Building a Group Decision Support Laboratory

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Abstract

The author describes the planning, development, and implementation of a GDS laboratory in a new, technologically-advanced engineering, computer science, and IS building. Based on GDS and other collaborative workgroup research, together with needs assimilated from executives and managers of the business community, we set three objectives for the GDS laboratory. These objectives are: 1) to maximize the flexibility of the environment for group decisions and related uses, 2) to maximize the power of the environment to enhance group decisions (including technological and non-technological features), and 3) to provide the ability to continuously improve and evolve the environment as dictated by empirical and theoretical research findings. The resulting laboratory is a vehicle for group decision research and activities.

1. Introduction

As evidenced in the IS literature, meetings conducted in Group Decision Support (GDS) environments can produce significant, positive results [17]. Most GDS proponents would agree that productive meetings need not be facilitated, need not be technologically enabled, and need not take place in a special meeting environment. However, practical applications and research suggest that, under the right circumstances, GDS and other adaptations can significantly add to the productivity and the satisfaction of meeting participants [3, 4, 12].

Based on their research interests and industry involvement, the Information Systems faculty at a Midwestern university were asked to propose and justify more than a dozen research and teaching laboratories in a new, technologically advanced building. Following the proposal and justification project phases, the University granted the IS faculty approval to build a GDS laboratory in the new building. This paper describes the creation of that GDS laboratory.

2. Background information for GDS lab design

2.1. Group Meetings

Group meetings are a critical element of organizational management and communications [8]. Although they are time-consuming and often unproductive, group meetings have existed for millennia; an ample supply of appropriately-outfitted meeting rooms is an important part of any office environment [11]. Groups gather for a variety of reasons. They attend to make decisions, hear presentations, discuss issues, develop plans and strategies, lecture, train, and many other purposes [12, 13]. Group activities include a range of meeting processes that include deliberation, negotiation, consensus building, decision making, generating of alternatives, problem solving, and planning [16]. Group meeting rooms are used for the breadth of research, teaching, business or administrative applications [1, 3]. Participants may include a widely diverse set of individuals, including executives, managers, professionals, educators, students, community groups, and a variety of visitors.

2.2. Strategic Management and group meetings

Executives and other managers frequently participate in meetings, especially when involved in Strategic Management (SM). SM, regarded as a critical corporate tool since the early 1980s, is a process for formulating the strategy and overseeing its implementation [3]. SM is often performed by groups of managers, from the senior management level through the middle levels of the organization [11]. The use of information technology

(IT) to support SM planning and decision making is well documented back to the mid-1980s [5,6]. Group decision researchers [3] observe that SM supported by IT involves a spectrum of systems using terms including group decision support systems, computer-supported cooperative work, Groupware, and Electronic Meeting Systems (EMS).

2.3. Group meetings, decisions, and productivity

Decision making is an important function of group meetings, especially in executive group meetings [12]. While meeting time is precious to most individuals, group meetings with executives are particularly expensive, even if only considering the aggregated cost of their salaried time. Therefore, executive meetings set effectiveness and efficiency as important requirements. GDS tools can significantly improve the productivity of these meetings [4, 16].

Multimedia, providing information from different media and presenting it in different forms, can enhance executive decisions [2, 13, 10]. A multimedia "toolkit" may contain a combination of electronic, verbal, and visual media. With the toolkit: "(1) a variety of SM activities could be supported; (2) the appropriate degree of structure needed to support a given group and activity could be provided; and (3) different combinations of electronic and verbal communication could be provided to address the demands of the task [3]." The authors also propose special features, such as parallel electronic communication channels, anonymity, automatic recording of all electronic communication, and a comfortable physical facility designed to accommodate these features.

3. Schedule and methodology

The author was the faculty-appointed project manager (PM) of the GDS lab development process; the step-by-step development timeline is described in Appendix A. The process of developing the laboratory required integrating IT project management skills, schedules, and budgets with the larger architectural, engineering, and construction (AEC) projects that built the new building. The PM continuously interfaced with vendor, AEC, University administrators, Facilities Management, IS&T, and IS faculty groups. However, this exercise was not merely a construction management activity. Building the GDS lab required forming a vision based on faculty needs, GDS literature surveys, and the input of numerous experts.

During the spring of 1996, selected university faculty were charged with selecting and justifying the funding of multiple laboratories to be included in a new, technologically-advanced building. IS faculty met with the architects and suggested that a GDS laboratory be included in the building, in addition to other laboratories. The proposed IS laboratories were then integrated into the college Academic Program Statement (APS), which summarized academic programs, student attendance projections, faculty loads and hiring, and college budget for the next five years.

3.1. Laboratory justification and architectural specifications

Following the initial discussion with the architects, faculty set about justifying the GDS lab and developing its preliminary specifications. This involved collecting specifications of GDS laboratories at a number of major universities, surveying the literature for applications and uses of GDS facilities, collecting input from consultants and other experts experienced in facilitating executive group meetings, and other sources. Faculty then assembled a set of preliminary specifications, including budgetary requirements, for the GDS laboratory.

At the time, many university GDS facilities used desktop workstations, had fixed desks facing a single moderator at the front of the room, contained a single projector and display screen, and featured a few writing surfaces. Internet access was usually absent. These existing facilities were designated as *earlier-design GDS*. However, the new GDS facility would be designed and populated with current technologies of two years hence. Despite the unknown nature of precise future implementation of the anticipated lab, the forecasted design and toolkit technologies were designated as *contemporary GDS*. The contemporary lab specifications and cost figures, together with a report documenting current and planned GDS research, comprised the technical and budgetary justification of the proposed GDS laboratory.

During the summer of 1996 faculty again met with the architects, who had developed the architectural specifications of the room from the preliminary GDS specifications and lab justification required by the University. Costs for the contemporary facility were extrapolated from the earlier-design model; software, hardware, and costs of earlier-design facilities at several selected major universities form the basis of these preliminary estimates. To purchase and utilize the most current technologies and design concepts available, the contemporary facility, then, would be re-designed nine months from the anticipated opening date of the new building.

Faculty also anticipated the need for multiple displays and called for three projectors and screens, with space for more projectors, if necessary. The architects included several small conference rooms in the building

design, which could double as breakout rooms. Because of building space and budget constraints, a GDS control room was not budgeted. Instead, a large, nearby control room assigned to serve the three distance education classrooms would do double duty for the GDS lab. Furthermore, in-room control features that could make the GDS lab self-sustaining were planned.

3.2. Prospective users of the GDS laboratory

The laboratory would have research, applied, and teaching uses. *The primary users* of the laboratory are GDS researchers and executive group meeting facilitators, although a single individual can occupy both roles. For these individuals, research and development of timely, quality, management decisions goals that produce quality data and quality results are goals. Researchers can team with facilitators to conduct research in the laboratory, while the facilitator both directs the session and operates the automated controls and the GDS software. *The primary subjects* of the laboratory are senior executives, managers, administrators, and other leaders involved in SM or other managerial-decision activities. Experimentation with environmental factors, including room configuration, electronic GDS, and multimedia would be accommodated by the facility.

The secondary users of the laboratory are faculty and researchers that are interested in GDS for teaching or demonstration purposes. *The secondary subjects* include students, administrators, and other visitors to the facility. The laboratory can also be used as a model for other conference or meeting facilities; it fills an information-providing role for the design of applied or other facilities.

Uses of the lab extend beyond GDS, as it was projected as an evolving, multi-use facility. *The tertiary users* would include individuals other than GDS users or subjects who would find the lab useful. Thus, it infrequently would be used for small presentations, private meetings, classes, teleconferencing, and a multitude of other purposes. *The tertiary subjects* are those individuals, including other faculty, students, and visitors who would attend the non-GDS sessions.

3.3. Laboratory requirements assessment

The architects completed the building design in the fall of 1996 and construction in late spring 1999. During the two intervening years, faculty had been consumed with creating the new College, in addition to their normal responsibilities.

As the building construction neared completion in early spring 1999, IS faculty revised the lab specifications and budget to meet the August 1999 grand opening. Faculty also focused on current GDS trends and the "toolkit" approach to designing the lab. They selected technologies identified in the toolkit. Specific technologies included in the lab will be discussed later in this paper.

Vendors provided valuable assistance in forecasting technology availability, estimating lead and installation times required to install technologies, and determining cost. The PM coordinated closely with contract construction managers and University network personnel to align the many simultaneous schedules. From this aggregated information, set of laboratory requirements emerged. The requirements assessment was completed late spring 1999, about six weeks prior to the building completion and about 15 weeks prior to the opening date in August.

From a research perspective, the laboratory design addresses the breadth of benefits and issues identified in the IS literature. From an applied perspective, it also addresses practical requirements and business management issues. As noted earlier, a major design objective was to create and maintain a sophisticated, flexible, and evolving learning environment ideal for investigating and solving almost any decision problem that can be addressed in a group meeting.

3.4. Laboratory characteristics specification

In late spring 1999, the requirements were formalized into a Request For Proposal (RFP). The characteristics list, which included desired technologies, cost estimates, and installation constraints, was divided into three categories due to anticipated budget constraints: primary, secondary, and tertiary expenditures. The GDS lab received funding for nearly all budgeted items.

3.5. Laboratory design and implementation

The IS faculty selected a vendor who responded to the RFP. Together with the vendor, building contractors, and university networking, technical, and facilities staff, the PM proceeded with the physical design of the laboratory.

Because time had created a gap between the original estimated requirements and the current actual requirements, some room modifications were necessary, including lighting, outlets (voice, data, and power), environmental controls, security, and other elements. The faculty selected technologies that: 1) fulfilled the purpose of the laboratory, 2) were available within budget, 3) could be delivered and installed by the deadline, and 4) could be supported by the existing infrastructure or a

modified infrastructure.[1] Choice also was driven by the realization that the laboratory must be continuously improved over time.

4. Characteristics of the GDS laboratory

The GDS lab was designed to accommodate as many kinds of meetings as possible.

4.1. Objectives for the laboratory design

The IS department's three major objectives were: 1) to maximize the flexibility of the environment for group decisions and related uses, 2) to maximize the power of the environment to enhance group decisions (including technological and non-technological features), and 3) to provide the ability to continuously improve and evolve the environment. These objectives are derived from GSS research and strategic management facilities [e.g., 2, 5, 12, 16, 17] cited in the Background section and were also influenced by budgetary constraints.

4.2. GDS laboratory physical design

Faculty proposed the design in Figure 1. The room design provides flexibility, and its contents can be arranged into many configurations using the modular tables, with seats for twenty participants and laptop computers for each. For instance, the participants can be organized into rows, circles, u-shaped groups, or a variety of other configurations. This feature avails the opportunity to reorganize the room for breakout sessions without using adjoining conference rooms.

The laptop computers can be equipped with both wired and wireless technologies; understanding that wireless limits streaming video capacity and also presents information security concerns. The laboratory has many writing and display surfaces (some movable) and the projector screens can be extended or retracted into the ceiling. The design included a V-Tel, or voice telephone, which is an ISDN teleconferencing device that will be integrated into the room infrastructure. An IP codec, which also has its limitations, was later added to overcome some of the bandwidth and switching limitations of ISDN technology.

As for the command console, the physical design specified the three computers proposed in the preliminary design—one computer for each of the projectors, with the center computer also controlling the electronic smart board, to be mounted on the wall behind the center projection screen. The computers would contain full multimedia capability, integrated into the console control system. The console would be fitted with a master room touch-screen control panel that controls lighting, screens, environment, and other aspects of the room with preset configurations. The console also would contain a high-resolution Elmo, as well as sound amplifier and mixer. Finally, the console computers would run a suite of software appropriate for a GDS lab, Internetworking, teleconferencing, and for multimedia presentations.

5. Implementation

In order to make the building opening date in August 1999, faculty were forced to postpone installation of some of the laboratory software on the console and laptop computers. In addition, all of the wiring was not fully operational and the room lighting required later modification.

The GDS laboratory was operational and functioning by the beginning of the Spring 2000 semester, and was being used for executive group decision support, as well as a multipurpose facility for special meetings and presentations. Figure 2 is a composite photograph of the GDS laboratory. The author on request will supply an inventory of the GDS lab hardware and software.

6. The user experience

The GDS lab is designed for 20 participants, but will seat up to 30 individuals. Users frequently comment on the "high-tech" nature of the GDS lab, from its open ceiling that exposes the painted conduits and cable trays to the quantity and variety of equipment located throughout the room. The GDS facilitator can adjust the lab's lighting to numerous pre-programmed levels, each of which is designed to focus user attention on displays or features chosen by the facilitator.

Because the tables are modular and the computers are wireless, users can be quickly arranged into a variety of configurations, from theater or classroom seating to boardroom or breakout arrangements. The multiple overhead projectors, display screens, sound system, and fixed writing surfaces surround the users with media that can be used for group brainstorming and decisions. Users can share information as they develop ideas using MS office programs, simulation or modeling software, or search the Internet with their laptop computers. The facilitator can control and display any of the laptop computer screens on the large, circularly-distributed, retractable projector screens.

[1] The GDS lab was 70 percent functional by the Fall semester deadline, primarily because of scheduling problems and equipment availability. However, the laboratory nevertheless appeared operational to the many visitors and non-IS faculty, and was completely operational by the beginning of the Spring 2000 Semester.

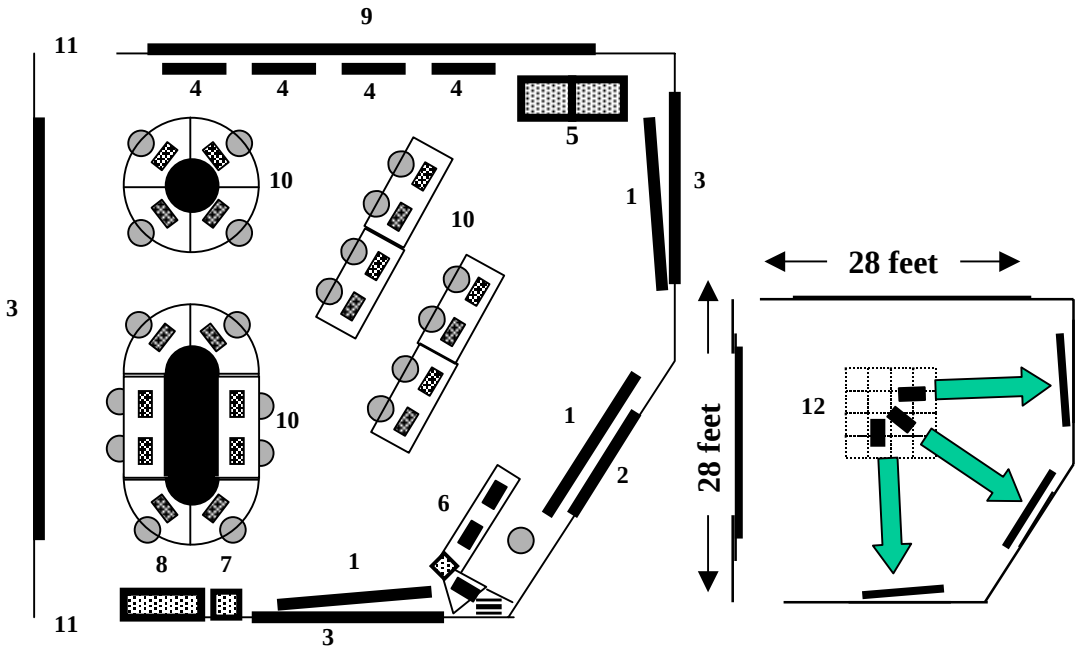

Figure 1. GDS Laboratory Design. Movable, modular tables with laptop computers (10), projection screens (1), electronic touch-controlled Internet smart board (2), wall-mounted writing surfaces (3), movable writing surfaces (4), V-Tel teleconferencing modules (5), facilitator console with three computers, Elmo, sound, VTR, programmable touch-screen room controls, and wireless projector controls (6), laser printer (7), storage cabinet (8), privacy screen (9), card-key security entrances (11), and overhead mounting grid for projectors and twelve spotlights (12).

In addition, numerous mobile writing surfaces are available for the personal use of small groups working in breakout sessions. A room-length floor-to-ceiling transparent wall offers lab users an inside-the-building view of faculty offices, and opens into a building-length skylight. Users can alternately experience a feeling of openness or privacy, depending on whether the retractable curtain is lowered to obscure activities in the room from outside view. Lavatory and refreshment facilities are available just outside the door of the GDS lab.

7. Lessons learned

7.1. User requirements

Getting buy-in from faculty users on needs, requirements, and specifications at each step of the process is critical—otherwise you'll miss the design target. It has been said that medical doctors make poor patients, presumably because they interfere with the treatment. In this case, the exact opposite was true of IS faculty. More involvement during the design and construction phases would have given the involved faculty a deeper understanding of the lab's purpose and required less training after the lab was completed.

7.2. Project management

Seasoned project management skills are prerequisite to building a GDS lab. In this case, we were required to integrate IT project management schedules and budget with the larger architectural, engineering, and construction (AEC) projects that built the facility. As noted earlier, the author was the project manager for the GDS and other laboratories. The PM interfaced constantly with diverse groups, plans, schedules, and budgets. Always find someone with a successful PM track record to build your lab.

7.3. Vendors

In general, vendors are a mixed blessing. The right one can become your best friend, but considerable patience is required. The lowest bid may not be the best bid: it is far better to select a cost-competitive vendor that is truthful, competent, reliable, and flexible. Cost is important, but vendors need to make a profit to survive—and support you.

7.4. Architectural, Engineering, and Construction (AEC)

As with all organizations, AEC groups have their own special needs and requirements. They take a broad view of the entire building project, of which the GDS lab comprises a tiny part. So, AEC schedules and resources

Figure 2. A photograph from the right rear of the GDS Lab.

reign supreme. Faculty should not communicate directy with AEC personnel, leaving that to the GDS PM instead. The AEC PM will plan and then delegate responsibilities on a case-by-case basis to supervisors and construction foremen who will do the actual work.

7.5. University administration

Building facilities on university property requires the oversight of many administrative offices. The most important lesson one can learn is patience and respect for the rules. They usually want you to succeed, but you must follow the many, many rules. All of them.

8. Summary research agenda

Below is a short list of research questions currently being investigated, using the GDS laboratory and its resources.

8.1. Convergence issues

How does a group decide on its ideas, its best ideas, and how do they arrive at a consensus decision? When is a facilitator necessary and what techniques help the group arrive at a decision? What elements are necessary in a quality group decision?

8.2. Deliberation issues

What tools and techniques, other than electronic brainstorming, benefit the group decision process? How should tools and techniques be used to thoroughly explore the problems or tasks being addressed in the session?

8.3. IT alignment issues

How can GDS tools and techniques assist in aligning the organization's IT with its strategic plan? Can GDS be used to ensure quality, enterprise-wide IT planning be consistently implemented? Can GDS significantly speed up the process?

8.4. Multimedia issues

When and how can multimedia be used to improve the quality of group decisions? What communication channels are used in making decisions and how can the decision process be enriched by multi-channel information?

8.5. Teaching issues

How can GDS benefit teachers in the classroom? When is it appropriate to use GDS to achieve a student consensus decision? How can colleges use GDS, including distributed GDS, to maintain an understanding of student issues and needs?

9. Current uses of the GDS laboratory

The GDS lab is primarily used as a research tool and as a facilitation tool for managerial decision making. In research, IS faculty are developing research programs in several areas, including: 1) exploring face-to-face decision making versus computer-mediated decision making, 2) as a data-collection tool for IT alignment planning, using GDS facilities and software to collect user needs, requirements, and information quality metrics, 3) investigating the effects of different channels of

communication on the decision making process, and 4) studying the effects of different media on the decision making process. The latter two research items involve the use of music as both a catalyst for and a medium of information, affecting the decision processes of knowledge workers.

In managerial decision making, industry managers and executives have been frequent visitors to the GDS lab, where they have brainstormed through a wide spectrum of strategic, operational, and organizational issues. The GDS software and laptops allow a facilitator to steer the managers through rapid data collection and voting/ranking exercises, providing the management sponsors with textual documentation and statistics on pertinent issues explored in the lab. The privacy features of the lab and its location in the neutral territory of a university are powerful attractors.

Secondary uses of the lab include teaching and GDS demonstrations. The IS department frequently uses the lab to develop teaching strategies and explore curriculum issues. For instance, the department has used the GDS environment to brainstorm and rank new courses, tracks, concentrations, degrees, and revisions to existing curricula. Students are regularly invited to experience GDS and to use it, under supervision, in developing class projects. Industry visitors are given similar opportunities and often become clients of the facility, following the demonstrations.

Occasionally the lab is used for distance learning exercises. Because the lab is equipped with IP codecs and ISDN V-Tel capabilities, it can be linked with remote sites for training and lecture opportunities. The lab is a formidable resource for presentations made by visiting speakers, although these activities are scheduled on an exception basis.

10. Conclusion and future plans

This project resulted in the specification, development, and implementation of a contemporary GDS laboratory. The laboratory is fully operational and is used to conduct research, outreach, and teaching.

As planned, the primary users are IS faculty engaged in research, as well as senior executives, managers, administrators, and other community leaders. GDS activities have focused on managerial-decision activities and processes.

The GDS laboratory accommodates its secondary users, which are individuals interested in GDS for teaching or demonstration purposes. Many student classes and faculty research/teaching groups have visited the lab to learn about GDS and its applications. The laboratory has been used as a model for other conference or meeting facilities, as well. The GDS lab accommodates tertiary users interested in using the laboratory for non-GDS purposes. Because of the available technologies, the variety and quantity of writing surfaces, the private environment, and the multimedia possibilities, the lab continues to be a significant area of interest for the University and the community.

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Appendix A: The step-by-step GDS lab development process timeline

1. **Summer - Fall 1995**. The University approves a preliminary plan to form a new College of Information Science and Technology (IS&T), composed of existing departments of Information Systems (IS) and Computer Science (CS), and additional future departments.

2. The IS and CS departments construct the Academic Program Statement for IS&T to propose curriculum, and estimate student enrollment, faculty and staffing, research, resource requirements, and budget.

3. The parent university system votes to support a new building that will house IS&T and the College of Engineering.

4. The University selects the architectural design firm and subcontract technology consultants, who comprise the architectural team.

5. **Winter 1995.** The IS faculty meets with university Facilities Management and the architectural team. The composite team forms a preliminary list of specifications for the various laboratories.

6. **Spring 1996.** The IS faculty perform GDS literature review and meet with the technology consultants to establish current state-of-the-art in GDS research and technology. GDS and GSS faculty at other universities are also consulted. IS faculty construct a preliminary design and justification for the GDS lab, which is approved by the University administration.

7. The Board of Regents approves the new College of IS&T.

8. The state legislature votes funds, to be matched by private donations.

9. **Summer 1996.** The architects complete the preliminary design of the IS portion of the building, together with its research labs, including a GDS lab.

10. **Fall 1996 – 1998.** The IS faculty works with Facilities Management and the architectural team to complete the design of the new building, including the dimensions, characteristics of, and location of the GDS lab. The faculty also develops three agenda for the lab: research, business use, and teaching agendas.

11. **Spring 1999.** The IS faculty again perform another GDS literature review and meet with the technology consultants to establish current state-of-the-art in GDS research and technology. As before, GDS and GSS faculty at other universities are also consulted. The product of this activity is a Needs Assessment.

12. Using the Needs Assessment and the three agenda, the faculty develops a list of desired characteristics for the lab.

13. The characteristics are used to formulate a final design, revised budget, and justification for the GDS lab, which is approved by the University administration.

14. A Request for Proposal (RFP) for the technical elements of GDS lab is issued. Vendors begin to respond as the building nears completion.

15. **Summer 1999.** The IS faculty selects an equipment vendor, who works with the building engineers and Facilities Management to construct the GDS lab. Building deadlines and equipment availability prevent completion by the deadline, so a compromise is reached to bring the room to be about 80 percent complete.

16. **Fall 1999.** Limited use of the GDS lab begins, pending completion. GDS software is purchased.

17. **Spring 2000.** The lab is completed and faculty begin to use it for research, business decisions, and teaching.