CHAPTER 1

INTRODUCTION

On October 4, 1957, a scientific event changed the world ("Reds Claim Victory," 1957). A small grapefruit-sized object was placed into orbit around the earth. It was called Sputnik. It was the product of Soviet inventiveness, not American ingenuity. This small foreign object orbiting our planet touched off near panic throughout American political and educational systems. Many predicted that America would fall behind as a world leader if it did not "catch-up" (Braun & Ordway, 1966).

On September 2, 1958, eleven months after the launch of Sputnik, the U. S. Senate and the House of Representatives passed Public Law 85-864 and established the National Defense Education Act of 1958 (N.D.E.A.) for the development of science and related programs. The law was written at a time of national need. Many Americans expressed fear that a wide scientific gap existed between the Soviet Union and the United States (Urban & Wagoner, 1996). The Soviet ability to place an object directly over American homes was unsettling. A book written in 1961 by Arthur S. Trace titled "What Ivan Knows that Johnny Doesn't" ignited the imaginations of many Americans into thinking the future of

their way of life was at stake. Many Americans viewed the national defense in peril and saw America entering a "brain race" with the Soviets. N.D.E.A. was implemented in an attempt to address the fear of America being taken over by communist technology (Urban & Wagoner, 1996) The wording of N.D.E.A. stated ". . . to strengthen the national defense and to encourage and assist in the expansion and improvement of educational programs to meet critical national needs. . ." (U. S. Statutes, 1959, p. 1580). Through N.D.E.A. the federal government would provide money to the educational institutions across the nation. Title III of N.D.E.A. provided financial assistance for strengthening science and mathematics instruction at all educational levels. N.D.E.A. also provided funding for the development of modern foreign language instruction and training programs. These measures were an effort to close the "gap" between America and the Soviet Union with respect to the space race and the future security of the United States.

One of the outcomes of N.D.E.A. was the construction of planetarium facilities in educational institutions across the United States. These facilities were constructed to increase scientific literacy of school-age children at a time of national need. Starting in the late 1950s and continuing today, the construction of planetaria in the U.S. has grown to more than 1,200, with more than 800 planetaria located in public school systems (Petersen, 1998).

Twenty-three studies were found in the review of the literature on the topics of planetarium education and planetarium facilities. A majority (74%) of the studies were conducted between 1960 and 1978. This was a time when planetarium facility construction was rapidly increasing across the nation. The remaining studies (26%) were conducted between 1980 and 1989. Only one study on planetaria was found after 1989 and it was on college-owned planetaria.

Limited research is available on the effect planetarium facilities have on the process of teaching science within the public school system (Mallon,1980; Mallon & Bruce, 1982; Pitluga, 1968; Powers, 1973). Much of the early research on planetarium facilities was in the form of listings (Sperling, 1973), surveys (Beck & Schrader, 1991; Dean, 1971; Hanna, 1973), or bibliographies (Reed, 1972; Smith, 1974a). Eight studies were found on curriculum methodology or teaching styles. These studies contrasted the planetarium with the public school classroom (Hayward, 1976; Reed, 1970; Ridky, 1974; Rosemergy, 1967; Smith, 1966; Smith, 1974b; Twiest, 1989; Wright, 1968). Four studies investigated the effectiveness of different types of planetarium learning experiences such as model manipulation and student participation (Bishop, 1980; Carr, 1976; Fletcher, 1977; Johnston, 1981). No studies were found on the personnel operating public-school-owned planetaria with respect to academic training or special skills needed

to perform the job of planetarium director. No studies were found on public-school-owned planetarium equipment such as the number and type of projectors used and whether automated systems are used or preferred. No studies were found that explored the use of new technology such as Internet access, computers, and video graphics in public-school-owned planetaria. Further investigation revealed no studies on community use of public-school-owned planetarium facilities.

Conceptual Context

In all research studies explored, no distinction was made between public-school-owned and operated planetaria and facilities owned by museums or municipalities. It is the opinion of this researcher that museum and municipality-owned facilities have different operational goals and objectives. They also have different pedagogies when compared to the public-school-owned and operated planetarium facilities. Municipality-owned planetaria have larger production budgets than public-school-owned planetaria. They are motivated by the necessity to generate revenue. Museum planetaria write and create programs in competition with other attractions such as movies, other museums, and special exhibitions. Planetaria located in museums and other municipality-owned facilities place a high emphasis on the entertainment value of the planetarium. There is also little or no direct linkage to the school curriculum. This is due partly to the fact that they serve

several school districts within a geographical location. Curriculum needs are often met with general programs covering broad topics on stars and planets. It is the belief of this researcher that public-school-owned planetaria are used primarily for instruction and place a higher emphasis on educational programing with a direct linkage to the school curriculum.

All research conducted on public school-owned planetaria must examine the stated purposes for these facilities. Studies must consider the differences between public-school-owned facilities and those of museums and municipalities. Past studies have not consider these factors. It would be difficult to find significance in any study on the effectiveness of a public-school-owned planetarium facility without a clear understanding of the stated purpose of the facility within the educational institution.

It is a belief of this writer that the operating agenda of public-school-owned and operated planetaria are different when compared to other planetarium facilities. The planetaria in public school systems are used to support the current educational program, while planetaria in museums and municipalities are installed to entertain, educate, or provide revenue. This assumption is based on 30 years experience working in the field of public school planetarium education.

Researchers have designed studies without regard to the stated objectives and goals of the facilities and personnel involved. Without knowing objectives and goals, researchers may have attempted to measure what was not there. A study conducted in 1977 attempted to measure the effectiveness of a planetarium facility to "teach" astronomical concepts using two different methodologies (Fletcher, 1977). The problem with this study is that the researcher assumed the role of the planetarium facility was to "teach" the concepts as opposed to "support" what was "taught" in the classroom. If the facilities in this study were only supporting the classroom teacher in teaching astronomical concepts, then the researcher possibly measured the teacher's efforts rather than the planetarium's effectiveness. It would be difficult to find significance in any study that attempted to measure the effect of a planetarium experience on students without knowing the school system's stated objectives for the planetarium facility.

Another variable in planetaria study is technology. Planetarium facilities are audiovisual experiences involving a multitude of technologies. In the realm of visual learning, sometimes referred to as visual literacy, the planetarium presents educators an opportunity to exploit the visual sense, one of the most dominate and important cognitive paths (Avgerinou & Ericson,1997). Many planetaria have complex multimedia automation, while other planetaria have limited audiovisual

capabilities. To evaluate a planetarium experience fully, and understand its possible impact on students, it is important to know the technology inventory of school-owned planetaria. The significance of this variable cannot be understated. In order for public schools to maintain high academic standards in the field of science, the effectiveness of school-owned and operated science facilities (e.g., planetaria) and the personnel operating these facilities (i.e., planetarium directors) need to be addressed (Stronge & Helm, 1991). Consideration also must be given as to how these planetaria fit into the existing science curriculum in school systems.

An organizational chart for this study outlining the areas to be investigated is in Figure 1. The five areas are: (a) the job, (b) the curriculum, (c) the organization, (d) the facility, and (e) the director. A conceptual model of this study outlining the perceived interactions of the areas to be investigated is in Figure 2.

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Purpose and Significance of the Study

This researcher will examine the overall responsibilities and administrative duties of the job of public school planetarium directors to facilitate the hiring of future educational leaders in the field of planetarium education. To facilitate the future development of create effective educational programs, this researcher will examine the curriculum and teaching methodology used in public school-owned planetaria across the nation. This researcher will also survey the organizational structure(s) of the planetarium within their school districts. In order to assist future construction of school-owned planetaria, the opinions of public school planetarium directors will be surveyed with regard to planetarium facility design, equipment, and technology. And lastly, this researcher will attempt to reveal any significant patterns among the public school-owned planetaria across the nation with regard to administrative personnel, curriculum, facility size, technology, community use, and daily use.

Given the importance of accountability facing public school board members across the nation, it is imperative that school boards understand all aspects of today's educational setting. One aspect of today's educational setting is the planetarium. These facilities have been constructed in more than 800 public school systems throughout the nation on the belief they would increase scientific literacy.

To date, no nationwide studies have been found surveying public-school-owned and operated planetaria for the purpose of increasing an understanding of the job of planetarium director. No studies were found which examined the curriculum used in these facilities. No studies were found that focused on the planetarium facility as to equipment and technology preferred by planetarium educators. And, lastly, no studies were found which examined the planetarium director's placement within the organizational structure of the public school systems across the nation. Overall, the current operations of public-school-owned planetaria in the United States will be benchmarked.

Research Questions

1. What are the qualifications, tasks, and skills of planetarium directors operating public-school-owned planetaria across the nation?
2. What curriculum is being taught in public-school-owned planetaria across the nation?
3. What are the organizational characteristics of public-school-owned planetaria within school systems?
4. How are public-school-owned planetaria used by schools and communities across the nation?

5. What are the characteristics of the facilities of public-school-owned planetaria across the nation?

Definitions of Terms

Terms are defined in Table 1. These terms are those used in the survey of planetarium directors operating public-school-owned planetaria. Some of the terms have been adopted from terms commonly used in contemporary and classic job organizational description and analysis literature (Gael, 1983; McCormick, 1979; Yoder, Heneman, Turnbull, & Stone, 1958). Additional terms have been adopted from the review of literature.

Table 1

Definitions of Terms

Terms	Definition[a]
Public-school-owned planetarium	A planetarium under the control of a local school board.
Planetarium director	The top-level administrator in charge of operating the planetarium facility on a daily basis.
Skill	A developed aptitude or ability of a planetarium director (items 11 and 12 in the survey).
Task	A unit of work with a beginning and end to accomplish a goal of a job in a planetarium.
Job	A regular activity or set of activities performed as one's trade, occupation, or profession.
Traditional methodology	The pedagogy of a show-and-tell planetarium program in which students are not directly involved and no student interaction is required.
Participatory methodology	The pedagogy that directly involves students and requires student interaction in a planetarium lesson.

(table continues)

Table 1 (continued)

Definitions of Terms

Terms	Definition
Planetarium facility	A building or room containing a non-portable devise for projecting images of celestial bodies and other astronomical phenomena onto the inner surface of a hemispherical dome.
School use	The use of the planetarium by individuals enrolled or employed by the public school system.
Community use	The use of a the planetarium by individuals other than those enrolled or employed by the public school system.
Equipment	Projectors and other mechanical or electronic devices commonly found in planetarium facilities.
Technology	The use of computers, video projectors, video graphics, and automated control systems in planetaria.

(table continues)

Table 1 (continued)

Definitions of Terms

Terms	Definition
Organizational patterns	The placement of the planetarium director and the facility within a public school administrative system.
Curriculum	Subjects taught in a public-school-owned planetarium.

[a] The survey is in Appendix C.

Limitations

Some of the perceived limitations to this study are: (a) Study results cannot be generalized to planetarium directors or facilities other than those in the public school setting. (b) The responses to the survey must be assumed to be the true opinions of the respondents based on personal experiences and observations. (c) The survey did not allow deep probing into respondents' opinions and feelings. (d) The survey did not allow the researcher to further clarify survey items if they were unclear to respondents.