DEVELOPING INFORMATION TECHNOLOGY FOR AUGMENTING CASE DISCUSSIONS: CURRENT STATUS AND FUTURE DIRECTIONS

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DEVELOPING INFORMATION TECHNOLOGY FOR AUGMENTING CASE DISCUSSIONS: CURRENT STATUS AND FUTURE DIRECTIONS

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ABSTRACT

It is becoming increasingly apparent that the traditional business curriculum is failing to provide many of skills that potential employers seek: higher-order thinking skills, applied problem solving techniques, and the ability to work in dynamic cross-functional environments. As much of the change in the business environment can be attributed to developments in Information Technology, it is possible that this same technology might provide a possible solution. This paper introduces a computer-based approach to enhancing the venerable case-based teaching method. Specifically, the analysis and discussion that are used in the case-based method are examined and a multi-level model of case discussions is presented. These levels extend the traditional case notion to include integrated cross-functional cases and virtual reality simulations. The goal of these higher order case discussions would be to more closely simulate the actual conditions of the topic company and to compress the time required to gain significant business experience.

In an effort to integrate computer technology with richer case discussions, an applied coordination and communication system has been developed. This system seeks to overcome some of the existing barriers to more traditional classroom activities by allowing for on-going discussions that emphasize the company's operations as a whole rather than just a single functional area. In these exercises, students may move between discussion threads in a seamless fashion and seek to identify how decisions made in one area of the firm will likely impact related functions. The contribution of this work is the development of a theoretical foundation for the development of educational and vocational training systems. Specifically, a framework for multi-participant interaction in a simulated environment is presented.

1. INTRODUCTION

The nature of managerial work is currently undergoing a number of dramatic (and often traumatic) changes. Corporations have grown larger and their functions have correspondingly become more complex. Information technology (IT) has radically altered the means of production in some areas and the practice of management has become more complicated as there is an impact of governmental, environmental, technological, ethical and other forces on managerial decisions. ("America's Business Schools: Priorities for Change," May 1985)
Some of the characteristics of the emerging organization that the new business school graduate will face are flatter, less hierarchical structures, cross-functional teams, companies that are global in perspective and scope of operations, networked and distributed in form, IT based, customer driven, individually and group empowered (Miles 1985; Wind 1991). These characteristics are forcing the need to develop a "new paradigm of management" and, consequently, a re-assessment of the fundamental basis of business school education (AACSB 1991).

The rationale underlying the structure and content of business school education has slowly been turning a full circle over the past thirty years. Business schools in the mid-1950s were criticized for being too vocational, not developing the process of analysis, and lacking rigor and analytical foundations (refer to the Ford and Carnegie Foundation Reports of the late 1950s). Since the acceptance and adoption of the recommendations of the Ford and Carnegie reports, there has been increasing emphasis placed on the promotion of theory, formal techniques, and abstract conceptualizations of problems.

This change has taken place at a cost—a reduction in the immediate relevance of business school education to business practice. Business education is largely seen as irrelevant to the changing business environment (Forbes 1992). Corporate recruiters complain that key components of business school education have lost touch with reality and students are unable to hit the road running. They feel that students have a theoretical understanding of tools but lack the practical skills to apply what they have learned in the real world. As quoted by David Kearns (1990) in Elliott and Jarvenpaa (1991), "to overcome the failures of education, industry is being forced to offer remedial education programs to its employees—at an annual cost of over $25 billion."

To meet the critical requirement of providing a richer set of experiences and exposure to the significant managerial concerns of the day, many business schools have adopted a dual-faceted strategy:

- The establishment of partnerships with business and opportunities for their students to work on the job during their summer vacations. While internships have proven beneficial, they are all too often unavailable to the majority of students.
- The increased recruitment of MBA students with a substantial amount of work experience.

Such a strategy forces schools to increase the value added in the education process by compressing a wide range of experiences in dealing with practical business problems into a short time frame.

Currently, the case method of education is a very popular method for tying classroom learning to business problem solving because it is rooted in pragmatism (Christensen and Hansen 1981). Raymond (1955) describes the goal of the case method:

It prepares students to become tomorrow's managers, not tomorrow's theorists. It helps managers to enhance their skills, but it does not train them for a future that may be too far ahead. The significance of the case method lies in what it seeks to achieve: a way of thinking logically and meaningfully in a given situation, analyzing the data that have contributed to the existence of the problem, interpreting and weighing the evidence that bears on the situation. The scope of the thinking and action appropriate is [sic] defined by the evidence available in the given situation.

In their landmark work on the case method of teaching, Christensen and Hansen (1981) describe three levels of case discussions:

- At the first level, students explore a problem by sorting out the relevant facts, developing logical conclusions, and presenting them to the group. The role is typical of the traditional commentator/observer.
- The second level is achieved by assigning students various roles in the case under discussion. Their comments tend to reflect a sense of the organizational and personal circumstances of the company managers whose robes they wear. When role-playing concludes, the traditional case method takes over. Dialogue is rooted in the practical and a shift from the external observer to the involved insider is made.
- The third level is reached when students, on their own initiative, project themselves into the situation. The classroom and case meld together, with the students vicariously acting as the firm's executive group. Problems are not discussed as abstract topics but as issues inextricably bound up in a manager's career and power circumstance.

Meeting the goal of increasing the value of a business school education, through increasing the variety of experiences available to students by facilitating level II and level III case discussions, involves overcoming three of the existing limitations to the case method of education:

- Cases are simple and static because case discussions are constrained by the existing spatial and temporal requirements of traditional class schedules.
- Cases are usually used to highlight issues in a specific functional discipline. There is very limited integration of multiple functional areas in the analysis of business decisions.
Our earlier work (Hashim, Rathnam, and Whinston 1991) addressed the issue of supporting the first of Christensen and Hansen’s levels of case discussions. CATT, a computer-based system, was implemented to facilitate the interaction processes that take place in a case discussion. In order to extend CATT to a system that can be adopted by instructors and prove effective as a pedagogic tool, this paper has the following goals:

1. To build on prior exploratory research in the area of using computer support for case discussion and present the results of a collaborative research project on the design characteristics of a groupware-based system currently being prototyped to facilitate the second level of case discussions (Figure 1 depicts a process model of a level II discussion).

2. To theoretically ground future research in examining the nature of computer-based applications that might serve as delivery vehicles for education and training in the future by supporting the third level of case discussions.

The remainder of the paper is organized as follows: Section 2 presents a detailed model of level II case discussions with a view to understanding the requirements for the design of new forms of IT. Section 3 presents a brief overview of previous work on using groupware technology to facilitate case discussions. Section 4 presents the design characteristics of IT to support level II case discussions. Section 5 proposes the foundations for supporting level III case discussions. Section 6 concludes the paper and describes the directions for future research.

2. THE LEVEL II BUSINESS CASE DISCUSSION

The goal of this section is to describe the elements of a business case, the steps involved in analyzing it, and the requirements for conducting level II case discussions.
### Table of Key Elements of A Business Case (Reynolds 1980)

<table>
<thead>
<tr>
<th>Opening</th>
<th>Case Body</th>
<th>Closing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name and title of responsible manager</td>
<td>Company history, if relevant</td>
<td>Scenario to establish a sense of urgency about the problem or decision</td>
</tr>
<tr>
<td>Name, location and product line of organization</td>
<td>Environmental facts, if relevant</td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td>Expanded description of the decision or problem situation</td>
<td></td>
</tr>
<tr>
<td>Synopsis of decision and problem setting</td>
<td>Organizational relationships</td>
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<td></td>
<td>Other case characters</td>
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<td></td>
<td>Products and processes</td>
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<td></td>
<td>Financial data</td>
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<td></td>
<td>Marketing Information</td>
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<tr>
<td></td>
<td>Human interaction facts, etc.</td>
<td></td>
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</tbody>
</table>

#### 2.1 A Model of the Business Case

Business cases consist of an intensive and exhaustive cataloguing of the results of organizational activities along a certain direction. As Fraser (1931) states, a typical business case consists of

a recapitulation of the results of business experience arrange [sic], catalogued, systematized, and then presented without the lumber of discarded precedents. In a full-fledged business case, the student would have thrown before him, with kalcidoscopic rapidity, the final and definite results of what lone experience has taught to be, on the whole, the best and most expedient methods of business conduct.

Reynolds (1980) further characterizes business cases as:

- Problem or decision cases. In these cases the focus is on developing analysis methods and/or action.

- Appraisal cases. These cases develop skills of analysis and/or appraisal of situations, short of making decisions/recommendations for action. Appraisal cases are further categorized as micro-appraisal cases in which the focus is on facts internal to an organization and macro-appraisal cases in which the focus is on environmental facts.

In order for IT to support effective level II case discussions, the key elements need to be represented in a structured form (Figure 2 depicts these elements).

#### 2.2 Analysis Methods for Cases

In analyzing business situations (and level II case discussions), emphasis is placed on reaching well considered decisions. The student is encouraged to reason from case evidence rather than general principles, to distinguish between case facts and opinions, to recognize the extent to which various considerations influenced their decision, and to state their reasoning clearly and succinctly.

Regardless of the nature of the case, three elements are essential for successful analysis. First, the students must possess a sufficient body of knowledge to understand the rationale inherent in the analysis. Second, the student must be able to communicate the results in such a way as to convey the necessary knowledge and understanding to the critic or evaluator. Third, an argumentation and dialectic approach must be adopted — few business problems are so simple that they can be solved by means of a single or one-sided line of analysis.

The use of a dialectic approach to analyzing and discussing cases at level II involves:

- Arranging and evaluating case evidence by studying the source of the data. Is it fact or opinion? Has it been honestly stated or does it come from a biased source? Can the evidence by reworked to have a bearing on more than one factor? When assumptions are made, they should be clearly designated and reasons for making the assumption shown.

- A statement of fact need not be further supported in an analysis. On the other hand, an opinion or the answer to a question must be justified because they may not
be reasonable under the circumstances. When an opinion is used, the underlying rationale should be stated.

- The elicitation and documentation of point and counterpoint in the form of questions, issues, positions and pro/con arguments.

2.3 Operational Characteristics of a Level II Case Discussion

The fundamental characteristic of the case method is that the analyses and solutions are developed by the student; the instructor's role is one of critic or evaluator, helping the student to gain insight into the problem and to develop his analytical ability by questioning his reasoning, pulling individual points together, encouraging and suggesting counter-arguments. (Raymond 1955).

The actual breakthrough in using level II case discussions in business education will come not just by applying technology, but by the actual understanding of how the process of learning may be enhanced with the aid of IT. Developing an effective tool requires a mapping between the abstract conceptualization of Christensen and Hansen's role playing to the concrete elements of technology. Consequently, in this sub-section we present the characteristics of a level II case discussion and their implications for the design of groupware-based systems.

2.3.1 Asynchronous and distributed case discussions:

Spatial and temporal proximities are no longer insurmountable barriers in today's business world, which is equipped with powerful networked computers and sophisticated communication technology. IT holds the promise for removing similar barriers in the educational world as well (Elliott and Jarvenpaa 1991).

The notion of a physical classroom and a fixed time for discussion is the cornerstone of the level I discussion and results in the analysis being simplistic. One of the key ideas required to empower a level II case discussion is the elimination of the barriers imposed by physical classrooms so that large cases, which actually reflect the intimate inner workings of an organization, could be discussed in detail over a longer period of time. From a spatial and temporal perspective, a level II case discussion would be more event or content driven rather than time driven (as is the result with level I case discussions).

2.3.2 Integrating analytic tools into the solution process for cases dealing with functional area problems:

Moving a large group of students beyond the simple ingestion of facts and figures to a point where they can effectively analyze and make decisions in a broad range of complex situations requires the development of higher-order reasoning skills. A level II case discussion supports the development of higher-order reasoning skills through the integration of the analytical/quantitative tools of management science and operations research into the analysis of a problem specific to a functional area. For example, "Break-even Analysis" might be used in a case dealing with small business. "Linear Programming by the Transportation Method" might accompany a case involving deciding which storage depots should be served by various factories. Unfortunately, today's business school education too often teaches these tools and techniques in isolation from the functional context and usage.

Indicative of this isolation has been the development of canned software exercises and laboratory sessions that only focus on demonstrating the mechanics of using a particular quantitative/analytical technique. Business school graduates are often taught management science models for which practical use is seldom emphasized. No matter how sophisticated the theoretical knowledge a student acquires, it is useless unless put in actual practice. Class and laboratory exercises should become vehicles through which the students actually experience real world situations presented and delivered through IT. Software tools which support a broad array of organizational activities and functions need to be developed to facilitate level II case discussions. Computer-based tutorials would not only explain the mechanics of spreadsheet usage, but would require the student to practice using sets of financial data provided by businesses. Just as engineering students receive practical exposure to computer-aided design packages and other tools that they will use on the job, so too should business students.

Integrating quantitative/analytical tools into the analysis of complex business problems would also allow students to support the arguments they develop in the process of finding managerially sound decisions that address the underlying issues in the case. For example, a student could build a Linear Programming model to support his/her position on the location for a new semi-conductor plant. Other students and instructors could then browse through the spreadsheet calculations and figures that were used to build the model and possibly raise arguments supporting and opposing the rationale behind the model.

2.3.3 Integrating multiple, inter-related cases:

There is tremendous pressure on business schools to make the educational experience typical of the workplace experience — which is typically team-oriented and cross-functional. In many business schools, the organization is built around separate departments that each focus on a particular functional area. Traditional cases about particular companies are often written as a series of simple standalone documents, each addressing a fairly specific issue in a single functional area. In such a situation, a student may take a course in Marketing and another in Manufacturing and never understand the relationship between the two.

The objective of providing a cross-functional perspective in making business and corporate decisions can be satisfied by integrating the various functional areas of the organization.
The role of cross-functional analysis to business problems requires that the impact of a business decision must be analyzed in terms of its effects on the organization’s other functional areas. For example, a sequence of cases on Frito-Lay dealing with marketing strategy, financial accounting methods, management methods and strategy, production schedules, information systems requirements, usage and practice has been developed. In a level II case discussion, raising an issue such as “What are the implications of the marketing strategies of Frito-Lay?” should not only consider the current marketing strategy but also provide information about production if the operations of manufacturing would also be affected.

In a case discussion involving multiple, inter-related cases, a record of the cross-case linkages that students create could be kept making it possible to set up an evaluation scheme based on participation and the quality of the linkages made. The basis for the successful conduct of a level II case discussion lies in the seamless integration of the multiple inter-related (from a cross-functional perspective) cases to provide a holistic view of the organization. As Reynolds (1980) writes,

there may be several cases dealing with different decision points in time. Such cases are particularly useful in policy and strategy, where it is important for students to gain an over-all view of an organization, or several organizations, while yet not having to deal with volumes of material at one sitting. By playing the role of a different manager each day for several days, and then come to a case that is set in the general manager’s office, students can gain an understanding of the breadth of the general manager’s responsibilities.”

The subsequent sections of this paper describe how computer-based representations of a case, interaction control and coordination mechanisms for a case discussion involving multiple cases but with no distinct inter-case boundary, can be developed. It makes the discussion of a set of multiple and inter-related cases about an organization (dealing with different aspects of the same organization) or the set of inter-related cases about different organizations (dealing with the same issue) feasible.

3. IT FOR SUPPORTING CASE DISCUSSIONS: A REVIEW

The goal of this section is to present a brief account of CATT, a prototype of a groupware system that was developed to support level I case discussions. The objective of presenting this description is to lay the groundwork for the reengineering of CATT that would be required in order to support the three critical characteristics of a level II case discussion as was laid out in section 2.3.

3.1 An Overview of CATT

CATT is a Smalltalk-based prototype of a groupware system that was developed to support level I case discussions. Figure 3 depicts the theoretical rationale for CATT.

To the end-user, CATT appears as an integrated collection of tools that contains multiple applications. The main functional characteristics of CATT as described in Hashim, Rathnam and Whinston (1991) are:

- Editing: Students and instructors can cooperatively create, build, modify, cross-reference, and browse the argumentation networks that are generated during a single case discussion (involving just one case). (See Figure 4 for an example of the use of this tool.)

- Query and report generation: CATT provides students and instructors with the ability to query the network and generate several kinds of reports. For example, an instructor could define the notion of an accepted position as “one for which there are accepted supporting arguments, rejected opposing arguments, no rejected supporting arguments, and no accepted opposing arguments” (Hashim, Rathnam and Whinston 1991) and check how many positions are still open in the current discussion. Similarly, closure can be declared on an issue by an instructor if “all the positions which respond to it are accepted.”

- Automated reasoning and sensitivity analysis to determine how important a particular issue or position has been to the overall discussion.

- Configuration of the structure of the interaction process.

<table>
<thead>
<tr>
<th>Factors impeding level I case discussions</th>
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<tbody>
<tr>
<td>• Multi-participant, same place same time nature</td>
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<tr>
<td>• Seams in curriculum design</td>
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<td>• Difficult to specify evaluation procedures</td>
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<td>• Poor infrastructural support</td>
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<table>
<thead>
<tr>
<th>Design goals of CATT</th>
</tr>
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<tbody>
<tr>
<td>• Multi-user, multi-media interfaces</td>
</tr>
<tr>
<td>• Representing and reasoning about group processes through structured argumentation</td>
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<tr>
<td>• Interaction continuity</td>
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<tr>
<td>• Interaction locking</td>
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</table>

Figure 3. Theoretical Rationale for CATT (Hashim, Rathnam and Whinston 1991)
3.2 Shortcomings of CATT

While CATT was implemented as a groupware tool to facilitate the discussion of a single case at level I, it had some major shortcomings in terms of being able to support the three critical requirements of level II case discussions. These limitations led to the current re-design and re-implementation. Some of the shortcomings in the previous work include:

- No support was provided for discussions involving integrated, cross-functional (and therefore multiple) cases. Our subsequent discussions with experts in case teaching and experimentation with the system have revealed that support for a multi-functional knowledge-base which includes multiple cases and supports several on-going case discussions is necessary for wide-spread electronic-classroom acceptance.

- The inability to manage multiple forms of interaction locking. A groupware-based system to support level II case discussion should incorporate two modes of interaction coupling: tight and loose coupling (Ellis, Gibbs and Rein 1991). In CATT, only tight coupling was provided

- Scalability: The lack of update mechanisms that would provide group and individual continuity even when participants infrequently log on to the discussion (i.e., periods of days).

4. ARCHITECTURAL ELEMENTS OF IT TO SUPPORT LEVEL II CASE DISCUSSIONS

In this section, we present the key architectural components required to enable level II case discussions. We focus on the development of an interaction model along with the associated knowledge representation scheme and automated reasoning tools.
4.1 Requirements of an Interaction Model to Support Level II Case Discussions

In a situation where multiple, inter-related cases are used as the basis for the level II discussion, an interaction mechanism that allows linkages (or networks of linkages) between the individual cases is required. Operationally, in such a case analysis a student would gain entry into an ongoing discussion and ask questions (whose form is determined by the underlying dialogue logic, the set of regulating rules, and the perspective and role adopted) in order to learn what is going on. Students incrementally assert their points of view as they learn more about the discussion and as they build hypothesis by creating linkages between existing facts. These linkages can also serve as a metric to evaluate the quality of the discussion.

The underlying model of interaction in CATT was that of concurrency control at the discussion object level. This simplistic model breaks down when students are participating in several case discussions at any given point in time and each of these discussions involves multiple, inter-related (from a cross-functional perspective) cases. Breakdowns occur for two reasons:

- Excessive cognitive loads: In a complex discussion that is carried out over a extended period of time, users tend to get submerged under the weight of data and evidence. The natural tendency of users to avoid excessive cognitive loads is to aggregate information with the downside of losing control over the smallest units of data.

- Temporal constraints play an increasingly important role as the discussion progresses. In a business situation, decisions have to be made within a finite amount of time — a fact that cannot be ignored by the system designers.

4.2 Representation and Reasoning Requirements to Support a Level II Case Discussion

There are two major technological barriers that must be overcome to support level II case discussions. The first arises from the necessity to share the artifacts of the interaction between students at several different levels of granularity among several different dimensions. The second barrier arises from the need to have a generalized model of the way each of the forms of user interaction with the system can be governed. We now deal with the solutions to each of these barriers.

4.2.1 A general object model for the structural components of cases and case discussions: In a case discussion involving multiple, inter-related cases, a history of the cross-case linkages that students create needs to be kept. One possible solution is to represent a level II case discussion as a hyper-media network. The nodes and links in this graph form the basic discussion objects. Discussion objects represent a single contribution to the discussion by either a student or instructor and form the nodes and links in the hypermedia representation of the discussion. As in Intermedia (Yankelovich et al. 1988), a separation between the discussion objects and their connectivity information is enforced.

Our model of the discussion objects is inspired by the Athena Muse knowledge representation scheme (Hodges, Sasnett, and Ackerman 1989). The underlying model of discussion objects combines the integration of three representation schemes: directed graphs, multidimensional spatial frameworks, and a procedural language to simplify the representation of case discussion networks. It must be noted that both the discussion objects and the elements of the case are represented using the same class of objects and follow a generic entity-relationship representational structure.

Every discussion object is treated as a collection of attribute objects. Attribute objects are instances of any other generic objects that are defined in the system. Examples of attribute objects would include the author of a statement, the time a new piece of information was added to the discussion, the content of an issue, and the strength of an argument. Attributes of discussion objects can be objects that are pointers to externally created objects such as spreadsheets and wordprocessed documents.

4.2.2 A general model of rules for controlling the interaction process: Coordinating the activities of case discussion participants via a generalized model of interaction requires the relationships between roles and tasks to be expressed as a set of regulating rules. The description of the task and role relationships through the rules of interaction governs the specifics of the enactment of a level II case discussion process. These rules can be described in terms of three categories:

- Rules of structure. These rules determine the class of possible discussion objects that a user could manipulate at any given point in time.

- Rules of process. These rules determine the set of constraints that are introduced based on the relationships between the role players.

- Rules of interaction. These rules form the norms of the dialogue logic rules.

The interaction regulating rules in our system determine two things.

- Authority and responsibility: What the user can do by way of permissible actions.

- Temporal ordering: What the user should do. The simplest form of such a regulating rule may be "responses to this position must be made within the next 60 minutes."
Hence, in our system the above rules do not describe the complete interaction process model. This has been done in order to allow more freedom of interaction. As the regulating rules become more constrained, they begin to resemble a process description language.

4.3 Applying the Representation and Reasoning Model to Support Level II Case Discussions

We now describe how the generalized interaction model helps address the shortcomings of CATT along two significant dimensions.

4.3.1 The design of a powerful query/browsing mechanism for information retrieval: In a level II case discussion, students learn through a process of "iterative exploration." When complex and subtle issues are represented using hypermedia, it becomes necessary to provide users with mechanisms to "avoid being lost in hyperspace" (Halasz 1988). Disorientation problems occur as browsing involves both looking through the structure of the network and through the information itself. The predominant problems encountered in supporting the browsing the huge amounts of information that are generated during a level II case discussion are the embedded digression problem and the art museum phenomenon (Foss 1989).

As depicted in Figure 5, in our system the solutions to these problems entail visiting a set of adjoining concepts enroute to a desired node in the network rather than retrieving the node directly. As suggested by Frisse (1988), the navigation tool utilizes the underlying query engine to help users select a starting point before exploring the case discussion, provide users with suggestions, and when necessary display objects at the appropriate level of detail.

4.3.2 Database model and transaction update mechanism: In the current system, all of the tools that an end-user can work with may be invoked from a single process as applications of the basic user shell on the client workstation. The server process is only responsible for resolving conflicts when client processes try to access shared objects (i.e., object locking is done by the server process.) The dOPT algorithm (Ellis 1990) that has been adopted in GROVE is used to facilitate object and interaction locking. dOPT provides a good algorithm by proceeding without locking or roll-back and provides user-level coordination by using an application specific semantic knowledge of the desired outcome of concurrent operations.

One of the key distinctions between a groupware-based system and a distributed database system lies in how users control and are notified of the activities of other group members. In supporting a level II case discussion with groupware technology, we chose to use the regulating rules of the discussion as the basis for how users manage their individual tasks in the context of group activity. Users can control the set of events about which they are notified. For example, a student could decide that he/she did not want to be notified of any changes to issues which were created more than three days ago.

4.4 Adding Hooks to Widely Used Sources of External Data

A fundamental weakness of the level I case discussion, was that the case usually presented students with a set of "canned" data. However, in a level II case discussion the role of data gathering begins to shift from the case author to the case discussants. In order to provide the ability to search for the data that would be required to support a

![Diagram](image_url)

**Figure 5. Controlling Browsing and Querying**
We need to turn anonymity on to confirm to the rules of ICIS or we will be identified.

What are the characteristics of a level II case discussion?
I think that the issue of integrating several cases into a large virtual case is important.
I think the ability to script the roles of actors is critical.
I think the ability to get students to act as managers is critical.

What are the kinds of publicly accessible databases should be made available:
- Annual report data
- Aggregate industrial annual data
- Industry segment data
- NYSE and AMEX daily returns
- NYSE monthly combined data
- NASDAQ daily combined data
- CRSP securities data
- US census data
- Department of Commerce data
- Department of Agriculture data

4.5 Supplemental Tools to Facilitate Decision Making in the Context of a Level II Discussion

We have included variations of common groupware tools (e.g., idea-generation and voting) in our system (Figure 6 depicts the use of the Electronic Brainstorming tool; Figure 7 depicts the use of the voting module). A major difference between the tools found in a typical electronic-classroom environment and the tools we have designed and implemented is that ours are based on a distributed desktop model of interaction. Users do not have to be physically located in the same room in order to have a brainstorming session nor is a trained facilitator required. Furthermore, the facilitator role can be played by any individual using any machine as long as the appropriate privileges are established.

5. SUPPORTING LEVEL III CASE DISCUSSIONS: INFORMATION TECHNOLOGY FOR BUSINESS EDUCATION IN THE YEAR 2001

In the future, the compression of or compacting of experience into a short time frame would be a driving force in business school education. The goal of such business education would be to convince a corporate recruiter that a
graduate has gained the equivalent of several years of experience during the time spent at school. The conceptual foundations for level III of case discussion, which deals with such a compression (with respect to time) of experience, are developed in this section.

5.1 A Technological Environment for Business Education in the Future: Virtual Reality

Virtual Reality (VR), according to the current technology driven literature, is the notion of combining the three-dimensional simulations of reality with tools that can sense the user movements — eyes, hands, and body. These tools are interfaced with software on a powerful real-time computer that can compute the changes in the model to coordinate with the user’s movements. The effect is often startling.\(^3\)

Recently a number of commercial, scientific and educational applications which show the promise of this new technology have been explored. For example, an application to simulate a scalpel cutting through a patient’s simulated body, providing valuable practical experience for an intern, was described. A second application has been to model the bobsled course at the 1992 Winter Olympics. The application, developed by Silicon Graphics, helped the US team simulate several hundred runs through the course while sitting in their hotel rooms, while the competitors were only given two actual trial runs.

The possibility of creating applications which simulate a similar (but more abstract) compression of experiences in the area of business education has come to a point where the design of the system can be considered. Just as a flight simulator can provide a pilot a year’s worth of “sorties” in a week of training, a business simulator based on VR could provide several years of practical experience to the typical student. The effects of such a time compression could possibly be due to the fact that most of a manager’s time is spent doing routine work and that only a small percentage of time is actually spent tackling the significant problems for which the specialized training would be required.

Until recently, only organizations such as the Department of Defense could afford the super computers necessary to simulate an artificial, yet realistic, world. Improvements in data storage technology, VLSI technology, and multi-media technology now hold the promise for media rich applications that once were the exclusive domain of the most advanced television and motion picture studios. In a report to DARPA (Baughman et al. 1991), the Center for Economic Research at the University of Texas projected what it believes will be the cost and level of technology by the

![Figure 7. The Voting Tool](image-url)
Table 1. Desktop Technology in the Year 2000: A Forecast by the Center for Economic Research at the University of Texas at Austin

<table>
<thead>
<tr>
<th></th>
<th>High-End Hardware</th>
<th>Low-End Hardware</th>
<th>Portables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost:</td>
<td>$10,000</td>
<td>$1,000</td>
<td>$1,000 - $10,000</td>
</tr>
<tr>
<td>Memory:</td>
<td>500 Megabytes</td>
<td>50 Megabytes</td>
<td>75 - 750 Megabytes</td>
</tr>
<tr>
<td>Hard Disk:</td>
<td>1.5 Gigabytes</td>
<td>150 Megabytes</td>
<td></td>
</tr>
<tr>
<td>CPU:</td>
<td>1500 MIPS</td>
<td>150 MIPS</td>
<td>75 - 750 MIPS</td>
</tr>
<tr>
<td>CRT:</td>
<td>4096 x 4096 pixels</td>
<td>2048 x 2048 pixels</td>
<td>1024 x 1024 pixels</td>
</tr>
<tr>
<td>Weight:</td>
<td></td>
<td></td>
<td>1 - 15 pounds</td>
</tr>
</tbody>
</table>

Networks
Speed: 1 - 10 Gigabytes/second

Multi-Media
Video: HDTV Standard
Audio: High-Fidelity Stereo (CD quality)

Note: With such technology, a ten-minute video clip could be downloaded in ten seconds.

year 2000 (refer to Table 1 for details). These projections support the notion that desktop computers, costing only a few thousand dollars, could create the complex and information-rich virtual worlds required to support Level III case discussions by the year 2001.

5.2 Virtual Reality: IT for Supporting Level III Case Discussions through the Compression of Experience

The use of VR as a tool has recently received significant attention in the popular press. However, most of the focus has been on the graphical effects of the total VR concept. It is not the ability to place a person in a 3-D virtual world that would be important in a business simulation. In fact, in many cases one would get much of the same knowledge by viewing a 2-D screen. Rather, the real benefit is the ability to realistically model a desired scenario and use it as a problem solving or teaching tool.

Business case discussions (even at level II) are primarily centered around a static and closed world. While there is certainly value in utilizing level I and level II discussions, there might not be a uniformity of learning as the level of learning is often determined by the level of participation. The problem in supporting case discussions has historically been how a single professor can present a series of "real life" scenarios to a group of students. IT in general and VR in particular have provided a way to make this static and fixed world more dynamic, open and realistic. Learning through the use of VR technology would be similar to other forms of "permanent learning" such as on-the-job-training: the effects of the compression of time would result in the creation of "virtual experiences."

In the first two levels of business case discussions, the discussion about the company and case is held at a meta-level where, in a VR setting, people and company become one ("meld together" in Christensen and Hansen's vocabulary). It is this fusion that gives the discussion more realism. To provide students with "real" organizational experience, we envision a scenario where the student is placed in an artificial virtual world which simulates a real business to a significant level of detail. The student may be placed as an intern for two to six weeks in different roles in the organization based on the functional discipline in which they want to gain practical experience. Other participants in the "case exercise" would be playing other roles identified in the case. The critical incidents in a case that highlight the key business issues will be discovered by the student through a process of "iterative exploration." Instructors do not follow a pre-arranged course outline, as the feedback from the VR system would allow them the flexibility to change the direction of the virtual case according to the activities of the students. Such an environment would be very dynamic as it constantly changes as a result of each individual action.

To support the level III case, the virtual world would have to be created from a set of different cases integrated from the various functional business disciplines. The challenge for the designer of the virtual world would be to develop virtual reality models that allow the participants to interact with each other, within the boundaries of the integrated and cross-functional case being enacted. The problems that arise in the real organization due to the individual role interactions would no longer be abstract topics but issues inexorably bound to the role being assumed by the student. VR creates the possibility of experiences and situations unparalleled in business education today.
6. CONCLUSIONS AND DIRECTIONS FOR FUTURE RESEARCH

Education has put us at a competitive disadvantage — our workforce doesn't have the skills an information-based economy needs. (David Kears CEO, Xerox Corporation, in Elliott and Jarvenpaa 1991)

The development of appropriate IT-based systems will be a critical success factor for the training of effective managers in the next decade. New forms of IT, especially groupware and virtual reality, could be used as tools to aid in the reengineering of business education by supporting the second and third of Christensen and Hansen's categories of business case discussions.

In summary, the three main contributions of this paper are:

- It builds on prior exploratory research in the area of using computer support for case discussions and presents the results of a collaborative research project on the design characteristics of a groupware-based system currently being prototyped to facilitate the second level of case discussions. Regulating rules have been incorporated to support the interaction processes between students and instructors as well as to guide the discussion toward a reasonable conclusion.

- It introduces a representation structure for describing inter-related cases (from a cross-functional perspective) and interaction and coordination control for case discussions (dialectics, dialogue logic, and regulating rules).

- It theoretically grounds future research in examining the nature of computer-based applications (based on Virtual Reality) that might serve as delivery vehicles for education and training in the future by supporting the third level of case discussions (as depicted in Figure 8).

In terms of future research, we see three key issues that need to be addressed. First, in terms of the design of IT, the integration of a multi-functional knowledge base that encodes the general knowledge that supports the enactment of diverse tasks within a particular set of inter-related domains needs to be accomplished.

Second, there is a pressing need for the development of an empirically validated theory of the impact of IT on the level II case discussion process. While technologies such as CATT are liberating, the very nature of technology makes them simultaneously constraining. Since the design of group interaction processes and groupware technology mutually influence each other, an understanding of the interaction of different group processes with existing forms of IT is required in order to develop both robust processes as well as new forms of IT.

Third, in terms of the conceptual development of level III case discussions, a framework for training students to identify and understand the importance of business processes is needed. VR models that teach students business process design are also needed. We do realize that the costs of developing VR cases could be currently prohibitive on a regular (as opposed to an experimental) basis. Currently, even the development of a half-decent regular hypermedia-based computer supported case is enormous. One of the possible ways to overcome these costs in building models is through the use of alumni input on a real-time basis. Alumni input is a must: they are an important and often under-utilized part of the process and may be better judges of the value of their training.

7. ACKNOWLEDGMENTS

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8. REFERENCES


9. ENDNOTES

1. At the University of Texas, Austin, the proportion of entering MBA students in 1991 with significant (two or more years) work experience is 80% and some full time work experience is 92%. The average work experience has grown from 2.65 years (1990) to 3.2 years (1992).

2. The design of CATT and the extensions proposed in this paper were done by Sukumar Rathnam. The first implementation of CATT was done by Sukumar Rathnam. The current implementation was a joint effort of Sukumar Rathnam and Ravi Kalakota.

3. The case method as it has been developed in the field of business administration resembles cases in both law and medicine. There is some contrast, however. Law
uses precedents; medicine diagnoses. Business administration cases present the facts in the development of a problem.

4. We have followed a domain-specific, evolutionary approach to the design and implementation of groupware technology to facilitate case discussions as prior research (Grudin 1988) has shown that ignoring the social consequences of groupware can result in significant failures.

5. As pointed out by an anonymous referee, Virtual Reality technology is not without its detractors and drawbacks. For example, it has been contended that Virtual Reality is just extended simulation with sophisticated graphics. Our contention is that while this might be true in the abstract, the scope and scale of the simulation models and graphics often qualitatively change the interaction process.