time volunteers
Number of visitors:	300-400 per day approx 30:1 child:adult ratio
Opening times:	Not yet open at new location. Previous times were Weekdays 9-3 or by appointment
Entrance fees:	\$3 adults \$1.50 children

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Glenn K Leto and Christopher J Chiaverina



Glenn Leto is a member of the National Science Teachers Association, the National Association of Biology Teachers and the American Association of Physics Teachers. He has written extensively for scientific publications and is the co-author of 'Physics', 1986. He is currently teaching biology at Barrington High School, Illinois.



Christopher Chiaverina is a physics teacher with 17 years teaching experience. He has written several articles on physics and physics education and has served on the editorial board of 'The Physics Teacher'. He is also the co-author of 'Physics', 1986



The duck-in kaleidoscope where even one is a crowd.

'It is, in fact, nothing short of a miracle that the modern methods of instruction have not yet entirely strangled the holy curiosity of inquiry; for this delicate little plant, aside from stimulation, stands mainly in need of freedom; without this it goes to wrack and ruin without fail. It is a very grave mistake to think that the enjoyment of seeing and searching can be promoted by means of coercion and a sense of duty' – Albert Einstein.

Science is a method we employ to perceive our environment. This particular method is employed because it consistently, although not always, provides us with a perception in our minds that is a faithful representation of reality. Science is a participatory experience in which the individual interacts with the phenomena being studied. A scientist, whether a professional, an amateur or a student, is an explorer searching for new horizons to experience and to cross.

True exploration is a creative process in which new ideas evolve from pre-existing knowledge. Just as Cook and Cortez were guided by the explorations of Columbus, the explorer scientist moves into new territory aided by the discoveries of his predecessors. Yet, because of the very nature of science, this experience is difficult to provide to large numbers of students within the curricular confines of the traditional classroom. Since its inception in 1981 The Science Place has given more than 10,000 visitors of all ages the opportunity to act as explorers in the world of natural phenomena.

In an attempt to touch our community with this feeling of mental exploration, we have undertaken the development of an interactive, participatory science centre, The Science Place. Frank Oppenheimer, in his San Francisco based Exploratorium, has created the ultimate example of such a science centre. The Exploratorium provides numerous exhibits which act as props demanding the interaction of the observer, prompting thought, stimulating curiosity and posing questions. This interaction leads the observer ever deeper into the mental arena of contemplating natural phenomena. Oppenheimer and his staff have created the Exploratorium, not only as a science centre, but also as an example to be used in the development of similar learning centres throughout the world. The Science Place, produced by high school students, consists of over 60 hands-on science exhibits which provide a much reduced but comparable experience.

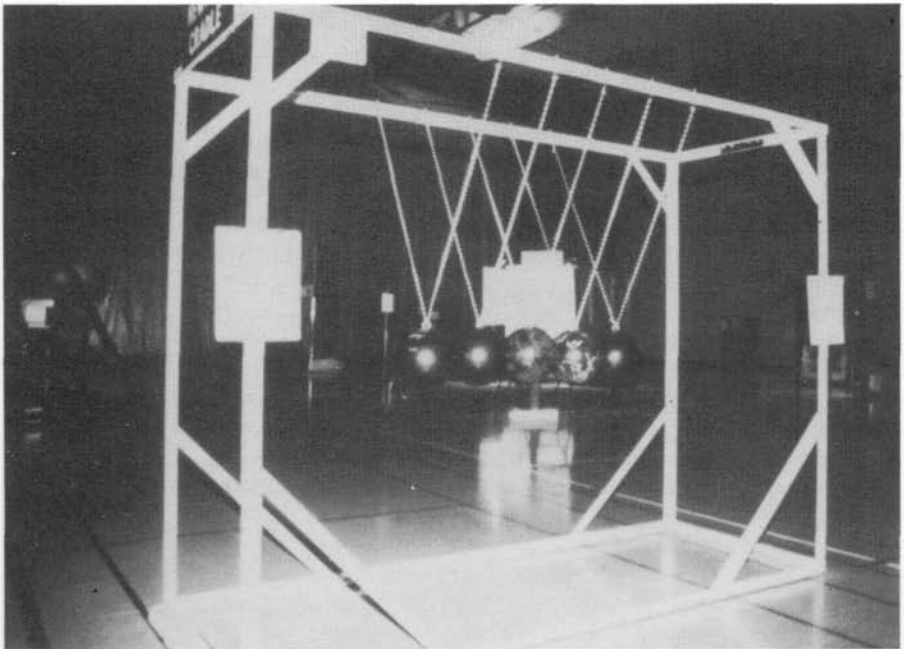
The Science Place is an on-going project of our science club. We feel that this is a unique opportunity for our club members to gain creative problem-solving experience and it

has long been recognised that teaching others is one of the best ways to increase your own understanding. The creative opportunity inherent in exhibit development is apparent, but we feel that our visitors should also be included in the creative endeavour. The club members take responsibility for the development of exhibits which, after introducing the phenomena, allow the visitors the freedom to explore. An ideal exhibit not only presents a simple demonstration of phenomena but it provides sufficient latitude to investigate unique questions and pursue answers. This has been one of the guiding principles in the development of The Science Place.

Some exhibits

The Polarised Light Table, Coloured Shadows and Newton's Cradle provide examples for visitor interaction, creative potential and concept development at The Science Place.

Five in-line bowling balls suspended by cables form Newton's Cradle. A familiar table-top toy was the inspiration for this large scale device which provides the visitor with the



A large-scale Newton's Cradle made from bowling alley balls suspended on cables.

necessary tools for exploring momentum and energy. Usually, without reading the directions, a visitor is enticed to lift a ball and release it to discover what will happen. After this initial contact, even the youngest begins to question why the intervening balls remain stationary while the outermost ball springs outward. This experience leads the visitor to investigate the phenomena through experimentation with various combinations of balls.

When viewed on the Polarised Light Table, transparent materials manifest their optical activity in a brilliant display of colour. This exhibit provides a brief explanation of the phenomenon and then allows the visitor to manipulate such variables as the type of material, orientation of polarisation and the nature of the light source. Especially intriguing to younger visitors is the potential inherent in this device for producing multicoloured works-of art using cellophane tape as a medium.

Coloured Shadows provides numerous opportunities for the visitor to establish and test personal hypotheses through experimentation. A student is initially intrigued by a light on a wall. As the student steps between the lamps and the wall he is often startled by the discovery that he casts a multitude of coloured shadows.

Not every exhibit in a science museum can act as the catalyst for propelling the visitor into a creative mental exploration. Collectively, exhibits must serve many purposes. An exhibit may simply be an experience to enjoy, as is a work of art or a toy. An exhibit may serve to communicate information that enhances other exhibits or adds to the knowledge base of the visitor.

Some exhibits serve only as a demonstration of phenomena because expense, space, time and/or safety constraints may limit the creative potential that can be built into them. Experiences such as these form an integral part of The Science Place because we feel that they tend to enhance the creative potential of exhibits. An example is the exhibit 'Everyone is You and Me', which, though it does not provide extensive opportunities for creative involvement, it does convey scientific principles in an interactive and playful manner. Based on the laws of reflection, this simple exhibit is capable of producing startling results. Sitting on opposite sides of a plate of window glass, two participants adjust the intensity of spotlights shining on their faces. When just the right amount of reflected light and transmitted light is achieved, one operator will observe a rather fantastic sight – an eerie composite of two faces. After experiencing 'Every-

'Everyone is You and Me'. Visitors sit each side of a half silvered mirror. Changing the light level transforms the reflection of one into the face of the other. An uncanny experience.



one is You and Me', one amazed visitor dubbed the device 'The Genetic Engineering Machine'.

While some exhibits in The Science Place are merely copies of works found in other museums, there is ample opportunity for the student builder to become part of the creative process. Due to the financial, technological and space limitations imposed on The Science Place, even faithful reproductions of exhibits generally require some degree of creative problem-solving on the part of the student developers.

Initially, the Exploratorium's 'Grey Step' exhibit appears to consist of a large grey rectangle divided in half by a shaggy rope. But, when the rope is lifted, the rectangle is seen to be made of two distinctly shaded squares, one noticeably darker than the other. Intrigued by this description, one student decided to construct this exhibit. He began by trying to paint the two squares with various shades of grey. Due to critical parameters involved in demonstrating the phenomena of lateral inhibition, his efforts were to no avail. Just as despair was about to set in, he had an idea; why not produce the shades of grey photographically. His solution to the problem

resulted in the production of seven adjacent grey steps instead of two. He found that a dowel rod of any colour, a pencil, or even a finger would obscure the boundary between any two shades of grey making them indistinguishable.

After a visit to the Exploratorium one of our students was so impressed with their 400lb Resonant Pendulum that he became obsessed with constructing one for The Science Place. The problems inherent in building, much less supporting and transporting, such a massive device was obvious. How to construct the pendulum bob? Since at that time we could not attach the cable to the ceiling, what could be used to support the 400lb weight? And finally, how could the weight be easily transported?

In probably one of the most creative and imaginative approaches to problem solving we have witnessed during our involvement with The Science Place, the student arrived at a viable solution to all of the problems. He decided that the pendulum bob would consist of four cylindrical concrete discs supported by a steel core and base. This would ensure ease of construction as well as portability. To support the pendulum, he designed and constructed a wooden structure that was not only sufficiently strong but also could be dismantled for transport.

The student involved in the development of this exhibit had little or no experience in carpentry, steel or design skills. He sought expert advice when appropriate but the design and construction of this exhibit was essentially his. The fact that this exhibit has been used for three years by approximately 10,000 visitors is a testimonial to the soundness of his creative endeavour.

The aims of The Science Place

While we feel that the development of The Science Place is an exceptional educational experience for its student designers, this is not the primary reason for its existence. The Science Place presents our school district with a unique opportunity to deal with two significant problems which plague modern science education: that students often feel intimidated by the subject and that they have insufficient exposure to concrete examples of phenomena prior to the development of abstract concepts.

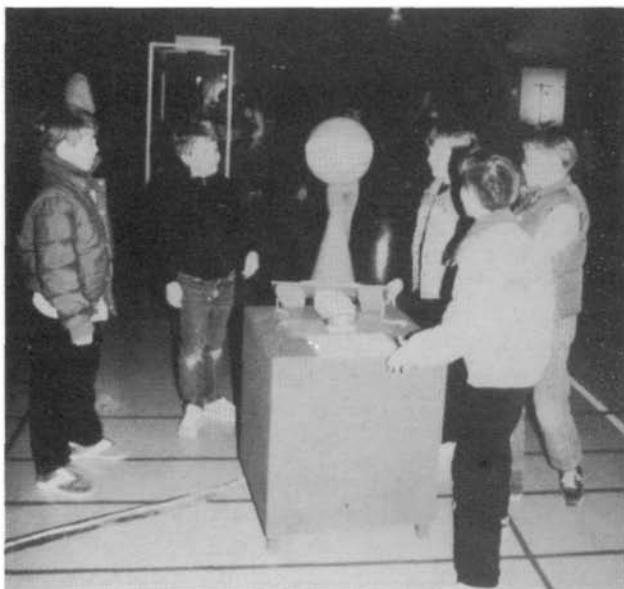
According to Mallow and Greenburg, '... these students often create a self-fulfilling prophecy and do poorly in science; or they may avoid science at all costs to avoid the painful anxiety which they associate with it'. This situation is so acute that science anxiety clinics have been established to

deal with the problem. The Science Place is an attempt to generate a positive attitude towards science and to help alleviate science anxiety by presenting interactive exhibits in a non-threatening environment. While fun is not a goal of science education, The Science Place gives the visitor the opportunity to explore science in an atmosphere that is less structured and more play-like than can be achieved in the traditional classroom.

It is the second goal of The Science Place to provide the student and teacher with props to be used to generate concrete examples of scientific phenomena. Our science centre provides the visitor with these concrete examples. Whether a visitor encounters live fish that appear to be made of glass or a giant swinging pendulum, the exhibit provides the concrete example that is the necessary first step in the development of more abstract concepts; a concrete example which is not always easily achieved in every traditional classroom.

In addition to dealing with these two very important problems, our faculty has used The Science Place as a resource in developing concepts germane to other disciplines. During the past two years members of the English, Art and Technology Departments have found uses for The Science Place within the curriculum. Our exhibits have been used as a basis for speeches and pieces of creative writing.

The Bernoulli blower. A ball is drawn into the airflow from a blower by the Bernoulli effect and held aloft. Plans for the blower can be found in the 'Cookbook' available from the Exploratorium.



Rather than building a shoebox according to the plans supplied by the teacher, some technology students have taken on the task of working from concepts to produce exhibits that communicate ideas. We are coming to see that The Science Place is not only a unique source of motivation within the student body but that it can also be an exceptional resource for interdisciplinary interaction both within the high school and between various levels of the school district.

Each of our exhibits allows the visitor to delve into natural phenomena to a level appropriate to their age and educational background. While many visitors may be experiencing a phenomenon for the first time, The Science Place also provides the serious student with the opportunity to experiment in a more sophisticated way.

We feel that the 'delicate little plant' comprised of 'the holy curiosity of inquiry' can be nurtured within the environment of The Science Place. The sights and sounds of The Science Place draw the visitor into our mental amusement park where the student not only touches the exhibits but is touched by them.