A MARRIAGE OF LEARNING AND DOING: MULTIMEDIA AND THE PUBLIC BUDGETING LABORATORY

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ABSTRACT

A long-standing pedagogical concern in public administration education is the development of graduates who can think critically and solve problems. This is especially true in the area of budgeting and financial management, a field of endeavor where no single framework is adequate for organizing all knowledge. Classroom methods emphasizing lecture over learning do not sufficiently equip graduates for real-world participation in public budgeting. Rather, successful knowledge transfer is the result of extensive involvement with concepts, something that best occurs when educators are integrators of the learning experience and students take an active part in the process. Multimedia technology can play an important synergetic role in the development of graduates with the skills needed to face the ongoing challenges posed by the complexity and diversity of today's budgetary environments.

This article addresses two themes: (1) public budgeting and financial management as an ill-structured knowledge domain and (2) the potentiality of instructional software to help students learn conceptually demanding material. The article concludes with a discussion of the PUBLIC BUDGETING LABORATORY, an interactive multimedia application designed to provide knowledge and experience necessary for competency in budget preparation.

INTRODUCTION

American higher education is on the cusp of a paradigm shift (McDaniel, 1994). The traditional, time-honored teaching imperative, the instruction paradigm, is giving way to something new: college as a learning enterprise--a change for which educational reformers have long argued[1] (Barr and Tagg, 1995; Hirsch, 1996; Jonassen, 1993).

What is driving this Ivory Tower makeover and new model of college pedagogy? The impetus for change is the confluence of several factors such as legislators and board trustees who believe that "colleges cost too much and deliver too little"; the demand for graduates with better skills; advances in instructional technology; and present-day reform movements at the elementary and secondary school levels (McDaniel, 1994:27). The learning paradigm, as this shift has come to be called, is part of the larger postmodern perspective that argues for a holistic approach to education, social progress, the environment, and political economic systems (Laszlo, 1994). This new vision sees the classroom as a place where quality and mastery are the dominant values, where students work together with other students and faculty toward shared goals, and where professors are orchestrators of the learning experience (*Ibid.*, 1994; Wasson, 1997).

The learning paradigm seizes the goal of **education for understanding**--that is, having "a sufficient grasp of concepts, principles, or skills so that one can bring them to bear on new problems and situations" (Barr and Tagg, 1995:22). The objective, then, is to produce graduates who can think critically and solve problems rather than merely regurgitating rote-learned information because the former will possess the skill needed to face the challenge of the next millennium. The method advocated to cultivate these high-order skills is "discovery learning" where students solve problems and make decisions on their own through independent inquiry and analysis of real-world projects (Hirsch, 1996:129).[2]

The commitment to develop students' higher-order thinking and problem-solving genius is a key consideration in public administration education and has been for some time. Curriculum reform (*e.g.*, Durant, 1997), program standards (*e.g.*, Golembiewski, 1979), innovation (*e.g.*, White, 1979), and competency building (*e.g.*, Alexander, 1986; Caiden, 1985' Grizzle, 1985; McCaffery, 1983) are just a sampling of some of the long-standing, pedagogical concerns in MPA programs. This article looks at one particular area of public administration education, public budgeting and financial management, and in doing so addresses two themes: the field as an ill-structured domain and how instructional software, such as the **Public Budgeting Laboratory**, helps students learn conceptually demanding material.

BUDGETING: AN ILL-STRUCTURED DOMAIN

The need to develop graduate students' higher-order thinking and problem-solving aptitude has heightened as greater notice has been given to the importance of subject-matter and the social context of learning (Lambrecht, 1993). This is particularly important in fields characterized by ill-structured knowledge domains (Saint-Germain, 1996) such as that which we have today in public budgeting.

The boundaries of public budgeting have been expanding, posing monumental challenges to research and teaching (Caiden, 1985). Caiden argues that generalization is more difficult due to the crescent complexity of financial management, growing politicization of budget processes, expansion of budget functions, and the ongoing turbulence for the "compartmentalism in study and teaching" of public budgeting. According to Caiden (1985:495):

> Traditionally, the study of public budgeting and financial management has been divided among several disciplines, notably economics, political science, management theory, and accounting, with relatively little overlap. Classifications, processes, and techniques have dominated the field, with less attention given to politics and policies. Teaching and research have usually been conducted at a high level of generality or focused upon special cases: systematic attempts to relate theory to environment have been relatively few. With new concerns, these conventional boundaries have begun to blur, raising problems of conceptualization and approach.

Caiden's assessment of the state of the discipline coincides with the characteristics and particular disposition of an ill-structured knowledge domain. According to Saint-Germain (1996), an ill-structured knowledge domain is one with rival perspectives such that no single framework is adequate for organizing all knowledge. Problems are fuzzy, many-sided, difficult to solve, and devoid of fixed standards; include numerous actors; and multifarious conflicting theories. Likewise, public budgeting is an eclectic field, multidisciplinary in nature, with competing perspectives, no universal rules and no quick solutions--thus, it is an ill-structured knowledge domain.

In the context of preparing students for real-world participation, ill-structured knowledge domains pose problems of knowledge transfer because past learning may be misconfigured to address new situations (*Ibid.*). Students must retrieve previous knowledge components and reassemble them into a new situation-specific approach. To do this, however, students must have ample prior knowledge in several contexts and must be able to make associations between the knowledge and its attendant conditions. Cognitive psychologists and researchers argue that ill-structured knowledge domains require higher-order thinking and critical inquiry skills that the **three Rs** and rote learning fail to provide (Lambrecht, 1993). This tension between "higher-order thinking skills and lower-order information" (Hirsch, 1996) has precipitated a tremendous "unevenness in the background preparedness" of MPA graduates in the field of public budgeting and finance (Alexander, 1986).

Transfer of learning is the result of extensive involvement with concepts so that their application is recognized in several contexts and in connection with other ideas (Lambrecht, 1993). If the classroom is to make intelligible the complexity of the real world in budgeting, the discipline will need to reflect current developments (Caiden, 1985:497) and students will need to make mental links to those developments.

Budgeting is about gathering and sorting information. Some of the more important qualifications include analytic ability, writing skill, a willingness to work hard, and good judgment (White, 1990). White submits that good budgeting is an art and craft which requires substantial amounts of learning by doing. As such, practice fields or learning environments allowing participants to experience budgeting processes (fiscal policy, agency accountability, political priority-setting, decision-making, etc,) and roles (managers, staff, elected officials, special interests, etc.) first-hand are an integral part of learning the art and craft.

One teaching method/modality that helps students conquer conceptually demanding subject matter is interactive multimedia (Athappilly, Durben, and Woods, 1994; IBM Corporation, 1994; Ragsdale and Kassam, 1994; Westland, 1994) which IBM (1994:34) defines as "a powerful set of technologies that combine the interactivity of a computer with a natural user interface that includes audio, video and real images." The use of multimedia in education and training is proliferating because it delivers a new level of "learning" and "seeing" (Ragsdale and Kassam, 1994:558) or what Lambrecht (1993) calls cognitive enhancement. Multimedia is particularly rich because it presents diverse modalities and presents them simultaneously (Westland, 1994:363). According to IBM (1994:34), "[M]multimedia has proved its worth as a unique set of technologies when used to support applications such as training, business presentations, and marketing kiosks," thus providing a way to command attention, improve retention, and clarify complex information.

Others are slightly less enthusiastic than IBM on the efficacy of multimedia applications. For example, Saint-Germain (1996) submits that many packages have been developed atheoretically and do not address how students learn conceptually demanding material. Similarly, Galagan (1987) notes that most application designers are more likely to be technically proficient rather than masterful educators.

Consequently, the resultant software does not necessarily add value to the learning process. In fact, a common complaint is that too much instructional software is machine-driven and manufacturer controlled rather than reflective of cognitive style. The section that follows suggests a typology to understand multimedia instructional technology better and to help potential users sort out the **good, the bad, and the ugly**.

TYPOLOGY OF MULTIMEDIA APPLICATIONS

Savage and Vogel (1996) posit a five-tiered process model to explain the uses and potentialities of multimedia where each tier represents an evolutionary plateau on a multimedia technology continuum. Ascending from one level to the next represents incremental improvements in process and learning, supported by better and fuller exploitation of the specific strengths of multimedia technology. Therefore, each level establishes a necessary foundation on which the succeeding levels rest.

The principal benefits that accrue from this conceptualization are twofold. First, it provides a classification scheme for all the diverse modalities that fall under the catchword, multimedia. A point often missed is that all components of the technology need not be present at the same time for multimedia to occur (Ragsdale and Kassam, 1994), just the integration of two or more media effects (*i.e.*, texts, graphics, sound, video, and animation) with the interactivity of the computer (Asymetrix Press, 1994).

Second, the model provides a starting framework for collegial dialogue, inquiry, and evaluation of the cognitive enhancement possibilities that interactive multimedia programs promise to contribute to higher learning, something that has lagged far behind application development (Heller, 1990; Reeves and Harmon, 1994).

Level 1. Embellishment: The Presentation

Level 1 applications enhance and extend traditional information formats (*e.g.*, lectures and printed material) with the inclusion of static images or sound. To the minimalist, these additions likely seem unnecessary and superficial. From an educational perspective, however, embellishment adds interest facilitating learning (Savage and Vogel, 1996).

Through the addition of images or sound, the presenter can make important points more apparent (Trainor and Krasnewich, 1994) and graphics and visual cues complement text. Similarly, sound complements text with voice-overs and other aural effects to create a mood, add emphasis, and communicate ideas (Asymetrix Press, 1994). Research shows that audio-visual material aids information-recall and makes a greater impact on the learner than either lecture or written matter alone (Athappilly, Durben, and Woods, 1994; Fletcher, 1990; Trainor and Krasnewich, 1994:174).

Level 2. Explanation: The Demonstration

Animation is the sequencing of single drawings or frames resulting in motion (Trainor and Krasnewich, 1994:190). Building upon the simple embellishment advanced by Level 1, Level 2 applications move from subject-matter presentation to subject-matter explication through the use of animated sequences. Animation enhances a presentation by activating graphics to illustrate a concept. Therein lies its power. Animation is especially "useful for visualizations of abstract and concrete processes, allowing perceivable manifestations of actions, motions and status changes that otherwise must be imagined by the user" (Morris, Owen, and Fraser, 1994:261). In other words, seeing is believing, animation makes sense of a concept through demonstration of the concept.

Level 3. Exploration: The Information System

At Level 2, multimedia technology moves beyond its use as a presentation tool and begins to realize its potential as an information resource (Savage and Vogel, 1996). Its defining features include the use of multiple media, access to a variety of information resources, and user interactivity.

The chief purpose of a multimedia information system is dynamic exploration of data resources stored in a large database containing text, graphics, animation, sound, and video. Using a multimedia information system requires an understanding how data are interrelated and how they can be used.

Resource access occurs sequentially--the entire equivalent of thumbing through a textbook--and randomly--the outline equivalent of using a book's index. But, unlike browsing a conventional book, users read, see, and hear subject matter as they explore, interpret, and make new mental connections (Savage and Vogel, 1996). Therefore, multimedia information systems provide insight in a way no traditional book can.

As a general rule, Level 3 applications are "passive" tools. Inasmuch as there is a bounty of data to seek, there is little or no guidance on finding useful pathways to the information (*Ibid.*). The reader must know what it is (s)he wants to find and where to look for help.

Level 4. Guided Inquiry: Hypermedia

The incorporation of smart links to interrelated, multiform data is the distinguishing feature of Level 4. Hypermedia provides users with "control navigation" or guided inquiry (Shim and Chun, 1994) through an information repository. The underlying rationale for hypermedia is that people's thoughts and communication patterns are associative--we constantly link words, images, and sounds in tangential, arbitrary or supportive ways (Net.Genesis and Hall, 1995). Therefore, the goal of hypermedia is to provide users with a mechanism to follow threads of information in a structured, purposeful fashion.

Park (1992:260) defines hypermedia as "a specific type of computer software for organizing and managing information into a system so that the user can easily access, retrieve and modify the information." Consequently, hypermedia is an amalgamation of "hypertext"--the linking of related text-based information--and "multimedia"--using different types of data to represent information. Thus, the basic linking premise behind hypertext remains the same in the development of hypermedia programs, save the inclusion of data forms other than text as viable links (Park, 1992).

The outgrowth of this union has been a cornucopia of tools that afford flexible, dynamic access to all forms of data through user-friendly interfaces. The technological benefits typically touted include: ease of operation, purposeful data searching; assisted discovery of new and relevant information; shorter seek and retrieval times; opportunities for data sharing and collaboration; and access to information in multiple media formats.

The basic structure of a hypermedia application is a network type of database that consists of nodes containing information and links connecting the nodes (Park, 1992). The actual organization of the network depends upon the structural characteristics of its content, the needs of its user, and the purposes of the designer. Nonetheless, most hypermedia networks use a combination of three basic linking strategies: hierarchical, logical, and web.

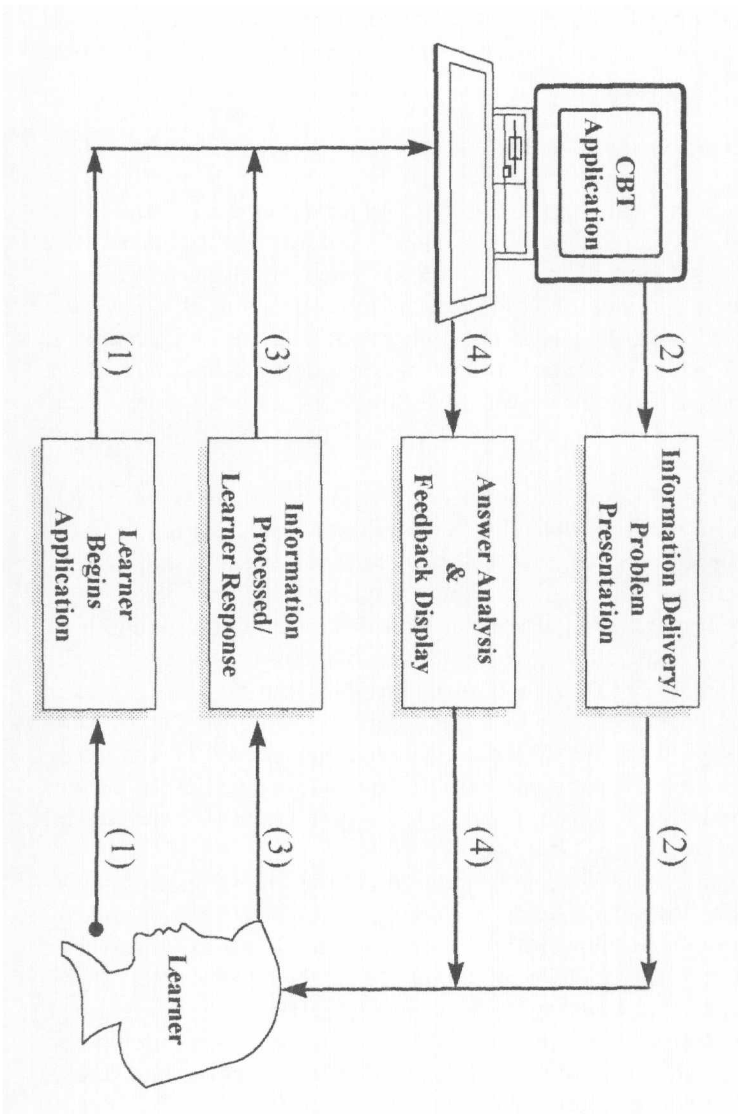
Hierarchical structure is appropriate when there are pre- and postrequisite relationships among content elements (*Ibid.*, 261) such as in an outline. Logical structures are used to organize elements that are logically related to one another where associations provide additional details or a comparative frame of reference. The content elements in a logical structure may or may not have prerequisite relationships. Finally, web structures are used when every node is connected to every other node. This structure is useful when unlimited access to information from any given node and time is important (*Ibid.*, 262).

In recent years, there has been a surge in the popularity of hypermedia applications (Shim and Chun, 1994)--most notably, perhaps, the World Wide Web.[3] From a social perspective, the Web has grown dramatically. Since its inception in 1993, the Web has burgeoned from a modest network of 200 hosts (servers) to over 897,612 hosts (Brannon, 1997:9). Estimates of users connected to the Internet today in the United States alone range from a conservative 5 million to as many as 25 million active users. Brannon (1997:9) adds, "Worldwide estimates are even harder to come by, but should at least double the U.S. figures."

Shim and Chun (1994) submit that the popularity of hypermedia is tied to the inherent strategic qualities of information. Their explanation is certainly true of the Web, ostensibly the new frontier for socialization and commercial enterprise. As more and more people use the Web, the greater the demand will be for additional functionality to help users locate useful information (Savage and Vogel, 1996) to meet their particular needs. Negroponte (cited in Savage and Vogel, 1996), Professor of Media Technology at MIT, predicts the coming of artificially intelligent computer programs or "interface agents" to meet this demand.

Hypermedia, used in conjunction with strategies for developing students' metacognitive abilities, shows promise as an instructional

FIGURE 1
A TYPICAL INTERACTIVE LEARNING SYSTEM



authoring and delivery tool (Park, 1992; Saint-Germain, 1996). This prospect provides a segue to the last tier in the multimedia classification scheme suggested here, namely, Level 5 of the Instructional Level.

Level 5, Instruction: The Tutorial

The particular contribution of Level 5 multimedia is to add a set of interactive strategies for computer-based learning to the mix--that is, both navigational components and some form of purposeful user engagement (Sims, 1997) to facilitate the acquisition of Knowledge. In other words, the goal is not only the quest for information, as in Level 3, but also "mastery" of that information where mastery means assimilating learned facts with skills to apply knowledge in new situations (Savage and Vogel, 1996). Figure 1 illustrates a typical interactive learning system.

Nearly all Level 5 applications provide an environment that is self-paced, learner-controlled, and individualized. This is not to say that all programs are created equally, however, because they are not. Instructional software runs the gamut from sophisticated page-turners (*e.g.*, tutorials accompanying software products, online help, topic overviews, etc.) to computerized simulations. As Spector and Davidson (1997:127) remark, each has its useful place. In terms of the pedagogical efficacy of a given package, the questions is: Does the design fit the need? (Heathman and Kleiner, 1991). Obviously, more complex learning situations require more elaborate designs that tap into the learner's "preferred way to assimilate and master learning" (Galagan, 1987:73).

In general, multimedia instruction has the following attributes in common: learner or learners; computer-mediated delivery mechanisms; machine-pupil interactivity; hypermedia; a graphical user interface; a setting in which learning occurs; a subject-matter focus; and negotiable learning goals, objectives, and desired outcomes. Some examples of Level 5 applications include computer-based training, tutorials, microworlds, simulations, learning laboratory, virtual worlds, and other such innovations professing to be interactive, learner-oriented, and employ the speed, storage, retrieval, and processing capabilities of the computer.

Multimedia learning environments typically revolve around a set of "constructivistic assumptions" (Jonassen, 1993) that emphasize the centrality of the learner and "the hidden mental processes that must occur" for learning to take place (Wasson, 1997:574). As such, constructivist pedagogy insists that the learning environment be tailored to fit the learner and, in so doing, that it reflect the learner's intentions, experiences, and metacognitive style (Reeves and Harmon, 1994:477). According to Reeves and Harmon, the major goal is to "assure that the learning environment is as rich as possible." That is, "self-directed exploration and discovery learning" replaces direct instruction and the traditional behaviorist point of view that emphasizes observable, measurable behavior and its modification (Wasson, 1997:574).

To accomplish the above end, learning environments usually purport to do the following (Jonassen, 1993:574): involve learners in authentic, context-sensitive learning tasks; support collaborative learning activities and socially negotiated meanings of subject area knowledge; facilitate problem identification, definition, and resolution; stress knowledge construction over reproduction; use hypermedia as a delivery technology; provide learner control of activities; present multiple perspectives; furnish alternative means for reflecting on personally constructed meaning; and offer experientially (situationally) indexed meaning. Examples of such learning environments include cognitive flexibility hypertexts,[4] anchored instruction,[5] and computer-supported intentional learning environments[6] (Jonassen, 1993; Saint-Germain, 1996).

Researchers have found that people retain 20 percent of what they hear; 40 percent of what they see and hear; and 75 percent of what they see, hear, and do (Fletcher, 1990). These results suggest that multimedia technology is a more effective means of communication than either text or voice alone (Athappilly, Durben, and Woods, 1004) and, therefore, has cognitive enhancement value[7] (Lambrecht, 1993). Other studies have found CBT and its derivative forms to be as effective as traditional teaching methods[8] (Kearsley, 1984; Kulik and Kulik, 1991; Saint-Germain, 1996).

Despite the positive implications of these and other findings, there is currently no consensus on the overall benefits of multimedia learning environments. As Saint-Germain (1996:3) observes, there are simply too many different types of technology, each with its own theoretical assumptions, for any generalization to be made. Savage and Vogel (1996) submit, nonetheless, that there is still cause for optimism because continued advancements in multimedia technology will prompt educators to take a fresh look at course material, leading to more engaging presentations, more effective ways of

TABLE 1
KEY FEATURES OF MULTIMEDIA LEARNING
APPLICATIONS BY COGNITIVE ENHANCEMENT LEVEL

Cognitive Enhancement Level	**Purpose**	**Features**
Level 1: Embellishment	Presentation	• Images • Sound
Level 2: Explanation	Demonstration	• Level 1 + • Simple Animation
Level 3: Exploration	Information Resource	• Level 2 + • Multimedia textbook (undirected linkage patterns)

TABLE 1 (concluded)

Cognitive Enhancement Level	Purpose	Features
Level 4: Guided Inquiry	Hypermedia	• Level 3 + • Information webs (sophisticated linkage patterns)
Level 5: Instruction	Tutorial	• Level 4 + • Interactive Strategies • Learning and Doing (Information and Skill Mastery)

communicating information, and new approaches to teaching and scholarship.

Table 1 summarizes the key features of multimedia learning applications by cognitive enhancement level, as discussed above. Note, as cognitive enhancement level increases from 1 to 5, the learning potential of the multimedia application also increases.

A discussion of the *Public Budgeting Laboratory*, an interactive multimedia application designed to provide knowledge and experience necessary for competency in budget preparation follows in the next section.

PUBLIC BUDGETING (VIRTUAL) LABORATORY

The *Public Budgeting Laboratory* (PBL) is a stand-alone, PC-based, self-contained learning system designed to take users through the various steps in the development of a line-item budget for a small city. The package consists of an electronic workbook, a data source book, a reader in local government budgeting, and a user's manual.

Learning and Doing

Recall what (White (1990) said that good budgeting is a craft that requires a substantial amount of art and are things learned by doing. Because the budget laboratory is a simulation, learning and doing are inextricably intertwined, meaning that the laboratory is expressly designed to teach budgeting to students by making them actually doing one (Rabin, Hildreth, and Miller, 1996). Once all the budget steps are concluded, the student has a complete budget document to show for his/her efforts, plus the experiential learning and skill development that coms from actually performing budgeting tasks. The laboratory is a marriage of theory and practice, designed to help achieve the following four goals of professional development (*Ibid.*, 1):

> To provide a learning opportunity in which a solid, theoretical base complements, compounds, and guides the application of techniques. Accordingly, the steps in the budgeting process are viewed in the context of the city's political, social and economic conditions.
>
> To provide experiential learning and skill development. By actually doing the budgeting tasks, the learner practices those processes and observes

the group dynamics that (s)he may find in a work situation.
To test techniques and perspectives by simulating problems the student confronts. As such, the exercise can bring many textbook concepts to life.
To perform a task bearing a time-sensitive product: a city budget. The task orientation engages and motivates deeper student involvement and understanding of the subject matter.

PBL is very intuitive and easy to use. Predicated on a book metaphor, the computer takes on the dual role of surrogate tutor and sophisticated page turner. Accordingly, each page in the electronic printer is characterized by colorful, imaginative graphics; simple animation sequences; explicit screen instructions; occasional sound bites; and content-sensitive help. The application's visceral design and innovative approach enable even the most technophobic users to overcome their computer paralysis so that they are up and running in a very short period of time.

Cognitive Enhancer

Traditional classroom methods are limited in their capacity to focus on an individual's learning needs (Bart and Tagg, 1995; Jonassen, 1993; Savage and Vogel, 1996). PBL, on the other hand, works one on one with the user advancing under his or her control. Students can move around in the application as desired and direct the speed with which new concepts are introduced. If interrupted, users can mark their places and return later. Since the Laboratory maintains an audit trail of the pages visited during a session, the learner can readily pick up where he or she left off. Topics are segmented and well-labeled so that users can easily advance to other areas, review previous topics, and take breaks at any time.

The software also provides students with cognitive support by eliminating much of the "grunt work" associated with developing the budget document such as speedsheet set-ups and tedious calculations. By capitalizing on the computer's strengths, namely, its interactivity, speed, storage, number crunching prowess, and text processimg capabilities, the learning experience is enhanced because there are greater opportunities to explore dynamically budget topics and engage in the higher order thinking required by an ill-structured knowledge domain (Resnick, 1987; Saint-Germain, 1996) such as public budgeting. The payoff for the student is a more effective learning system. First, the student is in command every step of

TABLE 2
FOURTEEN STEPS TO TRAIN LEARNER IN
BUDGET CONCEPTS AND USE OF PBL

STEP	OBJECTIVE
1. Introduction to Budgeting:	To become familiar with basic financial management terminology.
2. Introduction to the City:	To become acquainted with the City by researching general factors such as socioeconomic growth and specific factors such as revenue sources.
3. Expenditure History Development:	To grasp the nature of City operations by researching the expenditure histories of City Departments for the past five years. Learners look at past budget behavior to gain a perspective for judging the current budget year. As part of the simulation, learners become staff specialists for one or more departments, examining each in detail.
4. Report on Expenditure History:	To present other staff members with a spending history for each assigned department.

TABLE 2 (continued)

STEP	OBJECTIVE
5. Revenue History Development:	To understand the nature of City revenues by researching the history of each source of City funds for the past five years.
6. Report on Revenue History:	To present other staff members with a revenue history of the City.
7. Revenue Projection Development:	To project future City revenues with some of the methods commonly used by governments today.
8. Revenue Projection Analysis:	To determine collectively the revenues that the City reasonably may expect for the forthcoming fiscal year.

TABLE 2 (continued)

STEP	OBJECTIVE
9. Capital Improvements Estimation:	To develop information for the capital improvements section of the City's annual operating budget and to design a one-year program incorporating large-scale projects—e.g., buildings, land, equipment, etc.—for the next fiscal year.
10. Expenditure Proposal Development:	To estimate expenditures for each department that has already been analyzed. The expenditure histories may now serve as a basis for estimating changes for the coming year. The capital budget information in Step 9 will be used as well, and personnel information will need to be prepared. Each staff member may also propose new projects, extensions, curtailments, or significant programmatic departures from present practices.

TABLE 2 (concluded)

STEP	OBJECTIVE
11. Expenditure Proposal Analysis:	To prepare individual reports on proposed expenditures for each department and to present these reports orally.
12. Preparation of the Budget Draft:	To integrate collectively individual department requests and draft a City budget, reconciling expenditure requests with the earlier adopted revenue projections.
13. Preparation of the Final Budget Draft Document:	To prepare a final version of the budget document for submission to the Mayor. Revisions to the draft may be made following comment by the Assistant to the Mayor.
14. Feedback Session:	To review and comment upon the budgeting laboratory, evaluating what has been learned through the information on budgeting as well as the process of designing a city budget; and to explore key items in budget execution.

way (Jonassen, 1993; Reeves and Harmon, 1994). Second, higher order mental operations are possible when the computer relieves the learner of tedious operations.

Fourteen Budget Steps

The electronic workbook is the heart and soul of the learning system consisting of the fourteen steps shown in Table 2 where each is designed to train the learner simultaneously in both budget concepts and use of the tool.

Clear, explicit learning objectives and activity sequences provide the learner with a viable road map for navigating the application. By following a well-defined course of action, students are led step-by-step through the motions of developing a budget.

Laboratory users learn how to analyze, integrate, and document data from disparate sources as well as employing decision-making techniques like revenue forecasting and expenditure estimation. Spreadsheets templates allow the student to run through any number of "what-if" scenarios to examine the impact of changing values and recalculation. Activities can be repeated as often as necessary. It is this flexibility that enhances and individualizes the learning experience for the user.

Completion of each step accomplishes an assortment of budgeting tasks in the simulated environment. Collectively, these prescribed steps culminate in the completion of a comprehensive, balanced budget document.

Supplemental Materials

The *Data Sourcebook* provides the expenditure and revenue data to be used in the budget exercises while the reader provides the theoretical basis for all assigned activities. The user's manual is a concise guide to using the *Public Budgeting Laboratory*, specifies general information about the Laboratory, and outlines basic instructions for running the application. Since the budget application runs under Windows 95, users should be familiar with that operating system and associated terminology.

System Requirements

To run the Laboratory the computer configuration must meet the

TABLE 3
MINIMUM REQUIREMENTS FOR USE OF LABORATORY

COMPONENT	MINIMUM	RECOMMENDED
Computer	80486/33	80486DX/33 or higher
RAM (random access memory)	8MB	12 MB or more
Hard Disk	24MB	24MB
Disk Drive	1.44 MB (3.5-inch)	1.44 MB (3.5-inch)
Microsoft Windows	Windows 95	Windows 95
Graphics	VGA or better	VGA or better

minimum requirements shown in Table 3. However, the Laboratory runs most efficiently with the recommended components.

CONCLUSION

For too long, higher education has been in the business of providing instruction rather than producing learning. Holistic learning is/must be "a collaborative elaboration of insight knowledge and skill" (Laszlo, 1994:94) where students are active discoverers and constructors of their own knowledge and where multimedia technology can play an important supporting role.

Interactive multimedia is not a panacea, however, nor will the *Public Budgeting Laboratory* eliminate the need for lecture, an instructor or any number of other instructional modalities. Rather, the Laboratory is **part** of a learning environment where learning and doing are inextricably intertwined so that students may acquire necessary competencies in local government budgeting. By employing the cognitive enhancement afforded by multimedia, the learning experience is enlarged because there are greater opportunities to explore dynamically budget topics and engage in the higher order thinking required by an ill-structured knowledge domain like public budgeting.

NOTES

1. In their list of "LESS" and "MORE" exhortations, Zemelman and Hyde (from their book, BEST PRACTICES, cited in Hirsch, 1996:130) epitomize the shared beliefs of present-day reformers. Although directed toward elementary and secondary schools, they capture the learner-centered philosophy of constructionism. Some of these principles include:

LESS whole-class teacher-directed instruction
LESS student passivity, sitting, listening, receiving
LESS student time reading textbooks
LESS attempts by teachers to cover large amounts of material
LESS rote memorization and details
LESS stress on competition and grades
LESS use and reliance on standardized tests

MORE experiential, inductive, hands-on learning
MORE active learning with all the attendant noise of students doing talking,

collaborating

MORE deep study of a smaller number of topics

MORE responsibility transferred to students for their work; goal-setting, record-keeping, monitoring, evaluation

MORE choice of students; e.g., picking their own books, etc.

MORE attention to affective needs and varying cognitive styles of students

MORE cooperative, collaborative activity

MORE reliance on descriptive evaluations of student growth.

2. According to Hirsch (1996:259): "[D]iscovery learning] refers to the teaching method which sets up projects or problems so that students can discover knowledge for themselves through hands-on experience and problem solving rather than through textbooks and lectures ... The premise is that knowledge acquired on one's own, with difficulty and by spending lots of time and effort, is more likely to be retained than knowledge presented verbally ... [K]nowledge gained in a realistic context as part of an effort to solve a problem is likely to be knowledge that is well understood and integrated.

3. The Internet has always been an information-rich repository for the technical elite and technologically savvy--that small community consisting of academics and scientists familiar with its invocations, incantations, and particular mumbo-jumbo (e.g., line commands). In 1980, Tim Berners-Lee and other researchers advanced the idea of a system for displaying documents retrieved from Internet servers, based on the principles of hypertext. The first real application of this idea took the form of the Mosaic Web browser, released in 1993 (Brannon, 1997:8). A year later, Netscape Communications Corporation released the first version of Netscape Navigator, the first major commercial Web browser (net.Genesis and Hall, 1995). With this support for enhanced text presentation, graphics, sound, video, and hyperthinking, the Web provided easy access to the Internet. It was not long before Web technology began to infiltrate the masses. Today, almost everyone has some awareness about this rich information-web.

4. Cognitive Flexibility Theory (CFT) is a conceptual model for instruction that is grounded in cognitive learning theory. Proponents of CFT maintain that its virtues derive from multiple representations of content, emphases on case-based instruction, focus on context dependent knowledge, and support for the natural complexity of advanced knowledge, particularly that of ill-structured knowledge domains (Jonassen, 1993). Based on the premise that to use knowledge in many ways, it must be learned in many ways." Saint-Germain (1996:1) explains CFT as follows: "CFT treats knowledge like a landscape. To become familiar with the landscape, one visits various 'sites.' The landscape is traversed from many directions, revisiting the same sites but from different angles of approach each time. This criss-crossing of the landscape highlights the multifacetedness of the landscape and

establishes the multiple connections among scattered sites." Flexibility hypertexts are purported to employ CFT so that learners may engage in more meaningful, transfer-oriented, advanced knowledge acquisition (Jonassen, 1993).

5. Anchored instruction bids to root knowledge acquisition and skill application in interesting real-world, video-based, problem-solving scenarios. Jonassen (1993:36) explains: "Rather than relying on deceontextualized problem sets, it requires learners to use multiple operations in this macrocontext in order to sole problems. When the context is interesting enough, even special-needs learners utilize complex problem-solving situations."
6. According to Jonassen (1993:36): "Computer-supported intentional learning environments provide students with a forum to explore subject-matter/content area on the basis of individual self-determined needs and interest, and support student utilizing higher-order questioning, elaboration, constructive commenting and learning process management skills." In other words, learners should think more deeply, superintend their own learning, and cogitate on what they have learned.
7. Lambrecht (1991) argues that software can provide learners with cognitive support if it allows them to focus on complex concepts. Accordingly, she deems the software to be operating as a "cognitive enhancer." Since multimedia technology is a "more direct and complete communication model" (Athappilly, Duren, and Woods, (1994) than either text or voice alone, it is operating as a cognitive enhancer and as such multimedia has "proven its worth" when used to support applications such as training education, marketing kiosks, and business communications (IBM Corporation, 1994:34).
8. Kearsley (1984:v) suggests that continued advancements in technology will augment the educational capacity of CBT to a level that will one day rival if not exceed that of the best instructors. In their meta-analysis of 254 studies, Kulik and Kulik (1992) found that computer-based instruction (CBI) usually produces positive effects on students. In particular, CBI was found to raise examination scores, improve students' attitudes toward teaching and computers, and substantially reduce the amount of time required for instruction. According to Saint-Germain (1996:3), qualitative information and anecdotal reports corroborate "nearly universal student acceptance if not preference for these methods."

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