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ABSTRACT

Active learning is an important element of course design. It has, however, not been integrated in the conduct of class lectures as they have evolved from early, chalkboard-based discussions to newer, multimedia presentation styles. The sophisticated, multimedia presentation styles have forced some rigidity, and have often unintentionally relegated the student to a more passive role in the classroom. This paper proposes an alternate mode of lecture delivery--Hyper-Link Teaching. It involves conducting the classes as anchored and guided discussion sessions. Executing this mode of teaching requires preparing class handouts as anchors for discussions and sharing control over class conduct with the students. The approach was first implemented during Fall 1995 for an undergraduate course in Systems Analysis at an accredited, large university. Student feedback indicates that the approach encourages students to engage in a more active role in the classroom, promotes higher levels of learning, and augments instructor responsiveness to student concerns. A copy of the student questionnaire is appended. (Contains 10 references.) (Author/AEF)

HYPER-LINK TEACHING TO FOSTER ACTIVE LEARNING

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Active learning opportunities is an important element of course design. It has, however, not been integrated in the conduct of class lectures as they have evolved from early, chalkboard-based discussions to newer, multimedia presentation styles. The sophisticated, multimedia presentation styles have forced some rigidity, and have often, unintentionally, relegated the student to a more passive role in the classroom. This paper proposes an alternate mode of lecture delivery – Hyper-Link Teaching. It involves conducting the classes as anchored and guided discussion sessions. Executing this mode of teaching requires preparing class handouts as anchors for discussions and sharing control over class conduct with the students. The approach was first implemented during Fall 1995 for an undergraduate course in Systems Analysis at an accredited, large university. Student feedback indicates that the approach encourages students to engage in a more active role in the classroom, promotes higher levels of learning, and augments instructor responsiveness to student concerns. The approach is now an integral part of this instructor's class designs in multiple graduate and undergraduate courses.

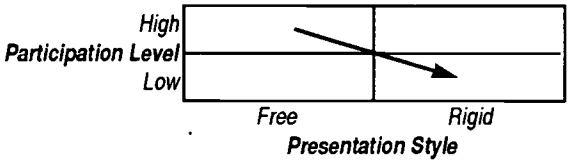
INTRODUCTION

Active learning has been a major theme in course designs over the years [2,7,8]. Techniques including hands-on assignments, team-projects, class presentations, industry-alliances and research-participation have been implemented for this purpose with considerable success. This philosophy of requiring an active role from the student (outside the classroom), however, does not appear to have filtered to the conduct of class lectures (inside the classroom), which have evolved [10], from early chalkboard style talks to overhead projector slides to the more recent phenomenon of direct-from-the-PC multimedia presentations using software packages such as HarvardGraphics™, PowerPoint™ and Freelance™. With the promise of reuse (and the time it affords for other creative pursuits), many instructors have elected the strategy of investing considerable effort in creating such class presentations. This has promoted consistency and coverage, but has required a great deal of effort for creating polished multimedia content such as sound, animation and video clips. With easy access to such presentation techniques and the widespread availability of PCs in university classrooms [6], the class sessions are slowly but unmistakably beginning to assume a high-tech presentation mode [1,11,13].

We contend that that an unintended consequence of this trend has been the relegation of the student to a more passive role in the classroom (see figure 1). While the use of multimedia facilitated by these presentation modes has captivated the student, it has reduced student participation in class lectures. Multimedia presentations have often forced a rigid mode of lecture delivery on the instructor and, perhaps sensing the instructor's reluctance to deviate from the technology-enforced game plan, has discouraged the student from active participation in class conduct.

FIGURE 1

CHANGING ROLE OF STUDENTS IN THE CLASSROOM



This paper argues that a class lecture is not the same as a presentation and should not be treated as such. It proposes an alternate mode of lecture delivery – Hyper-Link Teaching – that represents a conscious effort to step back from sophisticated presentation modes to recapture the teaching orientation of class lectures. While utilizing some of the benefits afforded by presentation software packages, it attempts to preserve the freeform lecture mode by designing and conducting class sessions as 'discussions anchored to and assisted by slide handouts.' The next section presents an outline of the proposed approach. It explains operation of the lecture mode and highlights pedagogical benefits anticipated. Section 3 describes implementation of the approach in an undergraduate systems analysis class, along with practices used for evaluation of the impact and reports the results. Section 5 presents a discussion of results and future directions.

HYPER-LINK TEACHING

In principle, hyper-link teaching represents a conscious effort to step back from high-tech, multimedia presentation styles to recapture the 'teaching' orientation of class lectures. It involves conducting class lectures as discussions anchored to class handouts and sharing control over the conduct of class sessions with the students. This section explains fundamental aspects in hyper-link teaching by juxtaposing them against comparable aspects of multimedia presentations, discusses practices required to successfully execute hyper-link teaching and highlights its pedagogical benefits.

Generally, the elemental building block of class lectures today is a 'slide,' prepared with a

FIGURE 2

MULTIMEDIA 'PRESENTATIONS' VS. HYPER-LINK 'TEACHING'

Figure 2 (a) Multimedia Presentation

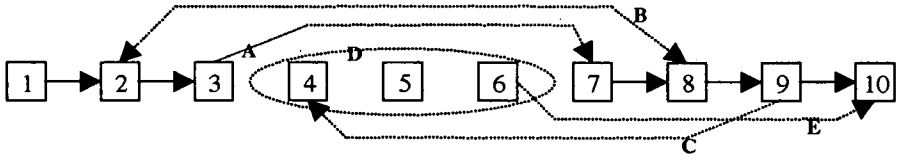


Figure 2 (b) Hyper-Link Teaching

An Example of Hyper-Link Teaching

The class begins with the instructor discussing concepts on slides 1 through 3. At this point, a question comes up regarding possibilities of using a construct introduced on slide 3. The class decides to jump (A) to slide 7 that shows an example of such use. The discussion is continued with more examples that appear on slides 8 and 9. While discussing slide 8, a reference (B) is made to a construct discussed on slide 2. After discussing slides 8 and 9, the instructor reverts (C) to slide 4 and the discussion proceeds again. The instructor now asks (D) the students to read together concepts presented on slides 4 through 6 and answers questions. The jump (E) to slide 10 wraps up the session.

software package such as Microsoft Powerpoint™ or Wordperfect Presentations™ or Framemaker™. These form the basis of class presentations and are often augmented with multimedia content. Often, the presentation is conducted by directly projecting the slides (with the multimedia content) from a workstation or personal computer. With this presentation mode, a typical class session proceeds in a predetermined fashion, with each slide building on material presented on earlier slides (see figure 2(a)). Slides are presented in a logical manner, often with additional information contributed by the instructor. The flow of slides, however, is strictly linear. Few deviations, if any, are encouraged or even permitted by the instructor. Hyper-link teaching, on the other hand, facilitates and encourages a dynamic path through the lecture materials (see figure 2(b)). The discussion flows typically, in a non-linear fashion. Deviations are encouraged and control is shared between the instructor and the students. Figure 2(b) schematically represents the conduct of a typical class session using hyper-link teaching.

Executing Hyper-Link Teaching

Executing hyper-link teaching requires viewing individual slides as anchors for class discussions, rather than one in an ordered set for structured presentations. This demands preparation of each slide as a relatively independent unit. Each slide contains important concepts and examples with related questions. For IS courses requiring a technical orientation (e.g. database management systems), the slides also contain definitions, problems and specific technical details. Though many of these elements are part of conventional class slides, hyper-link teaching allows formal and comprehensive inclusion of these. The slides are numbered and are delivered to the students in N-up (3-up or 6-up) format prior to the lecture (say, over the world-wide-web). The students are encouraged to (i) go over the slides, and (ii) attempt the questions from the slides – prior to the class session. The questions are placed strategically on the handout to serve as decision points for possible alternate hyper-links.

These handouts form the basis for class discussion. The class session proceeds as a 'discussion of slides' from the handout. No presentation software or overhead projector is used. Since the instructor and the students have the same class handout, with numbered pages and slides, reference to specific parts of the handout is easy. The session is conducted by the instructor and the students in an informal manner. The discussion often pivots around decision points provided in the slides. In response to concerns raised by students, the instructor sometimes decides to 'jump' to a slide out of sequence, in effect, forming hyper-links through the slides. This also involves choice – among multiple paths pointed to by student concerns – for the instructor. Often, class discussions evolve to integrate concepts, examples and ideas from multiple slides. The format also allows varying the amount of time devoted to one or more slides compared to others. Since the students are aware of the agenda for the class session – discussing the materials available on the handouts – they share responsibility (with the instructor) for managing the time spent on different parts of the handout. The discussion very often involves backtracking to a previously visited slide when students begin to make connections among concepts discussed on different slides. On occasion, the instructor also suggests that students simply read some slides allowing them a few moments of quiet reflection on difficult material. The 'big picture' – the topic for the day – often acts as the guiding principle in case conflicts arise during the class session.

Pedagogical Benefits

On reflection and after encountering reports from other educators who have grappled with similar issues [7,9], hyper-link teaching appears to reflect some aspects of Piaget's [5] model of the learning process. Piaget views knowledge as a mental framework that allows an individual to manipulate objects or ideas. Learning is the active process of modifying one's mental framework to incorporate a broader range of life experiences. Carried out in small, discrete steps, it is triggered when the individual encounters an unfamiliar idea that does not easily fit into her/his mental framework. The cognitive conflict that ensues is resolved only by a modification of the mental framework One of the prerequisites to successful resolution is the opportunity provided to the learner to manipulate the material. This involves quantizing the material in small chunks to avoid overload situations. In hyper-link teaching, the slides are designed to be

independent units designed to illustrate a single new concept. Presenting multiple chunks simultaneously also suggests a pattern or a framework in the new material that the students discover as they proceed through the slides. The ability to view multiple slides simultaneously and backtrack as required also provides the students opportunities to synthesize [4] the concepts across slides in a framework that is uniquely their own. The instructor becomes more conscious of the students' need to create their own frameworks and responds, as needed, to help the students in the learning process. Specific pedagogical benefits from hyper-link teaching, therefore, can be summarized as shown in table 1 below.

TABLE 1

PEDAGOGICAL BENEFITS OF HYPER-LINK TEACHING

Promotes Active Learning	By handingover to the student partial control of and responsibility for conduct of class discussions, the proposed approach requires and elicits active participation from students.
Provides Opportunities for Synthesis	By allowing the students to direct the flow of discussion, the proposed approach provides the students opportunities to form links among concepts from various slides.
Augments Instructor Responsiveness	By releasing the instructor from the burden of a rigid plan, the proposed approach provides flexibility to the instructor to quickly respond to students' questions and concerns.

IMPLEMENTATION AND EVALUATION

The hyper-link teaching approach was first implemented for an undergraduate course in systems analysis in Fall 1995. The changes mostly involved (i) incorporating additional materials in existing slides with a view to making each slide stand on its own, and (ii) integrating decision points on some slides to promote student interaction and serve as possible jump-off points to other slides.

Implementation

The handouts were made available in the form of Adobe Acrobat™ files via the world-wide web. Typically, the students were required to obtain slide handouts 1-2 weeks ahead of time (instead of at the beginning of the term) to maintain a sense of continual, active interaction. During the first few weeks, students were repeatedly encouraged to (a) read the handouts ahead of time and (b) answer questions on the slides – before the class meeting. As the term progressed, the students appeared comfortable with this routine. Many 'planned' to spend time on the handouts before class and some requested class handouts early to fit their schedules.

Early in the term, class sessions proceeded in a relatively linear fashion with the students content to follow the sequence of slides on the handouts. Fearing an impression of unplanned class discussions, neither did the instructor initiate any hyper-links through the slides. As students became aware of the freedom afforded to them and overcame some of the inhibitions, the class sessions turned more lively and required tracing nonlinear paths through the class handouts, coupled with extensive use of the whiteboard to further illustrate or explain points raised by students. Other than a few sessions that involved software demonstrations and hands-on use of the software, this pattern continued through the rest of the term. The implementation was an apparent success and students openly complimented the instructor for adopting this lecture format.

Evaluation

Evaluating the success of hyper-link teaching was a difficult task. As the term progressed, it was abundantly clear that success with this format was the product of a complex interaction among three sets of variables: characteristics of the instructor, those of the students, and the nature of the course material itself. Exact measurement was almost impossible considering the non-controlled environment. To provide an indication of success of hyper-link teaching, it was decided to employ two forms of measurement (similar to those followed in [3]).

The first was an in-class survey (see Appendix A) conducted at the end of the term. It was designed

to gather students' impressions about hyper-link teaching. The questions were designed to reflect different aspects of the three pedagogical objectives (see table 1) as well as general impressions about the format. The survey employed a five-point Likert scale for the questions and also included a section where students could give additional comments. The second was a comparison of grades across two sections of the same class taught by the same instructor in two different terms – one incorporating hyper-link teaching and the other without. These would, of course, be subject to the caveats mentioned in [3], such as the learning effect.

Results

Of the 25 students enrolled for the class, 20 were present on the day the survey was administered. No surveys needed discarding in spite of some apparent but minor inconsistencies in responses. Twenty usable surveys were available for analysis. Results from the survey are summarized in tables 2 and 3 below.

Clearly the student group represented was diverse and had been widely exposed to many other forms of lecture delivery. Also, since all the students were reasonably advanced in their education (Junior year or above), they presumably had the maturity to accept and exploit a given mode of lecture delivery. In view of this, the following survey results are particularly encouraging.

The results clearly indicate that hyper-link teaching found favor with the students. The approach was liked in general, and apparently contributed well to the three pedagogical benefits outlined earlier. It was particularly satisfying to see that some of the impressions that the instructor formed during the term were validated by student responses. Questions measuring different aspects of the first objective averaged 2.12 or less (on a scale of 1-5, where 1 indicated the best score). The comparable averages for objectives 2 and 3 were 2.06 and 2.11 respectively.

TABLE 2

STUDENT CHARACTERISTICS

Demographics	
Average Age	23.89
Gender	
Male	50%
Female	50%
Year in School	
Junior	6
Senior	11
Graduate	1
Unknown	2

Exposure to Different Lecture Modes	
Online slides on world-wide-web	65%
Multimedia Presentations	70%
Overhead Projector Presentation	100%
Chalkboard or other Write-On	100%
Open Class Discussion	100%
Number of Students Enrolled	25
Number of Survey Respondents	20

TABLE 3

SURVEY RESULTS

Scale: Best | 1 | 2 | 3 | 4 | 5 | Worst

Objective 1: Promote Active Learning

	Mean	StdDev
5. Provided chances to contribute to discussion.	1.95	0.62
9. Felt I could ask questions easily.	2.05	1.03
13. Allowed backtracking when required.	1.90	1.02

Objective 2:: Provide Opportunities for Synthesis

	Mean	StdDev
3. Was easier to see where we were and where headed.	1.65	0.67
6. Gave opportunities to digest material at different speeds.	1.55	0.60
8. Provided opportunities to see the big picture.	2.00	0.97
10. Created links across material from different slides.	1.95	0.71

Objective 3:: Augment Instructor Responsiveness

	Mean	StdDev
4. Lead to interesting and lively discussions.	2.15	0.88
12. Allowed flexibility in time spent on each slide.	2.25	1.12
14. Allowed instructor opportunity to respond to questions.	2.00	1.03

General Impressions

	Mean	StdDev
1. Gave an impression of unplanned discussion of ideas*.	1.33	1.41
2. Difficult to coordinate slides with the instructor*.	0.70	0.66
7. Was boring since it did not involve PC presentations*.	0.79	0.85
11. Did not give picture of the overall topic*.	0.65	0.67
15. I liked this format.	1.90	1.02

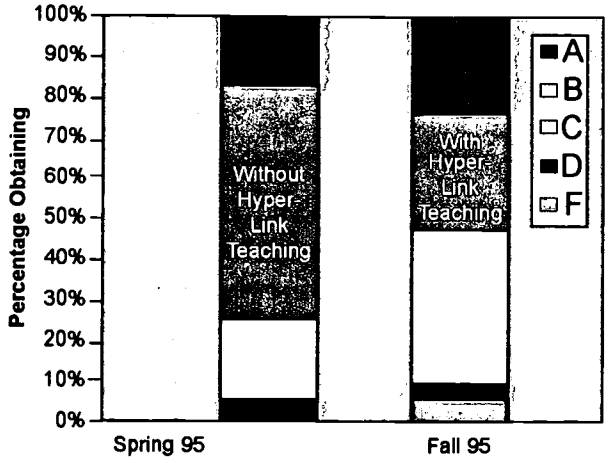
* adjusted for reverse scored questions.

Numbers refer to question numbers on the survey (see Appendix A).

Grade distributions for Spring and Fall 1995 are plotted in figure 3 below. The change in grade distribution (from Spring 95 to Fall 95) clearly indicates migration of students away from the large B-grade to either the higher A-grade or to a lower C-D-F-grade. The movement suggests that this mode of teaching may serve to differentiate students more clearly.

FIGURE 3

COMPARATIVE GRADES



DISCUSSION

Hyper-link teaching clearly found favor with the students. The changes in instructor-student interaction were amply evident to the instructor as the term progressed. The survey conducted at the end of the term confirmed the results. Impressions about the teaching format were surprisingly uniform. The format facilitated active learning (pedagogical objective 1) by sharing control for the conduct of class sessions with the student. It provided students ample opportunities for synthesis (pedagogical objective 2) by allowing non-linear and dynamic paths to evolve during class sessions. Finally, it augmented instructor responsiveness to student concerns (pedagogical objective 3) by permitting backtracking, skipping and bundling of slides. The statistics must be interpreted with caution since they are (i) based on a small sample (20 students), and (ii) do not span multiple instructors or courses.

Some speculations can, however, be made from the above statistics presented above and anecdotal evidence over observed over the last year and a half. First, it appears that some aspects of technology in classroom presentations may actually be harmful to the learning process. The rigidity introduced by presentation software packages may inhibit student participation. Hyper-link teaching allows a mode of instructor-

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APPENDIX A

This questionnaire solicits your feedback regarding the Teaching Format used in class - that is, the practice followed by the Instructor, of discussing/focusing on Slides from the Class Notes in a 'different' sequence, or discussing multiple slides simultaneously, or backtracking, or skipping, or spending more time on some slides than others, or asking you to simply read some slides.

Please tell me about yourself (anonymous):

Age: _____ Year in School: ❑ Freshman ❑ Sophomore ❑ Junior ❑ Senior ❑ Graduate

Gender: ❑ F ❑ M WorkStatus: ❑ Full Time Student ❑ Working Part Time ❑ Working Full Time

Please tell me about Presentation Formats in other courses you have taken:

How many courses have you taken so far at GSU (or other universities)? _____

Which of the following Presentation Modes have you experienced?

- Viewing OnLine Slides on the WorldWideWeb Y N
- MultiMedia (Audio and Video) Presentations Y N
- PowerPoint Slides or other (direct from the PC) Presentations Y N
- Trasparencies on Overhead Projectors Y N
- ChalkBoard or other Write-On Presentation Y N
- Open Class Discussion Y N
- Other: Please Specify: _____

Please tell me your impressions about theTeaching Format.

No	Statement	Agree			Disagree		No Opinion
1	It gave me an impression of unplanned and random discussion of ideas.	1	2	3	4	5	0
2	It gave me an impression of unplanned and random discussion of ideas.	1	2	3	4	5	0

Hyper-link teaching allows a mode of instructor-student communication that naturally evolves to informal interactions, which leads to surfacing of student concerns. It also results in a more 'personal' approach to teaching that students appear to like. Student evaluations also indicate this fact. For instance, the statements 'Cares about the quality of his/her teaching' and 'Has a genuine interest in students' resulted in a rating of 5.0 (on a 5 point scale). Placed against an average of 4.0, this appears to indicate the success of hyper-link teaching in *reaching* the students at a personal level.

The approach is now an integral part of the author's teaching style for multiple courses, both graduate and undergraduate. It has been in use for almost two years. The results have been extremely encouraging, as evidenced by a jump in the instructor effectiveness rating from 3.3 to 4.8 (on a 5 point scale) for one of the classes, over a span of two terms. The approach has also been adopted my other instructors at the author's home institution.

Finally, one entirely unexpected benefit of the approach that is being realized by the author is the ability to reuse individual slides from presentations in new contexts. Since the slides are designed to be independent units (instead of part of an ordered presentation) it is relatively easier to create new class presentations for different target audiences - by *assembling* slides from multiple presentations.

CONCLUSIONS

Hyper-link teaching represents a conscious effort to step back from high-tech presentation modes to recapture the teaching orientation of class sessions. We have shown that it contributes to active learning. The approach has been implemented in multiple IS courses, both graduate and undergraduate, over the last year and a half with considerable success.

After stepping away from multimedia tools for teaching for reasons described in this paper, the approach - hyper-link teaching - was, in fact, implemented using a software tool that allows students to engage in a hyper-linked, exploration mode of learning through the lecture materials. A related paper [Purao 1997] discusses this implementation and reports some additional findings.

ACKNOWLEGMENT

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Appendix A (continued)

No	Statement	Agree			Disagree		No Opinion
3	It was difficult to coordinate the specific slide I was looking at with the material the instructor was discussing.	1	2	3	4	5	0
4	It was easier to see where we were and where we were headed.	1	2	3	4	5	0
5	It was interesting because it was always a lively discussion.	1	2	3	4	5	0
6	It provided me with multiple chances to contribute to the class discussion.	1	2	3	4	5	0
7	It gave me the opportunity to digest material from different slides at different speeds.	1	2	3	4	5	0
8	It was boring since it did not involve any PC-based presentation.	1	2	3	4	5	0
9	It provided me opportunities to see the big picture.	1	2	3	4	5	0
10	I felt that I could ask questions more easily to clarify some points.	1	2	3	4	5	0
11	It helped me in creating links in my mind across material on different slides.	1	2	3	4	5	0
12	It did not give a clear picture of the overall topic being covered on that day.	1	2	3	4	5	0
13	It allowed flexibility in time spent on each slide before moving on.	1	2	3	4	5	0
14	It allowed me to clear up some questions by backtracking, if required.	1	2	3	4	5	0
15	It appeared to allow the instructor time and opportunity to respond to my questions.	1	2	3	4	5	0
16	I liked this teaching format.	1	2	3	4	5	0

17. Any suggestions for improving Hyper-Link Teaching?

_____

_____

18. What did you not like about Hyper-Link Teaching?

_____

_____

19. What did you like about Hyper-Link Teaching?

_____

_____

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