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ABSTRACT

This paper discusses some of the shortcomings of the business case method of undergraduate and graduate business education and examines the merits of a multimedia software system that is designed to teach topics and skills in financial accounting. It argues that the traditional case-based approach provides only limited assistance to students as they are reviewing cases, limits student feedback and comes long after the student performs his or her analysis, depends on the availability of a qualified instructor to evaluate student knowledge, fails to provide step-by-step solutions to case problems, and provides little motivation to students. The paper then presents the Financial Report Analyst (FRA) multimedia software system that uses goal-based scenarios to provide a learning-by-doing environment. FRA places students in specific problem-solving roles in realistic scenarios and provides intelligent coaching as the task is performed. The paper then describes the use of FRA in detail, demonstrating how the system overcomes the shortcomings of traditional business education methods. (Contains 33 references.) (MDM)

Administering the Business School Case Method with a Goal-Based Scenario

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Business Education

Often the aim in business education is to impart "general principles" to the student. The hope is that by teaching the student general principles (whether in Marketing, Finance, Organizational Behavior, or Accounting), the student will know how to apply those principles in the right circumstances in the future. However, students who are taught decontextualized facts and rules may have difficulty remembering and applying what they have learned. A number of cognitive and educational theorists have stressed the importance of learning problem-solving skills, integrating the teaching of thinking skills and content, and situating instruction in meaningful contexts (e.g. Resnick & Klopfer, 1989; Brown, Collins, and Duguid, 1989; Bransford, Goldman, and Vye, 1991).

Much of the knowledge in the various functional areas of business is not easily captured with facts and rules; instead, knowledge is bound up in the experience of practitioners. In view of these circumstances, we believe (in agreement with many graduate schools of business administration) that the extensive use of the case method in business education is a wiser and more effective approach than the various forms of the "general principles" approach.

Although there is not just one form of the business case method (Dooley and Skinner, 1977), the "classic" form of the business case method is aimed at promoting decision-making skills (Hunt, 1951). Students are given case materials that describe a complex,

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real-world business situation that has a problem or issue requiring a decision. Before class, they analyze the case and prepare a recommended decision or solution. In class, which may typically have between 20 and 80 students, the instructor leads a discussion in which recommendations from different students are critiqued and debated. Often, students also hand in a write-up that is graded by the instructor or an assistant. More than one credible solution to the business problem must be possible (McAninch, 1993). Cases in business range from short descriptions of relatively simple business problems to highly complex narratives that include "internal company information as well as external industry data, and psychological, sociological, and anthropological observations as well as technical and economic material" (Christensen, 1987).

A great deal has been written about the merits of the business case method. However, in practice the principles and ideals of case method administration are often not reached (e.g. Argyris, 1980). And Smith (1987) has pointed out that there has been little research that has closely examined the effectiveness of the business case method. Some assumptions about the case method are seldom examined. For example, case method proponents sometimes point out that not only do students learn to do good analysis in the given business domain, but also they learn how to communicate, express and defend their ideas, dynamically evaluate other people's arguments, and so forth. The latter is certainly a worthy educational objective, but the question of whether the learning of these two skills should be conjoined is not addressed. Is it conceivable that students would learn analysis skills better in a context other than the class discussion? Is it conceivable that students would learn communication and argumentation skills better in some other context, e.g. in a context where the students are not struggling with new concepts and analytical methods in a relatively unfamiliar domain? Such questions are seldom discussed

Most of the literature takes the current implementation of the business school case method as a given. However, at a closer level of scrutiny, several shortcomings of this implementation can be discerned.

First, help for the student while he[1] is working on the case is limited or sometimes unavailable. Sometimes office hours with a teaching assistant are an available resource, but asking questions this way is often inconvenient, slow, and limited. If a group is doing the case assignment, other students can be consulted, but they often lack relevant experience and are more prone to making weak or erroneous assertions. Students working on their own may run into frustrating impasses which can make the entire case analysis task distasteful.

Second, feedback to the student is limited and comes long after the student performs his analysis. Due to the logistics of running a large class, many of the students will not typically get to present their own analyses and recommendations in a class discussion, and even those who do present have no assurance that their analysis will receive much attention in the discussion. When students' write-ups are graded by an instructor or assistant, if any comments are written at all they are often short or cryptic. And such comments are only seen by the student long after the analysis is performed, when the student may have forgotten details of the case and the thoughts that went into their own analyses.

Third, the method depends on the availability of a qualified human instructor who can give the students feedback, discussion, or an evaluation of their recommendations. No

[1]Throughout this paper, "he" should always be understood to mean "he or she".

student will perform an analysis and write a report if he knows that it will never be read or evaluated.

Fourth, due to time constraints or teacher unwillingness, a concrete, detailed, step-by-step solution is rarely demonstrated to the student. Seeing such concrete, detailed solutions is invaluable for inexperienced students. However, the instructor realizes that many of the steps in any particular solution path may be subject to uncertainty, and may not want students to get the impression--even if a solution is flagged as a "possible" solution--that only one solution is correct.

Fifth, students' motivation for analyzing the case may too often be social and "indirect" instead of a direct interest in succeeding in the administrative scenario. Instead of a direct interest in "participating" in the case's administrative scenario, students' motivations often center on getting a good grade, impressing the instructor, and/or protecting their egos during the class discussion. Argyris (1980) documents various "games" and "camouflaging of games" that occur during the case discussion.

A learning-by-doing approach implemented in a computer-based environment can be effective in addressing each of these shortcomings of the traditional case method.

FRA (Financial Report Analyst) is an intelligent, multimedia software system that is designed to teach topics and skills in Financial Accounting. It is based on an architecture called a *goal-based scenario.* Grounded in cognitive principles of learning and memory, a goal-based scenario (GBS) provides a learning-by-doing environment which places the student in a specific problem-solving role in a realistic scenario and provides intelligent coaching as the task is performed.

A GBS designed to teach Financial Accounting or other topics in Business Administration provides *individualized tutoring and coaching*, which is typically impossible to provide in a large business class. By constructing a realistic task and having the student use the data in FRA to make important decisions about committing financial resources, the student will see the usefulness of the knowledge being taught and consequently is more motivated to learn the subject matter.

Goal-Based Scenarios

A goal-based scenario places specific constraints on the selection of material to be taught, the goals the student will pursue, the environment in which the student will work, the tasks the student will perform, and the resources that are made available to the student (Schank, Fano, Jona, and Bell, 1994). The idea of GBS's is grounded in theories of goal-based learning-by-doing (Schank 1994b), failure-driven learning (Schank 1982), and case-based remediation (Riesbeck and Schank, 1989; Kolodner, 1993).

In FRA, the student's goal is to analyze a set of financial statements and to make good enough recommendations to earn a promotion. Running a trucking company, managing a mutual fund, and deciding on a marketing strategy are each examples of other goals that might be suitable for a GBS. In FRA, the student plays the role of a junior lending analyst at Uptown Bank who must decide whether or not to lend money to different companies.

In addition to providing an engaging and appropriate role for the student, a GBS must satisfy other criteria in order to provide a successful learning experience. The GBS must

present both a set of target skills and an environment that will motivate the student and enable the productive use of the skills upon completion. The following issues are considered in the design of any GBS:

- *thematic coherence* - A clear relation between activities and the student's role is essential for student motivation. For example, getting a promotion for correctly computing a set of ratios would violate the spirit of this requirement. In FRA, the student must perform good analyses to avoid non-performing loans and the ire of superiors, which is typical of a lending analyst's situation.

- *realism/richness* - Realism is critical for ensuring that the indexing of the student's experiences into his memory is adequate for retrieval in relevant future situations. Solving a problem in the context of a three-line scenario description makes future recall difficult because of the lack of richness and vividness in the experience. FRA instead has an elaborate, realistic problem scenario which elicits authentic problem-solving behavior.

- *control/empowerment* - The student must feel responsible for the completion of the task and must have great latitude and flexibility in choosing a course of action. FRA allows the student to: explore the data in his own way, perform what-if analyses, experiment using a general-purpose spreadsheet tool, request coaching, and draw conclusions in whatever order he chooses.

- *responsiveness* - The student must see the effects of his actions and must have immediate access to useful feedback. In FRA, the student can make specific lending recommendations and then observe their effects.

- *pedagogical goal support* - The scenario must be compatible with and support the acquisition of the target skills. FRA embodies a scenario in which the skills of financial statement analysis are critical.

- *pedagogical goal resources* - Carefully-chosen intervention strategies and materials must be available to assist the student. FRA provides context-sensitive coaching whenever the student requests it, and can demonstrate expert analysis.

Several prototype systems in different domains have been built at the Institute for the Learning Sciences using the basic GBS framework, including systems for sales training (Kass et al., 1994), social studies (Kass and Guralnick, 1991), and medical diagnosis (Bell, Bareiss, and Beckwith, 1994). A number of other GBS systems are also in development at the Institute.

Embedding skills to be learned within some target activity is characteristic of most apprenticeship styles of learning. "Cognitive apprenticeship" (Collins et al., 1989) adapts characteristics of traditional apprenticeship instruction to cognitive processes. The GBS framework shares with cognitive apprenticeship an emphasis on the practice of skills within an authentic context, with both proposals drawing from prior work in situated cognition (Brown et al., 1989). Cognitive apprenticeship is based on the teaching methods of: (1) *modeling*, or demonstration by an expert (like the expert analysis in FRA); (2) *coaching*, which consists of immediate feedback to the student and in-context help and advice while the student is engaged in the activity; and (3) *scaffolding*, or provision of tools, suggestions, and/or partial solutions which reduces the cognitive load on the student.

These ideas are consistent with another approach called "anchored instruction" (Bransford et al., 1990). This approach calls for creating an authentic task environment in which learners can appreciate the utility of skills and knowledge they are acquiring and, furthermore, can recognize conditions under which these skills are applicable. Anchored instruction is similar is some respects to the GBS framework: both recognize the importance of situating learning in an authentic activity, and both regard the authentic practice of skills as essential. Goal-based scenarios and anchored instruction have in common the end goal of overcoming the classic "inert-knowledge problem", a phenomenon identified by Whitehead (1929) in which knowledge can usually be recalled when people are explicitly asked to do so but it is not used spontaneously in problem-solving even when it is relevant.

Studies have been conducted at the Institute for the Learning Sciences to test our hypotheses concerning the effectiveness of GBS's. For example, in a study of a goal-based scenario that teaches about genetic counseling and Sickle Cell Disease (Bell, Bareiss, and Beckwith, 1994), it was found that users of the program learned more about the conditions of applicability of the new knowledge, that is, the relevance of basic concepts to problem solving. Users were found to reason about Sickle Cell Disease with more correct concepts and with fewer misconceptions about relevant information than if they had learned from a more traditional medium.

Little empirical work exists for the evaluation of learning by doing in the area of business administration. However, if the inquiry is broadened to include learning by doing in other types of professional education, isolated studies can be found in the area of problem-based learning, which is a case-oriented learning by doing approach used in advanced medical education. In one of the most interesting of these studies, Moore-West and O'Donnell (1985) found that the clinical performance of students educated with problem-based learning was rated as significantly better than students taught with conventional methods.

The Architecture of FRA

FRA consists of a performance environment and a coach. In this section, the various components of the analysis environment will be described, followed by a discussion of how coaching supports the student in performing his task.

The analysis environment

In FRA, the student plays the role of an analyst in the corporate lending department of a bank. The student is given a series of *company files* containing increasingly complex financial statements and other relevant data, each involving a request for some kind of long-term or short-term debt financing. The student's job is to analyze each set of statements and to produce a *recommendation report* which lists his conclusions about the company and his recommendation concerning the proposed loan. When the assigned reports are completed, a simulated calendar is advanced to the next quarter, and the student receives new company files for analysis. After each company analysis, the student sees how each company actually performs in subsequent quarters. The student's objective is to make good loans and avoid non-performing loans, and so the student's performance will be rated over time. During each company analysis, the student is given access to extensive on-line help and coaching, as well as access to an embedded hypermedia system containing useful text, video, and "mini-demonstrations."

The student works in an *analysis environment* which contains: all of the items of the current company file; a simple spreadsheet with capabilities similar to (though less elaborate than) products like Microsoft Excel (TM); and a *button pad* (Jona et al., 1991) which the student uses to navigate through FRA and to ask for information or coaching. See Figure 1.

The company file contains the financial statements, the financial statement footnotes, supplementary information, and text documents typically including: a "summary memorandum" that provides an overview of the situation; a "company information" document describing some of the qualitative factors and issues involved; and a "loan request" describing what kind of loan is being contemplated. The student can easily flip though the items in the company file and use data in the financial statements to perform trend analyses, ratio analyses, projections, consistency checks, and other calculations in his spreadsheet.

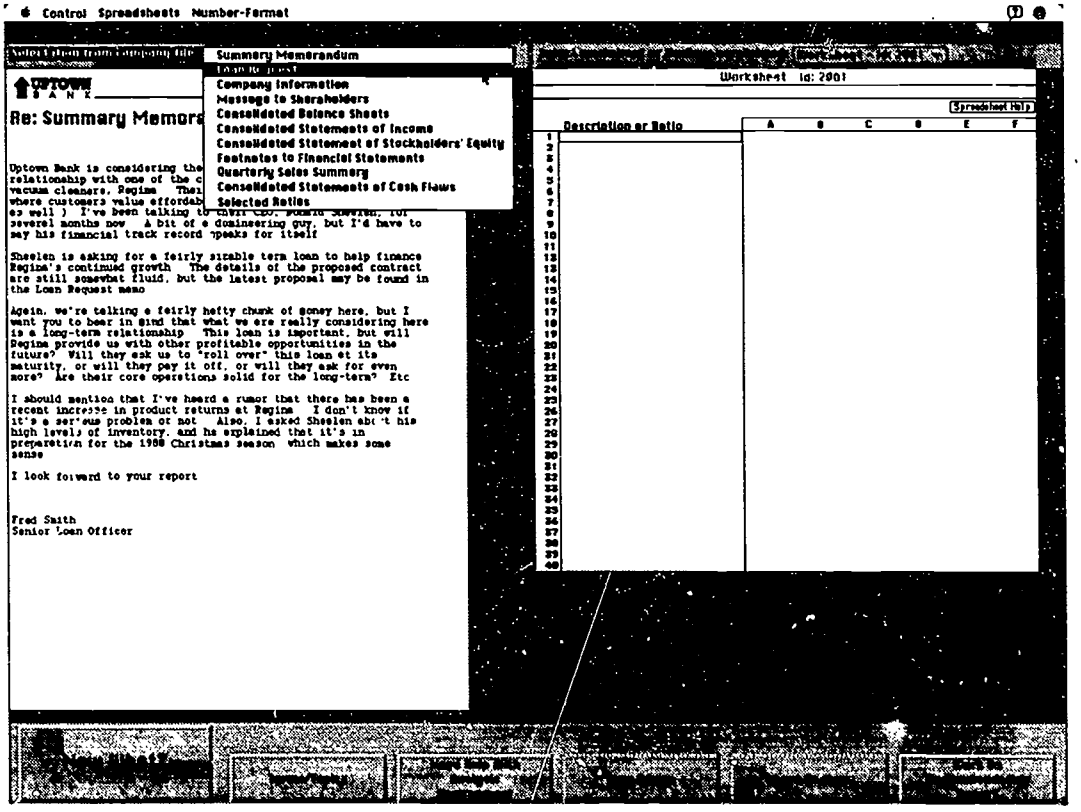

Figure 1. The analysis environment. On the left side is the company file and the company file item selector, which in this case contains eleven items. On the right is a general purpose spreadsheet, and at the bottom is the button pad.

The recommendation report

When the student clicks on a button labeled "Recommendation Report", the report form is displayed in the analysis environment.

The student's objective in each case is to complete a report that details his specific conclusions about the company and makes a recommendation concerning the proposed

loan. The recommendation report serves several important purposes. One is to focus the student's attention on what the specific *goals* of the analysis are and to make him aware of what issues are relevant for the task and domain. A second is to get the student to "go out on a limb" and make a specific diagnosis and recommendation. Third, the report serves as a limited but needed window into the student's mind: as the student draws specific conclusions and so indicates on the recommendation report, the program gauges how well the student is grasping the significant issues in the case and what problems or misconceptions he might have.

The recommendation report begins by asking for a number of broad financial characteristics such as "overall financial soundness", "accounting practices", and "liquidity." The student indicates his assessment for these categories, and, based on his response, is often directed to specify particular supporting findings coming out of his analysis. Thus, some parts of the recommendation report behave like hierarchical menus: the high-level conclusions are indicated first, and then the more detailed conclusions which support the high-level conclusions are indicated. The format of the recommendation report is designed to structure the argument being constructed by the student; it reflects an expert model of financial statement analysis, and thus provides scaffolding in the cognitive apprenticeship sense discussed previously (cf. Collins & Ferguson 1993). Figure 2 shows an example of a completed recommendation report.

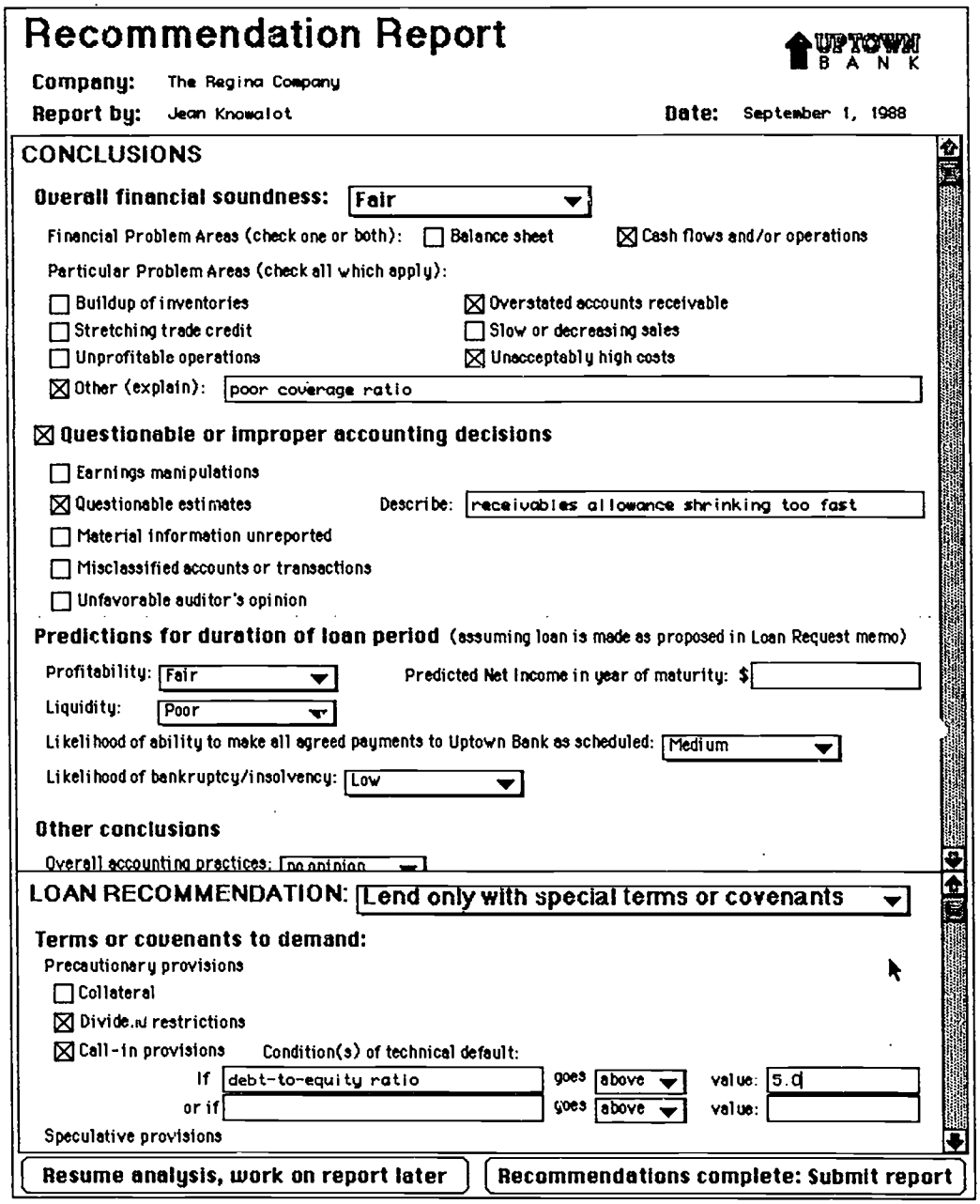

Figure 2. A recommendation report that has been completed. The top portion indicates the student's conclusions and some of their supporting justifications and evidence, and the bottom portion indicates the student's specific recommendation.

Expert analysis

After the student has submitted a recommendation, the student finds out how the company subsequently performed. He then has the opportunity to see a demonstration of how an expert analyzed the financial statements of the company. The expert analysis is performed in the same analysis environment as that used by the student in his own analyses, i.e. with the items in the company file, the spreadsheet, the recommendation

report, etc. Step by step, an "invisible expert" types formulas into the spreadsheets, flips back and forth to the different financial statements, and jots notes onto the findings scratchpad. Each step is annotated with either an audio commentary or a text description of what the expert analyst is thinking: what his current action is, why he is doing it, the hypotheses or conjectures he is pursuing, and/or the conclusions he is drawing. The student, having studied the same case in the same analysis environment, gets a clear and concrete picture of the sorts of things one must *do* during an analysis, as well as a valuable point of reference on the actions and conjectures the student tried during his own analysis. (The expert analysis is, of course, not the only "correct" analysis, and the student is made aware of this.)

The progress of the expert analysis is controlled by the student. At any time, he can stop it to ask questions via the hypermedia system, to retrieve his own previous analysis for comparison, or to quit the expert analysis. At the present time, a deterministic path is used for the steps in the expert analysis sequence, although there is no theoretical reason why the expert analysis cannot have branching points based on the student's initial recommendation report or on dynamic interactions with the student during the expert analysis.

Coaching

Coaching in FRA is similar to the situation where an apprentice has been working on an involved, complex activity with a human mentor nearby, and then realizes that he wants help and calls the mentor over. Sometimes, with a quick look at the apprentice's progress, the mentor can give a terse piece of advice which immediately satisfies the apprentice. On the other hand, often the apprentice has some responsibility for communicating to the mentor what his specific problem is, since there are a large number of paths the apprentice could have taken, and the mentor does not have a detailed model of the apprentice's mental state. After the mentor has selected and delivered the most appropriate piece of advice, the apprentice often will have follow-up questions. The apprentice may want examples and stories which will give him perspective or a referent to concrete experience; he may want clarifications and explanations; he may want more detail, or perhaps the "big picture"; he may want a demonstration of a technique. He will often want to ask several questions in succession, perhaps sometimes backing up to previous topics. Eventually, the apprentice will be ready to return to his task.

The mentor, knowing well the ins and outs of the problem that the apprentice is working on in this instructional setting, will sometimes notice an aspect which the apprentice has overlooked, or some technique which it would benefit the apprentice to try. The mentor will seldom interrupt immediately, but instead will wait to see if the apprentice figures it out himself, because he knows the satisfaction the apprentice will get if he does figure it out by himself, and realizes that he will learn it more effectively that way. However, at some point the mentor will make the apprentice aware that he has a piece of advice if the apprentice is interested; if the apprentice assents, the advice is given and then follow-up questions are answered.

FRA is designed to have all of the basic coaching capabilities that this mentor has. Coaching rules determine which advice is appropriate in a given circumstance. The conditions part of each rule consists of combinations of tests that are implemented using a relatively small library of testing functions. Testing functions either test the current state of the analysis environment, or query a dynamically-maintained record of all events and actions which the student has performed so far. Coaching is thus context-sensitive:

exactly what kind of coaching is given at a particular time is dependent on what actions the student has done so far, what conclusions he has drawn, and what advice has already been given.

Students are coached while they are performing their analyses. To provide students with memorable perspectives on the task of financial statement analysis, we have gathered videotaped interviews with an accounting professor at the Kellogg Graduate School of Management at Northwestern University and with a number of experienced analysts in the banking industry. Upon the student's request, brief, contextually-relevant video clips containing war stories and analysis techniques are presented to the student while he is working in the analysis environment (Figure 3). The cases which the student analyzes provide a context in which the relevance and the usefulness of the experts' words becomes clear and memorable; the student cares about the information being given because it will help him to draw the right conclusions and make the right recommendation in his own case assignment.

Two interface functions support coaching. One of the buttons on the button pad is labeled "Now What?". Depending on the situation, when the student clicks on this button he can receive hints or suggestions, be reminded of his current goals, see a "mini-demonstration" of a technique, or engage in an interactive dialogue. Whenever the student receives advice or information, he can ask follow-up questions via a hierarchical "Ask menu" that contains hypermedia links to other relevant pieces of information (Ferguson et al., 1992).

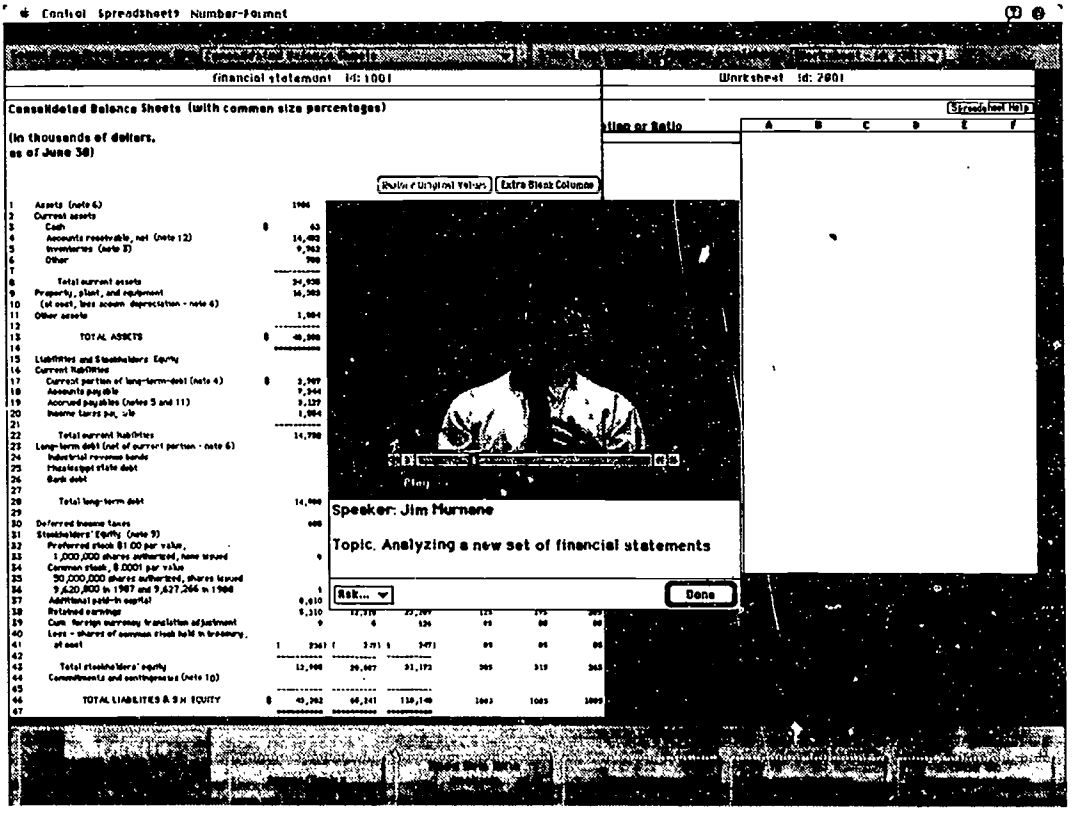

Figure 3. Here, advice has been requested by the student, and in response a video clip of a lending expert is provided.

In addition, a button labeled "New Advice" provides a mechanism for tutor-initiated hints and suggestions. While the student works on the case, the tutor "watches" in the background and observes the student's progress; if the coaching rules suggest that the student needs a particular bit of advice, and the student has not been asking for help, the "New Advice" button is enabled and illuminated. However, the student remains in control. If and when the student clicks on this button (in our experience, the student always does), the advice is presented.

Usability Test

When building interactive computer artifacts, usability is a serious and complex issue. Often, the program designers believe the initial versions of their software are quite sensible, well-planned, and neatly organized, but when it is placed in front of target users, the users may be bewildered and may have any of a number of problems. They may be confused about the function of parts of the interface; they may fail to recognize available resources; or they may fail to comprehend the overall organization of the available information or the structure of the program itself.

In the case of educational software, usability is especially important. In addition to the fact that many users may not be sophisticated about using computers, users are trying to learn unfamiliar concepts or material, which may diminish their patience or capacity for figuring out the interface. And, unlike the case where a user is willing to invest effort in learning how to use a new productivity tool, the normal expectation is that an educational program will only be used for a limited period.

At the same time, tests of highly interactive educational software present unique complications. When the environment is sufficiently rich, different students will have different experiences, will explore different areas, and will follow different paths of action; this complicates the aim of a "controlled experiment." Furthermore, usability may be difficult to infer from examining the interactions only. In light of this, it is important to include the user's own evaluation of the software and of their experience with it as part of the usability test.

A usability test of FRA was conducted in February 1994 with a class of MBA students at the Kellogg Graduate School of Management at Northwestern University. 21 students used FRA as a required assignment in course entitled Corporate Reporting and Analysis, taught by Professor K. Ramesh. All students had previously taken an introductory course in Financial Accounting.

In their interaction with FRA, students analyzed a detailed case involving a medium-sized manufacturer; the case highlighted issues involving inventory and accounts receivable accounting, cash flow analysis, discretionary accruals, and reporting fraud. The content of the case fit strategically into the course curriculum. The case was fairly complex; the company file contained eleven separate documents, six of which were number-filled financial statements or summaries. The goal of the test was to expose any problems with the user interface, to see whether the problem scenario and analysis environment were comprehensible to students, and to obtain students' reactions to the program. Due to scheduling constraints, most students were not allowed to work on FRA more than four hours; almost all of the students made use of the full allotment of their time using the program (including case analysis, submission of a recommendation report, and demonstration of the expert analysis.)

Three types of data were collected: (1) while the program was used, all student actions were automatically recorded and saved for later review; (2) all students filled out a questionnaire after use; and (3) students were informally interviewed during and after use.

Overall, the results were very positive. Students generally found FRA to be understandable, helpful, and "user friendly", and uniformly claimed to enjoy using it. As one student wrote, "Interactive makes it more interesting. Immediate feedback and guidance is helpful." With respect to the coaching, different students judged it as being "Excellent", "Great help", and that it "Helped keep my thoughts focused."

Several of them singled out the expert analysis as being particularly effective; one student stated, "This was the most helpful aspect of the program. I gained a ton of insight into how an analyst thinks." However, a number of the students complained that the spreadsheets lacked features that they expected and wanted. And many of the students wished they could have had more time to explore the system (which was not possible during this test due to the scheduling constraints).

Table 1 lists selected summaries of the students' activities.

Total analysis time, in minutes (from start to time of report submission, excluding clock pauses):		
	Least	126
	Most	239
	Average	193
Number of worksheet cell entries by students:		
	Least	81
	Most	249
	Average	149

Table 1

As shown, the total analysis time averaged three hours and thirteen minutes; this amount of time does not include clock pauses (initiated when, for example, the student temporarily left the room), and it does not include viewing of the expert analysis, which took roughly one half hour on average. The shortest amount of time was taken by a student who currently works in the Corporate Finance Division of a Chicago bank; he very quickly came to a "Do Not Lend" decision, and admitted afterwards that the decision was not especially difficult for him. He also opined that the program was "a little generous in the information and hints provided."

As is also shown in Table 1, all students used the worksheets quite actively. This suggests that the worksheet is an important resource to provide for the student to "think through" the analysis, or at least that the students believed that such activities was useful. Note that, although FRA's architecture does not prevent doing so, the program did not make any effort to interpret or reason about the student's worksheet entries. Fortunately, all of the students had some experience with commercial spreadsheets. This familiarity of course cannot always be presumed; while FRA provided basic online reference and help for the worksheets, most students did not avail themselves of this help.

In the tests, we saw that the first two or three users of FRA were spending an inordinate amount of time calculating financial ratios; consequently, after five students had used FRA, we inserted an additional document into the company file that pre-computed some basic ratios for the student. Professor Ramesh judged that this was a mechanical detail that would not significantly reduce the difficulty of the problem. Not surprisingly, some of the first five students were at the low end for number of dialogues and video clips seen, presumably because they were too occupied with calculations.

Table 2 summarizes information related to the coaching in FRA.

Total number of "dialogues" seen by student during analysis (before report submittal):		
	Least	29
	Most	144
	Average	91
Total number of video clips viewed:		
	Least	4
	Most	25
	Average	16

Table 2

A "dialogue", as defined in FRA, is any piece of advice or information that is presented to the student in the center of the screen during the course of the interaction; a dialogue may be a video clip, a short piece of text (typically no more that two paragraphs), or a small spreadsheet demonstration. As shown, there was wide variation in the amount of information obtained by students. The same can be said for the number of video clips viewed. Video clips generally are between one and four minutes in duration. The highest number of video clips seen was 25; recall that FRA includes over one hundred video clips (none of which are specifically tied to the particular case that the students analyzed). Note also that the total number of dialogues in the system (including the videos) is close to five hundred.

Final recommendation:	
"Lend, without special conditions"	0 students
"Lend only with special terms or covenants"	11 students
"Do not lend - too risky"	10 students

Table 3

As shown in Table 3, none of the students recommended lending to the company without special conditions. This is encouraging because, in this particular case, the company was fraudulently hiding unfavorable information and funding large losses with increased debt; however, detecting this was no easy matter. This suggests that, at least to some degree, the coaching "worked." While the coaching was designed not to "give away" the

"correct" analysis, it was also designed to keep students from getting lost or missing key issues in the case; and apparently none of the students did. The recommendation reports completed by students were generally judged as being sensible and not too far off from the "intended" analysis.

A few other interesting findings were obtained from a closer examination of the recorded action-transcripts.

Almost all of the students used all of the available resources in the analysis environment: the Ask menus, the worksheets, the NowWhat? button, the NewAdvice button, the Terms/Topics button, and a "hypertext" facility for getting advice about parts of the recommendation report. This indicates that students did not have too much trouble figuring out how to use the interface.

Recall that the NowWhat? button is the device that the student uses to request coaching and advice. One of the coaching rules specified that if, in the first forty minutes of interaction, the student clicked the NowWhat? button less than three times, the suggestion would be offered to the student that they should try using it more often. Interestingly, 12 of the 21 student received this advice. This suggests that, without such explicit advice, some students are unlikely to use the NowWhat? button as often as we would like them to.

On the other hand, the behavior of a few of the students suggested that they may have been trying to "pump" the NowWhat? button repeatedly, presumably so that they could get more hints and advice. Fortunately this kind of situation is handled in FRA with a mechanism that enforces a delay in the availability of some kinds of advice; if a student clicks NowWhat? too soon after getting advice from a prior NowWhat? click, then, instead of specific advice the student is usually presented with a list of general topics about lending and financial statement analysis, and the student must interactively indicate what kind of information is desired.

Exploration of the hypermedia system was more limited than what had previously been hoped, and this may indeed have been due to the artificial time constraints. Most students praised the video clips, and one suggested that there should be an index of available videos.

In general, the tests indicate that FRA's architecture is viable, which encourages our belief that refinements of the architecture will make it a practical system for presenting a wide range of case problems in Financial Accounting and other areas of business administration.

At the same time, these tests do not indicate the pedagogical effectiveness of FRA. In the future, we would like to conduct tests that afford some such indication. To do this, we must design appropriate transfer tasks, measure short- and long-term retention, and, of course, compare the performance to a control group which is taught the same information by traditional means.

As was mentioned previously, in this kind of system the student's actions are not closely constrained. Different students will have different experiences, will explore different areas, and will follow different paths of action. In our tests, for example, we found that different students had different calculations on their worksheets, looked at the documents in different orders and for different durations, used the Ask menu to different degrees, and did not view all of the same dialogues. With a program like FRA, it is therefore

more difficult to assign credit or blame for what the student does or does not learn during the interaction, and this can make evaluation an interesting challenge.

Conclusion

In the introduction, we pointed out five shortcomings in the business case method which can potentially be addressed by a system like FRA. FRA provides coaching and advice while the student is performing his analysis. It provides students with immediate and relevant feedback: they receive suggestions concerning their selections on the recommendation report, they find out about the company's subsequent performance, and they can compare their own analysis to an expert's. FRA does not require the availability of a human instructor. It provides concrete, step-by-step demonstrations of expert analysis methods. And it can increase the student's direct interest in the scenario.

We also mentioned a more general question, namely, whether the learning of communication skills and argumentation skills should be conjoined with the learning of analytical skills. (Once again,) is it conceivable that students would learn analysis skills better in a context other than the class discussion?

Both in the literature about the case method and in practice, much of the focus is on the classroom discussion rather than the work the student does when performing his analysis. We suspect that this focus may have the effect of "delegitimizing" the student's sense-making and solution-finding activities. Not only are students not given support or coaching while they are performing their analytical activities, but these activities are often not acknowledged or demonstrated in the climactic class discussion. The result may be less motivation to perform important but painstaking detail work. A detailed multivariate sensitivity analysis that may not be easy to describe in the class discussion may be jettisoned in favor of a radical, attention-getting theory whose plausibility is then rationalized with limited case data. Also, when a student discovers that he is going down a blind alley during his own analysis, he is likely to view it as a failure rather than as a useful experience.

In contrast, FRA is completely focused on the student's analytic and problem-solving activities. Furthermore, unlike class discussions in the traditional case method, in which only some of the students will present their work and interact with the instructor, FRA provides individualized instruction to every student. Thus FRA exemplifies a promising alternative to the case method as traditionally implemented in business schools.

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