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POLANAL: AN EXPERIENTIAL APPROACH TO DECISION SUPPORT

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ABSTRACT

POLANAL is a pedagogical decision support system designed to introduce support system concepts to business school students in the context of business policy and strategy case analysis. Since POLANAL is formulated around the basic principles learned in previous courses, it provides students an integrated framework for policy analysis. This paper presents the experiential approach that introduces students to the technology, approaches, expectations, and advantages of computer assisted decision support via the POLANAL vehicle.

INTRODUCTION

Management is on the threshold of a new type of managerial interaction with computer-based information systems. The essence of this new interaction is captured by the term "decision support systems". Decision support systems are the subset of management information systems that truly support decision-making processes. The primary focus of computer-based decision support is on the extent to which the information processing bond between decision makers and computers can be enhanced for relatively unstructured types of managerial problems.

Decision-making constitutes the core of managerial activity. The quality of the decisions taken determines an organization's long-run viability. However the complexity, interrelationships, and rapidity of events in the private and public sectors have accelerated a need for increased support in making these decisions in upper levels of management. Management researchers have long recognized that "... it is at the top levels of organizations where better decision-making methods are most needed" [7, p. 246] but that management scientists tend to give excessive attention to operating decisions. The result often causes organizations to pursue "... inappropriate courses of action more efficiently" [7, p. 246]. Proponents of decision support posit that the successful implementation of computer-based decision support systems creates the potential to reverse this trend by providing a management tool to help solve certain types of strategic problems commonly faced by management.

DECISION SUPPORT SYSTEMS

It was the initial work of Scott Morton and Gorry [3] that integrated Anthony's [2] three level taxonomy for managerial activity with Simon's [9] "programmed" and "nonprogrammed" (semi- or nonstructured) human problem solving scheme to identify a framework for management information systems. The framework interrelates managerial activities with the managerial decision environment. The management activities addressed are (1) the strategic planning process--e.g., setting financial, marketing and research policies; choosing new product lines; acquiring a new division; (2) the management control process--e.g., formulating budgets, working capital planning, choosing product improvement; and (3) operational control activities--e.g., controlling credit, scheduling production, controlling

inventory. The types of managerial problems addressed include structured, semistructured, and unstructured. Decisions are structured to the extent that they are repetitive and routine and that a definite procedure has been worked out for handling them. Decisions are unstructured to the extent that they are novel, consequential, and require a manager's experience, intuition and judgment.

The Gorry/Scott Morton framework provides the basis for drawing a clear distinction between the generic types of managerial problem solving activities that can be supported with computer-based information systems. Programmed (structured) problems existing at the operating level readily yield to conventional structured data processing systems. However, the important strategic problems existing at the other end of the spectrum are largely nonprogrammed (semi- and unstructured) and cannot be solved without manager involvement. But these nonprogrammed decisions are recognized as the very ones contributing to the long-run viability of an organization. Therefore it was proposed to support this type of managerial decision-making activity with a new form of computer-based tool identified as the decision support system. The decision support system movement rapidly gained momentum during the 1970's as a multitude of various system applications were implemented [1] [5] [6] [8].

The technology required to operationalize the decision support system concept utilizes the opportunity provided by time-sharing and computer graphics to tailor computer systems to a manager's decision-making requirements and processes. An implemented system consists of a manager-user, an interactive (conversational) communication device such as a terminal, a software interface allowing interaction between user and computer, a data base, and a set of management science models [6, pp. 42-79]. The trend in software interface between the user and the machine has been a progression from procedural, programming languages towards nonprocedural, English-like interface languages [5] based on the myriad language translation and compiling techniques developed over the last decade.

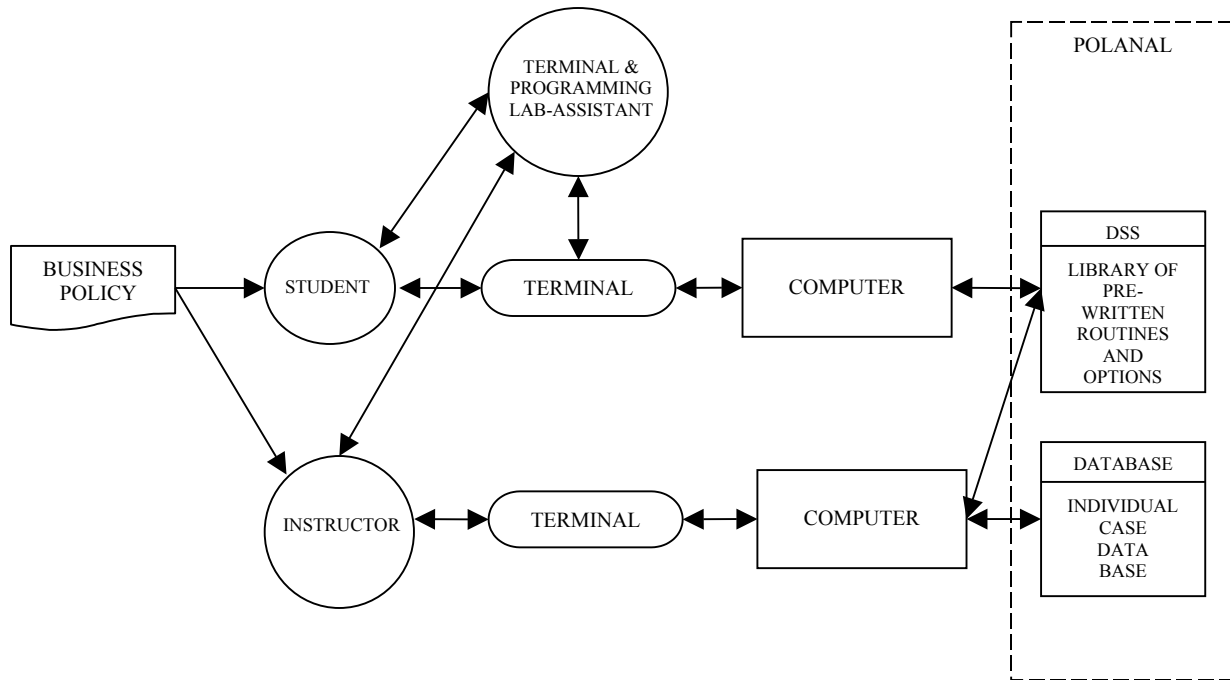
With the increasing use of decision support systems in business today, the time has come to teach the concepts of decision support in both undergraduate and graduate business school curriculums. This paper reports on the implementation of an experiential, pedagogical decision support system named POLANAL. This system is designed to introduce students to the technology, approaches, expectations, and advantages of computer assisted decision-making while enhancing the teaching of business policy courses.

THE POLANAL CONCEPT

Since a prime thrust of computer-based decision support activity for business is in the semistructured portion of the strategic planning environment, those courses in the business school curriculum focusing on problem solving in this decision environment are the most

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FIGURE 1
THE POLANAL CONCEPT



appropriate in which to introduce the concepts of decision support systems. The logical choice is the business policy course. An alternative choice is the management information systems course when it is taught from the managerial perspective of the information user. POLANAL is designed to introduce students to computer-based decision support concepts through an experiential learning approach while engaged in strategic planning oriented case analyses in either course. The teaching emphasis is on relating the concepts of decision support to managerial activities in the semi-structured problem solving environment.

Figure 1 presents the interactive decision support system called POLANAL that was designed and implemented for policy analysis and strategic planning pedagogical purposes at Texas Christian University. POLANAL is written in BASIC and can be employed for case situations involving the formation of new enterprises, project analyses, new product introductions, or other capital investment decisions. It is user-oriented with a major focus on the role of financial planning in decision-making. POLANAL consists of two main subprograms: DATABASE and DSS. DATABASE is employed solely by the instructor to initialize POLANAL for the assigned case. DSS is the program through which the student user accesses POLANAL during analysis of the case.

POLANAL provides students the option of engaging in online analysis utilizing either a graphical visual display or a typewriter terminal. The latter furnishes hardcopy

documentation found useful for formal case presentations. POLANAL has built-in report generation capabilities for those students who are not overly familiar with computer languages or programming. The system has the capability of printing proforma income statements and balance sheets. It also computes such items as net present value of an investment, working capital, profit margin, return on investment, return on equity, and other key financial ratios for each projection year considered in the case. Corporate data presented in the case are stored in a common data base for student use. This approach allows students to devise and set alternative policies and strategies by entering only the structured components of such strategies--i.e., projected market curves, projected time horizons, alternative investments, etc. Required discount tables are generated internal to the model. Approximately two pages of printout are produced at the student's option for each projection year.

All interaction between POLANAL and the student user consist of English language words, sentences, abbreviations, or the input data needed to explore the strategy under consideration. The computer, through the remote timesharing terminal, asks in a conversational form for the relevant data, the computational options desired, and other financial factors that the user considers important. An example of the conversational interaction that occurs between POLANAL and the student user is shown in Figure 2.

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FIGURE 2
EXAMPLE OF STUDENT-POLANAL CONVERSATIONAL INTERACTION

THIS PROGRAM, AFTER ENTERING YOUR MARKET CURVE AND RATE, AMOUNT, AND LENGTH OF AN INVESTMENT, WILL ALLOW YOU TO CHOOSE BETWEEN TWO OUTPUT OPTIONS (DESCRIBED BELOW).

ENTER THE NUMBER OF THE RUN OPTION YOU WISH:

- 1) COMPUTATION OF NET PRESENT VALUE OF AN INVESTMENT
- 2) ANALYSIS AND REPORTING OF CHANGES IN FINANCIAL STATEMENTS UPON INTRODUCTION OF A NEW PRODUCT

ENTER CODE CHOICE (1 OR 2) ?1

ENTER THE YEARLY MARKET CURVE VALUES ONE AT A TIME IN RESPONSE TO THE QUESTION MARKS. AFTER ALL VALUES HAVE BEEN ENTERED (MAXIMUM OF 20) TYPE A 1.

?500000
?1000000
?3000000
?4000000
?6000000
?6000000
?1

ENTER THE TIME IN YEARS ?6

ENTER THE INTEREST RATE EXPRESSED AS A TWO-PLACE DECIMAL (FROM .08 TO .12 INCLUSIVE) ?1.0

ENTER THE INVESTMENT (ANY POSITIVE AMOUNT) ?250000

OPTION 1:
← ← CASH
FLOW
ANALYSIS

AFTER THE REQUESTED DATA IS PRESENTED THE USER CAN REPEAT OPTION 1 OR GO TO OPTION 2.

DO YOU WISH TO MOVE TO OPTION 2 ?YES

DO YOU WISH TO RECEIVE STATEMENTS FOR ALL 6 YEARS OF THIS CASE ?NO

DO YOU WISH TO RECEIVE 3-YEAR COMPARATIVE STATEMENTS ?NO

IN RESPONSE TO EACH QUESTION MARK, ENTER A YEAR FOR WHICH YOU WISH TO RECEIVE OUTPUT (THAT IS, 1 PRODUCES 1ST YEAR'S REPORTS, 2 THE SECOND YEAR'S, ETC.) ENTER A -1 TO END THE LIST OF YEARS.
?3,-1

WHICH DO YOU WISH TO HAVE PRINTED:

- 1) FINANCIAL STATEMENTS FOR THE NEW PRODUCT LINE ONLY
- 2) STATEMENTS OF THE NEW PRODUCT AND THE COMPANY COMBINED
- 3) BOTH

?1

WHICH DO YOU WISH TO HAVE PRINTED:

- 1) BALANCE SHEETS ONLY
- 2) INCOME STATEMENTS ONLY
- 3) RATIO ANALYSIS ONLY
- 4) ALL

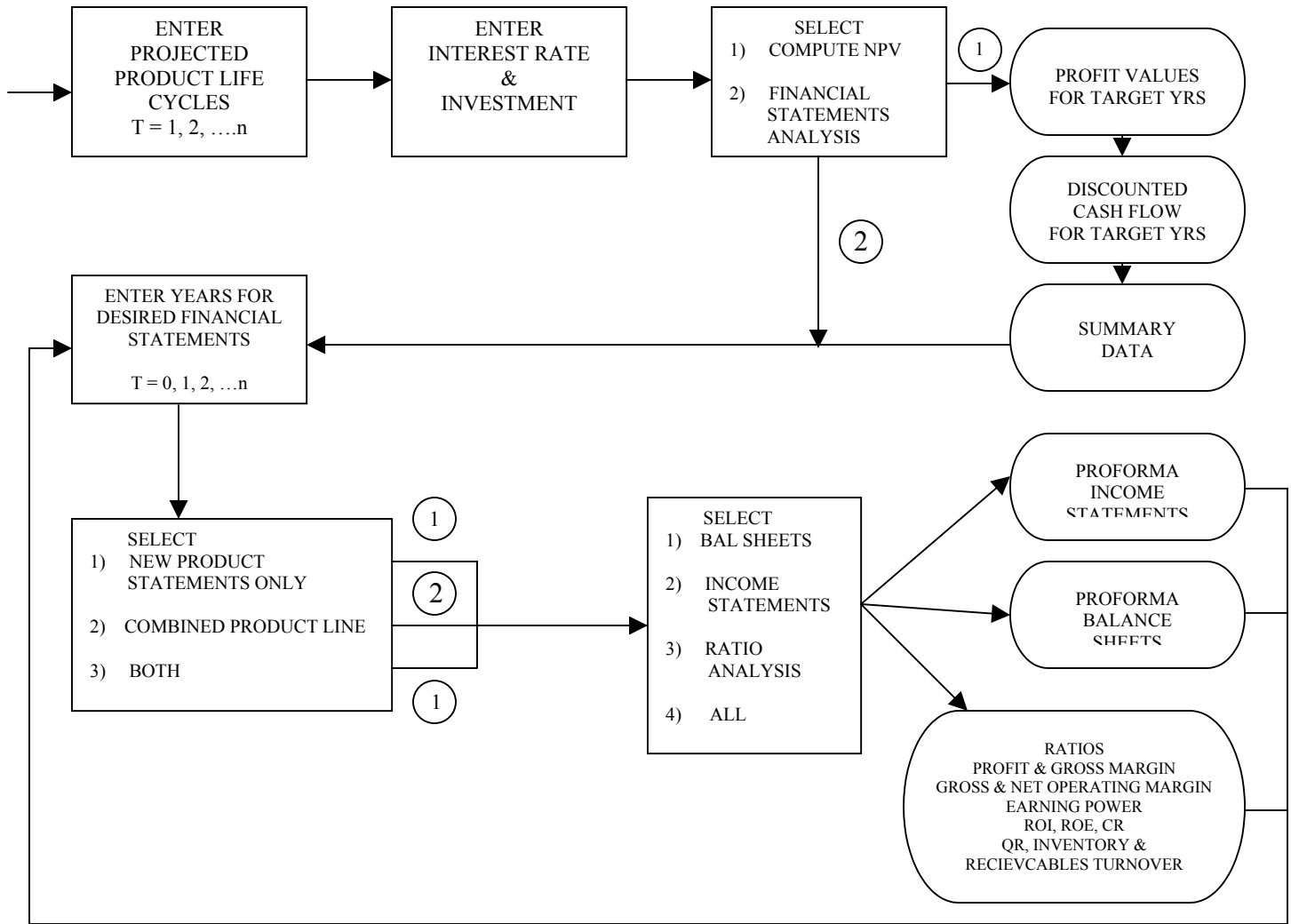
?4

DO YOU WISH TO RECEIVE THE STATEMENTS OF THE COMPANY AT END OF YEAR 0
?YES

OPTION 2:
← ← PROFORMA
ANALYSIS
AND
RATIO
ANALYSIS

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FIGURE 3
DSS PROGRAM FLOW FOR STUDENT INFORMATION



USING POLANAL IN CLASS

POLANAL is designed for those strategic planning and policy analysis cases that have a major focus on the role of financial planning in decision-making. Once a case assignment is made the instructor must first initialize POLANAL for student use. This involves creating the case data base through the use of the subprogram DATABASE. DATABASE allows the instructor to enter the beginning balance sheet and income statements account for the company as given in the case. As indicated by Figure 1, this is accomplished in an interactive mode. The program runs sequentially through the accounts and asks for each separate balance. Checks are performed on the balance sheet values to ensure that the statements balance. Following the input of all the account balances, the program allows the instructor to set the gross margin ratio to another value than the one computed from the data entered. The values entered into POLANAL through DATABASE initialize the company model contained in the student subprogram DSS and provide the basis from which all calculations are made in DSS. (Data values are changed for a new case simply by rerunning

DATABASE).

For use during case analysis the student accesses the student portion of POLANAL via a terminal by loading the program DSS. The flow of the DSS program during student interaction is shown in Figure 3. The student is first requested to enter four types of data: a market product (project) life cycle sales curve, the length of time over which the analysis is to be conducted, the discount interest rate, and the Initial investment at time zero. Next, the student is requested to select one of two computational options; a capital budgeting based product evaluation option or a financial statements based analysis.

When the capital budgeting option is selected POLANAL calculates and sequentially displays the yearly profit values; the discounted cash flows for each year; and a summary statement consisting of the discount rate, the analysis time period, the initial investment, the discounted cash flows, and the net present value. The student then has the choice of continuing with this

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option (possibly by changing the shape or slope of the product life cycle or by varying the discount rate), moving on to the second option, starting a new analysis, or exiting from the program.

If the financial statements based analysis option is selected, the student is first requested to specify the years for which financial statements are to be prepared. The range is from year zero (the case database values) through the last year requested by the input analysis time period. A second option provides statements for the new product line only, or the new product line combined with the company, or both. A request is then made for which statements are to be displayed: proforma balance sheets, proforma income statements, ratio analysis, or all three. Once the information has been displayed, the student has the choice of continuing with other permutations of this option, of moving to the first option, of starting a new case analysis (entails entering new market and investment data), or ending the session.

The students are requested to read each case thoroughly and become acquainted with all of the data prior to utilizing POLANAL. To ensure that all of the pertinent information is "captured" it is suggested that the students follow a standardized approach covering all the multiple facets contained in the case and in understanding the company's situation. Then the student is urged to employ POLANAL in the detailed analysis of the company's major problems and opportunities and in the development of a plan of action. In this manner, the student investigates his or her views of the problem environment, explores the options faced by the company, and identifies and evaluates alternative strategies in light of factors considered important.

Rather than force the student to evaluate strategies and alternatives on the basis of a single arbitrary decision criterion--i.e., net present value, discounted cash flows, return on investment, return on sales, etc.--POLANAL allows freedom of decision criteria selection to be made on the basis of what is appropriate to a particular case. The built-in options permit the student to construct a custom-tailored version for each assigned case. Thus, in its most fundamental sense, POLANAL is a decision support system that relies heavily on the expertise and experience of the student user.

CONCLUSION

The teaching of decision support system concepts through a traditional lecture approach is difficult. The option of discussing and/or demonstrating applications to well structured and understandable managerial problems does not exist since the very concept of decision support is aimed at problem solving in environments characterized by (a) little to no structure and (b) high levels of ambiguity and uncertainty. On the other hand, the use of decision support systems in business is rapidly increasing. Thus the teaching of basic support system concepts can no longer be ignored.

POLANAL was designed to introduce support system concepts to business school students in the context of business policy and strategy case analysis. As the student accomplishes cycles of analyses that integrate case facts and his or her own judgment, intuition, and experience with POLANAL generated output a sounder and more comprehensive understanding of the case situation and the viable alternatives open to the company develops. POLANAL never attempts to automate the decision process for the student; nor to produce objectives or impose solutions. Instead, the storage and high-speed computational capabilities of the computer are employed to support the student's cognitive skills. Thus POLANAL provides an experiential approach for teaching the use of

decision support in poorly structured decision environments by allowing students to learn decision support concepts through personal experience.

A side benefit of POLANAL is the enhancement it provides to the teaching of business policy and strategy. Often students encounter great difficulty integrating previous course material into the coherent whole required for policy case analysis. The POLANAL system is formulated around the basic principles learned in previous courses. Thus it provides students an integrated framework for policy analysis.

The evolution of decision support systems in today's business environment requires that students be introduced to the technology, approaches, expectations, and advantages of computer assisted decision support. POLANAL¹ has been developed to accomplish this objective while enhancing the teaching of business policy and strategy.

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¹ POLANAL is the family operating name applied to the current generation of POLANAL software. This paper is based on the second generation software package identified as POLANAL 2 programmed summer 1979. Programming support for POLANAL 2 was provided by a grant from the Sid W. Richardson Foundation. POLANAL 2 programming was accomplished by Frank Pittman.