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Production and Evaluation of a Self-Instructional Computer-Based Training Module for Novice Courseware Developers

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A Thesis Equivalent

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at
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ABSTRACT

Production and Evaluation of a Self-Instructional Computer-Based Training Module for Novice Courseware Developers

Andrea Buell

This thesis equivalent presents the design, production and evaluation of a computer-based self-instructional module used to teach novice courseware developers the Inquiry instructional strategy of the *Dynamite Authoring System*. The materials were designed to meet the following general goals:

1) To teach non-programmers how to easily construct a computer-based training (CBT) module using the Inquiry structure in *Dynamite*; and

2) To explore Inquiry as a teaching strategy.

Design and evaluation were conducted according to the method described by Dick and Carey (1985) with additional design and production techniques specific to computer-based materials suggested by Alessi and Trollip (1985). The package consists of a one-hour course created and delivered via the Inquiry strategy of the *Dynamite Authoring System* supplemented by a paper-directed exercise using Inquiry. The module is part of a 70-hour lecture, print and computer-based instruction course delivered to a large government organization interested in expanding their computer-based training development skills.

A preliminary one-on-one evaluation was conducted for the Inquiry module when the two-week course was piloted. The evaluation focus of this report is on the small-group version conducted on the module independently of the full course. Results were compiled from a representative group (n=10) of potential courseware developers based on a pretest/materials/posttest/attitude evaluation format.

Th. results indicated that the materials were instructionally effective. There was an increase in mastery from pretest to posttest a total item basis and on an objective basis. The conclusion discusses the strengths and weaknesses of both the instructional materials and the use of Inquiry as an effective computer-based training strategy as part of the *Dynamite Authoring System* and revision recommendations are presented.

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Katherine Buell

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CHAPTER ONE

Statement of the Problem

The purpose of this study was to combine practical solutions for the training needs of a large American organization with the theoretical soundness of established instructional design principles and computer-based training technology. Questions answered are:

1) Can trainees learn via the Inquiry Structure in the *Dynamite Authoring System*?

2) Can trainees learn to use the Inquiry structure in *Dynamite*?

The training was designed to satisfy part of the training delivery and development requirements of a large US corporation. A three level computer-based training (CBT) platform was piloted and included expert system based simulation, NATAL authoring language based tutorials and programmerless *Dynamite* authoring system based courseware. Each of these levels involved progressive degrees of sophistication. For instance, as the sophistication level of the CBT type increased from simple tutorial to simulation, so did the interactivity, development time, team development skills, and addressed level of cognition. The purpose of all three levels was to allow Milbase to create material that was modular, cognitively progressive and easily revised.

The *Dynamite* modules addressed the needs of the organization's requirement for easy to use CBT development tools. Milbase required their trainers to efficiently create courseware. The trade-off for ease of use in a creation tool is the flexibility and degree of interactivity of course delivery. Thus, the modules created in *Dynamite* focus on the knowledge and comprehension levels of cognition such as recalling and interpreting facts, definitions, discriminations, rules, charts and procedures (Romiszowski, 1981). One of the four strategies in *Dynamite* is the Inquiry structure. The module created for evaluation

and the object of this report teaches novice courseware developers how to use the Inquiry structure to create CBT modules. It is one component in a 70-hour course that teaches the objectives stated in Appendix A. The main focus of the full course is on the principles and stages of the CBT courseware development process and on using NATAL and the *Dynamite Authoring System* as a sample development tool.

To summarize, the goals of the tools, course and module as specified by the "customer" and prescribed by instructional theory and CBT principles are as follows:

1) The tool must be quick to learn and easy to use.

2) The courseware developed with the tool must be pedagogically effective.

3) The instruction on the tool and its strategies must be effective.

4) The instruction must be compatible with the client's technology.

CHAPTER 2

Rationale

In 1987, a joint effort between two large American organizations and Softwords (the author's employer) was initiated to solve the electronic information needs of one large American organization herein referred to as Milbase. Softwords' role was to provide the tools necessary for development and delivery of the computer-based training solution of Milbase's electronic information needs. The organization's training needs are vast and ever-changing New recruits must be trained and existing personnel must be upgraded to match the growing technology. In peace-time, this organization's main role is to train its workforce in all facets of defense and operability. The estimated number of potential trainees is in the 150,000 range. Many of these potential trainees are part-time employees and have limited time to train. Readily accessible CBT would improve Milbase's ability to train these employees.

Milbase's goal was to improve training in terms of currency, interest-level, effectiveness, adaptability and accuracy through the use of modern network, graphic, database, interactive video instruction (IVI) and CBT technologies. The proposed solution was to combine existing under-utilized technology with new applications to provide centralized CBT and Information Distribution (ID) (Softwords, 1988). The original mainframe technology in place at Milbase was solely used for report gathering and personnel records. Milbase has close to 100 of these mainframes across the United States. The key was to upgrade the existing system as inexpensively as possible while still providing an instructionally effective and viable distributed training. With the addition of networking and videotex software, the mainframe now provides centralized distributed information and CBT which is delivered on MS-DOS computers readily available throughout the organization.

Videotex

Videotex is a graphics-oriented database system extensively used in Europe and targeted at the mass distribution of information. The graphics produced for this system are in NAPLPS (North American Presentation Level Protocol Syntax) format and are storage efficient. The graphics stored in NAPLPS format are resolution-independent and can be displayed on PCs with CGA, EGA and VGA configurations. They are also independent of the operating system and can be displayed on a Unisys System 1100, a UNIX system or a MS-DOS system, provided a NAPLPS decoder is present. This is not true for bit-mapped graphics. NAPLPS graphics are very compact so they store efficiently and transfer quickly. For centrally distributed CBT, speed of transfer and compact storage are important requirements.

Instructional Videotex

In the last several years, there have been studies of and experimentation into the use and effectiveness of videotex in education and training. A videotex system is a combination of three main entities: a graphics protocol for describing two-dimensional graphics, a database to store those graphics and a communications link from storage to presentation (Godfrey & Chang, 1981). *Telidon* is the Canadian videotex product released in the early 1980's. Many organizations and universities explored the educational possibilities of Telidon. Athabasca University wrote Unix-based Telidon database software and tested it throughout the province of Alberta (Cowper, 1982). The National Research Council and the National Museum of Man explored the effectiveness of combining NATAL (NATional Authoring Language), a programming language for courseware authoring, with Telidon (Carbery, Hlady, Kee & Wilson, 1986). Similar videotex technology was used at Syracuse University for a pilot project at the University's Center for Instructional Development (Florini & Pearson, 1988). In 1982 the University of Guelph worked on a grant from the Canadian Department of Communications to study three areas of which the

most relevant to education was the use of Telidon in teaching (Moore, 1986).

With the exploration of videotex/Telidon in education, as with most new technology came a barrage of praises, complaints, suggestions for improvement and design and cost advice for future developers. Although NAPLPS is a software protocol, Telidon was considerably hardware dependent. The most significant drawbacks encountered were hardware oriented and can be summarized as follows:

1) High cost of equipment
2) High cost of development
3) High cost of communication charges
4) Slow or variable response speed
5) Slow speed of graphics presentation
6) Time-consuming information search.

Many authors have recommended ways in which Videotex may be implemented successfully for education. One author suggested that those who already have the hardware and software in place would best benefit from videotex training development due to the low costs (Florini & Pearson, 1988). Several authors suggested that to improve the problem or frustration with slow response time and high access charges, microcomputers should be incorporated. The key to Telidon's success in the field of education is being able to transmit text and graphics to the local terminal where it will be stored, thus freeing up unnecessary access charges (Cioni, 1981).

The greatest noted benefit of the Telidon system was the graphics protocol. The basic Telidon/NAPLPS technology describes two-dimensional color pictures in a manner that allows a microprocessor to deal effectively with them. The most significant outcome of a study conducted by the Alberta Correspondence School found that although their Telidon videotex course was a primitive form of computer-based learning (CBL), the graphics protocol could be an effective communications standard CBL (Montgomerie, 1982).

NAPLPS is a North American standard and contains all the graphics capabilities required for true CBT (Abell, 1981).

The experience learned and guidelines put forth by users of Telidon or NAPLPS graphics for computer-based training are still useful today. The recommendations focused primarily on the design and presentation of text and graphics. Although NAPLPS graphics are resolution-independent, this particular NORPAK hardware implementation is restricted to a low resolution giving the screens a column-row capacity of 42 by 19. This strongly limits the amount of instructional text an author can put on the screen when combined with graphics. These and other technical restrictions were common for early Telidon developers. Issues such as small screen size, screen shape, word capacity, color palette and low resolution "plagued' the videotex display (Hurly, Hlynka & Hurly, 1982). Similar constraints are found when designing CBT. In fact many of the graphic and text design principles used for Telidon can be applied when presenting instruction for all electronic media (Kerr, 1983).

The primary and most useful element of Telidon is the graphics protocol NAPLPS. The use of graphics in CBT is growing. Although not a great deal of research has been performed in this area, some studies indicate that the use of graphics can actually improve the effectiveness of CBT (Siliauskas, 1986). The goal of using graphics and its related counterpart, color, in instruction is to achieve maximum instructional and visual impact and stylistic consistency (Nugent, 1984). The advantage of graphics is their ability to facilitate verbal comprehension when combined with complimentary text. This appeals to the nature of flexibility and context-sensitivity of the human conceptual system. Also, NAPLPS graphics are especially effective in CBT since high-quality, schematic line and geometric graphics conserve the variables of an optical structure necessary for human perception (Mills, 1980). Due to the highly graphic nature of *Dynamite* and Inquiry, these advantages can be exploited.

Authoring Languages and Authoring Systems

At the PC level of Milbase's hardware structure, a NAPLPS-based authoring system was developed to provide compatibility with the mainframe videotex technology. All the NAPLPS graphics created with the authoring system on the PC are interchangeable with those created for the mainframe videotex application. The authoring system was also developed to enable new CBT authors within the organization to produce effective courseware without the labour-intensive task of programming. It is called the *Dynamite Authoring System.*

The virtues and vices of authoring systems have been discussed ever since they were available to courseware authors (Kearsley, 1984; Merrill, 1985). There are many features of authoring systems that enable non-programmers to produce effective computer-based training. These features would generally include special purpose editors, student and course management system and instructional templates. The ease-of-use features of authoring systems, however, create a disadvantage when compared to authoring languages for the restriction imposed by their instructional templates.

Authoring Language. An authoring language is a programming language specially designed for instructional programming. NATAL is such an authoring language. Authoring languages make programming courseware easier than do other general purpose programming languages such as C, FORTRAN or Pascal. The capabilities that make an authoring language easier to use are display formatting, graphics creation, test scoring, answer matching, student data collection, and report generation. Authoring languages are usually written in general purpose languages. NATAL is written in C.

Authoring System. An authoring system is a set of programs that eliminate or minimize the amount of actual programming required. They allow content experts or instructional designers to author courseware without having to use or know an authoring or

general purpose programming language. *Dynamite* is an authoring system and is written in NATAL.

The Differences. There are several differences between authoring systems and authoring languages regarding development effort, user interface and instructional strategies. Gery (1987) cites four main areas affecting the development time and complexity of courseware. These are courseware variables, technical variables, human variables and overall project variables. Some of these differences are described below:

1. The first major difference in the two types of authoring tools is programming. The major effect of this difference is the amount of time spent developing the courseware. With authoring languages, the amount of time it takes to produce one hour of courseware depends heavily on two factors: author experience and the existence of pedagogical structures. See the table below (Kearsley, 1983).

Table 1

Development Time Required to Produce One Hour of Courseware

	Author Experience	
Pedagogy	Low	High
Existing	8-63 hrs/hr	6-39 hrs/hr
New	165-610 hrs/hr	27-180 hrs/hr

Because of the non-programming features of authoring systems, the time it takes to produce one hour of courseware is substantially less than for authoring languages and

programming languages. Gery (1987) indicates that low production time and cost produces standalone CBT that aims at lower level objectives (recognition and recall of knowledge), contains prescribed learning paths, has low interactivity, and limited feedback, graphics and instructional strategies (linear tutorial or drill and practice). The high end of the cost/time scale describes multimedia courseware and contains complex non-linear material, aims at high-level learning objectives (synthesis, analysis and extrapolation), has high interactivity, learner control, creativity, complex answer analysis and includes strategies such as simulations, games, highly branched tutorials, case studies and dialogues.

2. Another difference between the two types of authoring tools is the computer-user interface. Authoring systems provide a high level interface for the creation and editing of content. As in *Dynamite*, such an interface performs error checking on input to eliminate the need for debugging. Built-in text and graphic editors provide fast and easy content production. Some authoring systems also have built-in tracking facilities for the recordkeeping of student performance. Authoring languages do not have these capabilities built in; they have to be programmed into the courseware.

3. Authoring systems provide built-in CBT instructional strategies. Authoring languages require that strategies be coded from scratch. However, most authoring systems do not have simulation or gaming strategies built-in due to the complexity of design. Although authoring languages require extensive programming effort, the range and variety of strategies is much greater with authoring languages than authoring systems. With *Dynamite* an experienced programmer could easily modify its NATAL code to provide the functionality required to meet more complex instructional needs.

Milbase required authoring tools aimed at different levels of CBT development expertise. These tools range from an entry-level authoring system such as *Dynamite* to the

high level authoring language NATAL. The focus of this study was on the authoring system. As previously mentioned, it was determined through months of needs analysis that Milbase had numerous training needs many of which could be solved using CBT. The organization decided to train small groups of personnel across the United States in the CBT development process. The intent was that, once training was completed, Milbase personnel could use a combination of tools to produce CBT for the rest of the organization. Part of the solution to the lack of development experience in CBT among Milbase personnel was to designate the newly trained personnel to work with the vendor of the C. T tools and other professional developers to produce courseware.

The design of Inquiry/*Dynamite* with its menus favors the particular audience in question: Menu-interface systems are easier to use thus more appropriate for novice users than a command-oriented interface. As users become more proficient, the simple, rigid menu oriented structure may seem tedious (Norman, 1987). Similarly, as Milbase gained proficiency in producing its own materials it's authors would require more power and flexibility in the tools. In the case of *Dynamite*, users would graduate to more complex authoring templates and, eventually, NATAL programming. The major difficulty of designing software systems involves users differences since users vary in capability, training and experience (Baecker & Buxton, 1987).

Dynamite

Hardware Requirements. Some authoring systems and authoring languages are dedicated to specific hardware configurations. Some authoring systems require a whole system unit only used for authoring courseware. These systems cannot be used for any other application. At the other extreme, some authoring languages and systems run on a wide range of hardware configurations. NATAL is an example of a widely portable authoring language. *Dynamite* falls somewhere in between.

Dynamite requires an IBM-PC/XT or AT or compatible that runs the MS-DOS operating system. The minimum amount of memory the machine must have is 640 kilobytes. This is a widely used machine configuration. The non-IBM-standard hardware special to the *Dynamite* authoring system is the NORPAK PCX6 hardware decoder. This decoder board enables *Dynamite* to create and quickly display NAPLPS graphics in the courseware. Another item that is required for the *Dynamite* authoring system configuration is a serial mouse. All input from the student and most of the input from the author is entered via a mouse.

Different module types in *Dynamite*:

Dynamite has four different module types built into it. This enables an author to create CBT without programming. The four strategies are:

Inquiry. The Inquiry module type is quite different from the other module types. The Inquiry module is organized hierarchically rather than linearly. Each instructional frame in an Inquiry module is a NAPLPS graphic screen. The instructional graphic screens are linked in a hierarchical structure made up of two different types of nodes: menu nodes and information nodes. Th author designs, creates and links the graphic screens and the trainee views them according to the structure the author devised. To do this, the author uses mouse-controlled menus to select commands to build the graphic tree. For instance, the author selects graphics from a menu to link to the module. In addition to the mouse, the author uses the keyboard to enter the option names that will lead the student through the *Dynamite* tree during its delivery. A history chart is displayed on the screen to show the author the pathway being linked. The resulting tree structure offers five levels of instruction and up to seven options or branches per level.

The trainee progresses through the module via menu options. Inquiry modules do not keep records of trainee performance as the module strategy is designed for trainee-controlled browsing. The author-defined links cannot be changed by the student, but no

access restrictions to the pages are imposed.

Tutorial. The tutorial module, or "programmed tutorial" (Romiszowski, 1986), is a sequence of instructional frames and question frames. The author builds the frames using *Dynamite* author mode and the trainee views the module via a delivery and tracking program. In a tutorial module, the trainee proceeds frame by frame through the module. The trainee can skip backward and forward to any frame to provide the trainee with full control of the module. The trainee can also move to the beginning of any instructional or question sequence via self-directed branching to review or advance to material on the advice of the author. No student tracking records are kept for tutorial modules.

Quiz. A Quiz module type is a sequence of question frames. As in Tutorial, the author builds the question frames in the *Dynamite* author mode. In Quiz, the trainee proceeds through the questions frame by frame. At the end of the quiz sequence, the score is presented to the trainee. Quiz does not record any score for the trainee. Quizzes are for student practice before a certification. The question types in Quiz are true/false, multiple choice and graphic matching. At any time, the student can quit the quiz and start again.

Certification. The Certification module is a sequence of question frames, similar to a Quiz module. The only difference between Certification and Quiz modules is the score keeping. Certification modules record the trainee's score and stores it in a file accessible to both trainees and instructors. At any time, the student can quit the certification and start again.

Why Inquiry?

Inquiry is the strategy most closely resembling the standard videotex database structure. With this strategy the author can link a series of NAPLPS pages into a hierarchical structure. In Inquiry, *Dynamite* combines the functionality of a videotex database with

the ease-of-use of an entry-level authoring system. Romiszowski (1986) includes the inquiry mode as a category of instruction along with testing, drill and practice, programmed tutorial. dialogue tutorial, and simulation. He states that Inquiry:

> ...is really a mode of *information retrieval* from some form of organized bank of information, or *database* [sic] However, if the database is organized to supply all the information necessary to achieve certain groups of educational objectives and if the learner is given (or formulates for himself) a set of specific objectives to be achieved, then we have a form of instructional system -- indeed a very flexible, self-instructional system. (p. 312)

According to the summary of instructional theories presented by Romiszowski (1981), the Inquiry strategy clearly fits into the reception learning category developed by Ausubel. Materials in Inquiry are presented using an expositive approach and represent verbal reception learning. When combined with an interactive exercise, they represent "meaningful reception learning" in which "the potentially meaningful task or material is comprehended or made meaningful in the process of internalization" (Ausubel, 1968). The concepts and rules of Inquiry are presented to the learner via the expositive Inquiry strategy and internalized with an exercise.

Although the self-instructional material presented via an Inquiry module might appear best presented via print, there are three main reasons for using Inquiry.

1) *Graphics.* Romiszowski (1988) states that a using the computer to present a linear tutorial may be like "using a steam-hammer to crack a nut" (p. 312) but sometimes "computer-generated effects" justify its use. The effects created using NAPLPS graphics to illustrate some major concepts of Inquiry could not have been demonstrated on paper.

2) *Resemblance to Videotex.* The Inquiry structure is a simplified model of the mainframe videotex that Milbase employs. Using Inquiry to develop mini-courses on the PC will provide Milbase with a stepwise progression to creating information/graphic databases on the mainframe.

3) *Reference Material.* The Inquiry strategy was designed as a reference tool. Once an author trainee goes through the course to gain familiarization with the subject matter of the Inquiry module, it remains on-line for unlimited reference--like a database. While creating a new information/graphic database, the author can reference the module material as required to complete the task.

Dynamite and other tools were developed to train these new courseware developers in the fundamentals of courseware production and to fit into the overall technical and training solutions at Milbase. To see whether or not the Inquiry structure was an effective CBT strategy, a module was developed and evaluated.

CHAPTER 3

Instructional Design

The module that was developed to evaluate the effectiveness of the Inquiry structure was aimed at teaching new CBT authors about the Inquiry strategy. The instructional model used for the course was based on the systematic model of instructional development (Dick & Carey, 1985). With this model the instructional goals were identified, an instructional analysis was performed, performance objectives were written, and test items were written (Bloom et al, 1956; Kibler et al, 1981, Romiszowski, 1981, 1986).

As stated earlier, the CBT module that was evaluated was part of a 70-hour course produced for Milbase on the CBT development process. First, the instructional analysis involved interviewing Milbase administrators, trainers and users on their expertise in the CBT development process. A diverse, enthusiastic audience of computer literates and some instructional designers was discovered, but no one was experienced in software or CBT design or production. The objectives for the 70-hour course are contained in Appendix A. Then a closer examination of the Inquiry structure was made to determine the sequence, organization and contiguity of the content to be taught. The resultant instructional goal was produced.

> Given a list of pre-built graphics and a course map, the participant will be able to use the necessary commands in *Dynamite* to link the graphics in a hierarchically-structured Inquiry module.

The material represents a combination of intellectual, verbal and procedural skills and was thus organized into a hierarchical structure from general (top) to specific (bottom), known to unknown, rule to example as suggested by Dick and Carey (1985) in their discussion of Gagne's work. A diagram of the analysis can be found in Appendix B.

Once the instructional analysis was complete, performance objectives were written according to Bloom's taxonomy as discussed by Romiszowski (1981) and Dick and Carey (1985). The objectives address the knowledge, comprehension and application levels. The module objectives are listed in Appendix C. The CBT module focuses on the first two levels of knowledge and comprehension and the accompanying exercise addresses the application level. Due to the interactivity constraints of the Inquiry structure, a paper-directed exercise was designed for hands-on experience.

The Dick and Carey instructional model was also useful for planning and mapping out the instructional strategy. The four main components of an instructional strategy as applied to the creation of this module are 1) Pre-instructional Activities, 2) Information Presentation, 3) Student Participation, and 4) Testing.

The Pre-instructional Activities include motivation and objectives. The motivation factor is that technique used to "hook" the learners' attention. The major motivational factor used in this module to keep learners focused is the use of color and animation in the graphics. The objectives are also stated as the second suggested pre-instructional activity.

The model was also useful for the presentation of the instructional material for sequence, size of instructional "chunks," content presentation and examples. The nature of the computer as an instructional medium introduces presentation factors such as screen size, character resolution and strategy (Inquiry) that required the use of an additional instructional development model. The new model focuses on CBT development and includes the design of storyboards, production of graphics and entering of text (Allessi & Trollip, 1986).

The presentation design is a more important part of the CBT development process when compared with most other forms of instruction. The computer introduces many factors of interaction and screen design that must be handled properly to ensure effective

CBT courses. Many authoring systems handle many of these factors for the author. For instance, *Dynamite* handles factors like screen layout of text, graphic and response areas, question types, feedback and CBT strategies. It has the four strategies previously described. It has two screen formats for three of the strategies: "mixed" in which the screen is divided half and half between text and graphic and "full" which toggles between a full page of text and a full graphic. It provides randomly generated, predefined feedback for incorrect and correct responses to a question. However, as simple as *Dynamite* is to use many instructional factors remain the responsibility of the author such as introductions and endings, text, graphics, color and questions. The author still must perform certain instructional duties such as properly placing the text within the predefined text box, using the appropriate shade and number of colors, and providing suitable instructional cues and advanced organizers. Guidelines for effective screen design and the effective use of color and graphics were followed (Allessi & Trollip, 1986; Suchinsky & Losleben, 1987; Steinberg, 1984). A summary of the CBT design guidelines from both CBT and Telidon designers used for the Inquiry module is as follows:

1) Introductions and Endings:

   a) Use a title page and keep it short.

   b) State the lesson or test goals/objectives briefly.

   c) Summarize the lesson or test goals/objectives.

   d) Give accurate directions and make them available to the student at all times.

   e) Make the end obvious with a short final message.

   f) Suggest new courses/modules to take next.

2) Text

   a) Presentations should be short. Display one idea per frame.

   b) Layouts should be attractive and consistent.

   c) Use chunks or blocks of text for clarity.

d) Use point form when possible.

e) Use conventions in paragraphing, key presses, directions and response prompts.

f) Text should be lean, clear and grammatically correct.

g) Avoid semicolons and hyphenation.

h) Text should be in upper and lower case (easier to read).

i) Use short text lines - eight to ten words per line (easier to read).

j) Use short paragraphs - 3 to 6 lines long.

k) Stress clear transitions between presentations on different topics.

l) Use appropriate organizational methods for verbal information, concepts, rules and principles, and skills.

3) Graphics

a) Use graphics for important information, analogy and cues.

b) Keep graphics simple; break big graphics down.

c) Avoid excessive detail or realism.

d) Display graphic on same page as text.

e) Text and graphics should be complimentary, not competitive.

4) Color

a) Use color sparingly for important information.

b) Avoid color in text unless for emphasis to attract attention.

c) Use contrasting and not clashing colors for emphasis.

5) Questions

a) Ask frequent questions, especially comprehension questions.

b) Ask questions about important information.

c) Alternate-response questions (true/false) are harder to write, easier to judge and allow guessing.

d) Foils on multiple choice questions should be plausible.

e) Be aware of whether you should be testing recall or comprehension and use the appropriate question types.

f) Reading difficulty should be appropriate to the trainee's reading level.

g) Avoid abbreviations and negatives in questions.

The author designed special structuring forms that are used for mapping Inquiry courses. They are designed to accommodate the hierarchical and sequential nature of Inquiry as well as the instructional sequencing of hierarchical and procedural material. The Inquiry mapping sheets for the module under investigation can be found in Appendix D. In the design stage of the module, the author acted both as a subject matter expert and instructional designer. The structure, text and graphics for the course were entered on storyboards before the production began. These storyboards were passed on to graphic artists as guidelines for graphic creation. The text version of these storyboards can be found in Appendix E, along with a blank sample of a graphic/text storyboard.

Another element important to the design and production of CBT and Telidon is the team approach to development. Throughout the whole CBT development process, several people worked on the module; these included subject matter experts and instructional designers in the analysis and design phases. The importance of the team approach to the development of CBT allows for the best use of the specialized skills of each team member (Hurly et al, 1982; Gery, 1987; Kearsley, 1983). Graphic artists are especially important in the design and production stages of course development. They work with the instructional designer to establish layout, color and placement of the graphics and text. They also are most familiar with the technical aspects of production (Nugent, 1984).

In the production stage of the module the author designed the instruction, sketched the graphics and wrote the instructional text. Under the supervision of the author, two graphic artists produced the graphics using two different NAPLPS page creation tools. Finally, a junior instructional designer entered and edited the text. It was impossible to find one person with all the skills required to complete the production of the module.

The graphics were designed to take full advantage of the NAPLPS protocol to attract attention, reinforce verbal material and increase motivation. The objects that comprise a NAPLPS graphic can be structured to provide visual movement and animation. This technique, commonly referred to as "redraw animation," was useful for illustrating some of the effects of different commands when creating an Inquiry course. It was also useful for reinforcing certain instructional points such as the total number of graphics that can be linked into an Inquiry tree. Further, the analogy of the upside-down tree to illustrate the structure of a completed inquiry course was much easier to represent graphically with text reinforcement than solely in verbal form. Samples of the main types of graphics used in the module can be found in Appendix F.

The resultant courseware consists of 140 NAPLPS frames. The course should take the average student approximately sixty minutes to complete. Designed as a self-instructional module, it was incorporated into a 70-hour instructor-led training course teaching the fundamentals of the CBT development process which included hands-on exercises using authoring tools such as *Dynamite*.

CHAPTER 4

Method

The Evaluation Model

Dick and Carey (1985) describe a three-phase formative evaluation process for more effective and efficient instructional materials. The three phases are one-to-one, small group and field trial evaluations. With each phase the number of individuals evaluating the materials increases and the interaction of the designer with such individuals decreases. This study focuses on performing the small group phase of formative evaluation.

The one-to-one phase of evaluation involves at least three potential trainees interacting with the designer to remove the most obvious errors from the instruction. In the case of the Inquiry course, six trainees completed a one-to-one evaluation as well as a pretest and posttest. The author worked with the trainees individually to locate typographical errors, cueing inconsistencies, unclear concepts and inadequate directions. The Inquiry courseware was one of a dozen CBT modules presented to the trainees incorporated into the 70-hour instructor-led training.

The next stages of the study were to correct the errors found in the one-to-one evaluation and perform a small group evaluation. The purposes of the small group evaluation are to ensure the changes made from the one-to-one evaluation are effective and to determine additional learning difficulties (Dick & Carey, 1985). Unlike the one-to-one phase, the designer should interact as little as possible with the trainees while they are using the learning materials.

The data for the small group evaluation are collected using a pretest, a posttest, an attitude questionnaire and, if the subjects are willing, a debriefing interview. The data to

be collected as suggested by Dick and Carey (1985) include:

1) Test data collected on entry behaviors, pretests, posttests, and embedded tests.
2) Comments or notations made by learners about difficulties encountered.
3) Overall subject reactions revealed by attitude questionnaires or debriefing comments.
4) Time required to complete the instruction.
5) Reactions of subject matter experts.

Once the data are gathered from the small group evaluation, they are analyzed on an item per item basis to determine instructional problems or ineffective measurement of a particular objective. These data are also used to determine consistent performance problems on a particular item or objective among the trainees. Additionally, these data help determine the trainees' degree of mastery.

The steps that were followed to conduct the small group evaluation as described by Dick and Carey (1985) can be summarized as follows:

1) Identify the trainees.
2) Arrange for a group to participate.
3) Make notes for instructors during the evaluation.
4) Administer entry level test if appropriate.
5) Administer the pretest.
6) Administer the materials.
7) Administer the posttest.
8) Administer the attitude questionnaire.
9) Arrange for discussion of tests and materials.

Participants

For the small group evaluation, ten potential trainees were selected to go through the instruction. Since the course was designed for self-instruction, the participants went through the instruction individually. The evaluation spanned two weeks accommodating for the participants' busy schedules.

The participants were chosen for their lack of experience with CBT development. The entry requirements were simple and consisted:

1) Comfort and familiarity with microcomputer operation;
2) Interest in, curiosity with and awareness of CBT; and
3) Ability to read English.

Due to the unavailability of Milbase personnel at the time of evaluation, other participants were selected. The participants were employees of Softwords and consisted primarily of Sales, Marketing and Support staff; one participant was a graphic designer. They were chosen for their similarity to the typical users at Milbase. All participants met the entry requirements of microcomputer familiarity, interest in CBT and English reading level. None of them had experience with the *Dynamite Authoring System* or the Inquiry structure. There were five males and five females whose ages ranged from 19 to 47 years with a mean of 31 years. This group was judged to be representative of Milbase users.

Evaluation Materials

The evaluation materials consisted of a pretest, posttest and attitude questionnaire. The 10-item pretest and 20-item posttest were generated from the objectives written at the beginning of the course design process. A sample of the evaluation package including pretest and posttest can be found in Appendix G. They cover the five main objective areas associated with creating Inquiry courses. They were modified based on feedback received

from the trainees in the one-to-one evaluation. There were no embedded question results since the Inquiry structure does not support student tracking. The attitude questionnaire was developed to assess their reaction to the course and their general attitudes about CBT. The questionnaire queries whether or not they have developed or used CBT, if they would like to take or produce more, and what they would like to produce. It also queries ways in which the Inquiry module could be improved.

Course Materials

The course materials consisted of two parts. The first was the 60-min CBT Inquiry courseware teaching how to create Inquiry courses. A supplementary course map was included to allow the trainee to follow the course, make evaluation notes and make learning notes. A sample of the course map can be found in Appendix H. The author's reason for providing the course map to the participant was to compensate for the Inquiry structure's lack of mapping for the student. (The authoring system provides navigational charts for the author to follow during course creation, but not for the student during course delivery.) This addition was partly based on comments from the trainees in the previous one-to-one evaluation.

The second portion of the training materials was an exercise. It consisted of a course map outlining a simple 10-frame 2-level course the participant was expected to create. All the necessary graphics were previously created by the author and stored in a course subdirectory on the computer ready for linking into a hierarchical Inquiry structure. The purpose of the exercise was to see if the participants could apply the concepts and creation commands learned in the courseware.

Procedure

Each participant was scheduled for a two-hour session in one of two separate rooms each equipped with a computer containing the courseware. The rooms were isolated

allowing participants to proceed through the module uninterrupted. The session consisted of an evaluation briefing, pretest, instruction, posttest, attitude questionnaire and debriefing.

Each person was briefed individually regarding the purpose and nature of their involvement in the evaluation. Essentially they were told that they were going to learn how to create Inquiry courses in *Dynamite*. They were also told that they were assisting the author of the courseware to ensure sound and error-free instructional materials. Thus, they were directed to focus on presentation as well as content. Also, a short *Dynamite* familiarization session was provided as it would with normal course usage. At the end of the briefing, participants knew each step of the evaluation process and their role therein before it began.

Then the participants were presented with the supplementary material (directions and course maps) and evaluation material in booklet form. The evaluation materials were presented on paper rather than via the computer in order to avoid any negative performance effects as result of computer or *Dynamite* unfamiliarity. Also, time constraints restricted the proper development of a computer-generated test.

Once the participant was familiar with the process, the pretest was administered taking approximately five minutes to complete. It consisted of a combination of 10 multiple choice, true/false and short answer questions.

Once the pretest was finished, the participant was administered the training materials and the administrator left the room. First the participant proceeded though the Inquiry course taking learning and presentation notes as required and, second, completed the exercise. In the exercise, the participants were provided with a course map and the necessary graphics and were asked to create a small course. The completion time of the instruction and the exercise was estimated to be one hour but the participants were allowed to take as much time as they wanted. The administrator was available to answer

any procedural questions.

Once the participant completed the instruction and the exercise, the 20-item posttest was administered. It tested the same five objective areas as the pretest using the same question formats. Then, a 16-item attitude questionnaire was administered. It was designed to assess participants' attitudes toward the module's motivational effects, testing, instruction and CBT in general. It used scale and open comment formats. When debriefing interviews were possible, the participants were asked about their general reactions to the course, how it might best be improved, and what they liked best about it.

CHAPTER 5

Results and Discussion

Achievement Tests

The results of the pretest, posttest and module exercise are described in the paragraphs below. The item by item results of the tests can be found in Appendix I. The participants' posttest and pretest scores (n=10) were evaluated on two bases: item and objective. Item scores reflect the average performance of the items answered correctly within an objective. For instance, referring to Appendix I, the items associated with Objective 1 are 1, 2, and 3 for the pretest. Their respective scores are 100, 100 and 50 giving an average of 83%. Similarly for the posttest, items associated with Objective 1 are 1, 2, 3, 9, and 19 with scores of 100, 100, 80, 80, and 90, respectively, giving an item average of 90% for that objective.

Objective scores indicate the average number of people who mastered the objectives. To pass an objective, the participants had to correctly answer 80% of all items in the associated objective. For example, on the pretest, items 1, 2, and 3 were answered correctly by 50% of the participants. Similarly, on the posttest items 1, 2, 3, 9 and 19 were answered correctly by 70% of the participants. Generally, the scores were higher for the overall item performance than the objective performance. A summary of the item-by-objective analysis on the pretest and posttest is listed in Table 2.

The item score range for the pretest over all objectives for all participants was 50-80%, with a median of 65% and a mode of 65%. The objective score range was 0-60%, with a median of 30% and a mode of 40%. The item score range for the posttest was 70-100%, with a median of 90% and a mode of 95%. The objective score range was 30-100%, with a median of 80% and a mode of 80%.

Table 2

Pretest and Posttest Scores by Item and Objective

	Individual Means					Overall
Objective	1	2	3	4	5	Mean
Pretest						
%-item	83	55	35	80	60	65
%-objective	50	30	0	60	60	40
# items	3	2	2	2	1	10
Posttest						
%-item	90	87	100	97	73	90
%-objective	70	60	100	90	30	70
# items	5	3	3	6	3	20

There was a mean improvement across all objectives when compared on an item basis (65% to 90%) and on an objective basis (40% to 70%). The most noticeable improvement in performance from pretest to posttest was in Objective 3 which went from 35% to 100% for items and from a 0 to 100% for objectives. The least noticeable improvement was for Objective 1 which only improved 7 item percentage points and 20 objective percentage points. There was also improvement across all objectives when compared on an objective-mastery basis except for Objective 5 which dropped form 60% to 30% on a pretest to posttest comparison.

Item Difficulty:

An examination of the item difficulty across objectives on the pretest and posttest

reveals some interesting points. The item difficulty table for the pretest, Table 3, indicates difficulty with Objective 5, but only one question is presented. Although mastery is not expected on the pretest, two out of three of the questions for Objective 1 were easily answered. Similarly, the answer difficulty of questions for Objective 4 were at divergent ends of the scale. Question 7 was answered correctly by all participants and question 12 was answered correctly by 60% of the participants.

Table 3

Pretest Item Difficulty

		Item Difficulty (% Correct)			
	Item	*100-91*	*90-71*	*70-51*	*50-0*
Objective					
1-General	1-3	1,2			3
2-Menu	4,13		13		4
3-Info	5,11				5,11
4-Command	7,12	7		12	
5-Chart	17			17	

On closer examination of the items for Objective 5 for the posttest, certain indicators emerge (See Table 4). The answer difficulty for the first four objectives appears relatively consistently low with mastery contained in the *100-91* and *90-71* percentiles. The fifth objective, composed of items 16, 17, and 20, has a scattered answer difficulty with item 17 at the *50-0* end and item 20 at the *100-91* end. When comparing objective 5 from pretest to posttest, the answer difficulty for item 17 actually increased. The large scattering of answer difficulty among questions 16, 17, and 20 indicates that either the instruction for Objective 5 is unclear or that the test items themselves are not representative of the instruction. Additionally, comments from individuals as shown on the course map state that the Menu Chart instruction was confusing and difficult to follow (see Appendix H for a sample of the feedback received from the course map). This leads the author to conclude that this portion of the instruction is weak and needs to be reworked.

Table 4

Posttest Item Difficulty

		Item Difficulty (% Correct)			
	Item	*100-91*	*90-71*	*70-51*	*50-0*
Objective					
1-General	1-3,9,19	1,2	3,9,19		
2-Menu	4,6,13		4,6,13		
3-Info	5,11,14	5,11,14			
4-Command	7,8,10, 12,15,18	7,8,12,15	10,18		
5-Chart	16,17,20	20		16	17

On the pretest, the answer difficulty of questions 1 and 2 for Objective 1 (100% mastery) points to the probability of faulty items. Participants should not have known about the Inquiry structure. Similarly, question 7 which is associated with Objective 4 shows easy answerability. This suggests an examination of question 7 for answer cues.

Exercise:

The performance on the exercise with the instruction revealed an interesting pattern. On a total score of 10, the average score was 7.6. The range was 10 to 2, the median was 5.5 and the mode was 10. Three participants not only incorrectly completed the instruction but received such low scores as 2, 2, and 3. One of those individuals did not have time to complete the exercise. Another one performed the poorest on the posttest and this same participant was the only one who stated he *didn't* want to create a course as a result of going through this course. The third participant performed well (90%-I, 80%-O) on the posttest. Comparing the exercise performance with the *Attitude Questionnaire*, the latter two participants both rated the exercise the lowest in usefulness out of all participants. Also, neither of these participants had taken any CBT or created any type of instruction before this evaluation.

General Information and Attitude Questionnaire:

The responses on the *General Information and Attitude Questionnaire* were measured on a scale of one to five with five being the most positive. The results were:

Table 5

General Information and Attitude Questionnaire Results

Question	Mean Ratings (n=10)
Motivation:	
Did you enjoy the INQI course?	3.8
Would you take another course as a result of taking this course?	4
Would you like to create a course as a result of taking this course?	4
Objectives:	
Did you realize the purpose of this course was to teach you how to construct Inquiry courses?	5
Testing:	
How clear did you find the questions on the **pretest**?	3.2
How clear did you find the questions on the **posttest**?	4.2
Instruction:	
How interesting was the instruction?	3.7
How clear was the instruction?	3.5
How useful did you find the exercise SANDWICH?	4.4
Overall:	
Generally, did you like the INQI course?	4.5
Did you learn something from the course?	4.6

Background:

Male: **50%** Female: **50%**
Age: **31** Low: **19** High: **47**
Have you ever developed a CBT course? Complete: **10%** Partial: **50%** None: **40%**
Have you ever taken a CBT course? Yes: **40%** No: **60%** None: **40%**
Have you ever designed any kind of instruction? Yes: **50%** No: **50%**

The overall responses on the attitude questionnaire were positive and consistent. Participants enjoyed the course, especially the exercise and the moving graphics. They also thought the analogy of the tree to describe Inquiry structure was very useful.

The clarity of the questions was perceived to be slightly above average (3.2) by the participants. Interestingly, the same questions and others were perceived clearer on the posttest by a whole point (4.2). This leads the author to speculate that some of the participants' lack of understanding of the subject matter contributed to their perceived question clarity.

The mediocre values for clarity (3.5) and interest (3.7) of the instruction indicates that a review of certain portions of the instruction is required. Additional feedback on where clarifications can be made is found in the participants' notes and the course maps.

When the participants were asked about how the course could be improved, their comments were few but valuable. Improvement suggestions were as follows:

1) Convert the paper course map to an on-line course map.

2) Provide more interactive exercises during the instruction and actually create a menu structure while in the course.

3) Add clearer instruction, additional examples and multiple choice questions.

4) Improved screen resolution.

A discussion of these improvements is presented in the next section, Revisions and Recommendations.

CHAPTER 6

Revisions and Recommendations

The training appeared to contribute to the learning of the ten evaluating participants. It provided most of them with enough information to create a small course for which the graphics were previously created. It did so with the help of supplementary materials such as an exercise and a course map. Inquiry can present lower level objectives such as knowledge of facts, discriminations and descriptions. It can be combine with other types of non-CBT instructional interactivity to provide a well-rounded learning experience.

The participants found several features of the instructional materials useful in gaining an understanding of the Inquiry module. These include the use of graphics in the material, the course map for both navigational and note-taking purposes and the exercise. The latter allowed them to gain hands-on experience in using Inquiry.

Improvements

Four levels of improvement have emerged as a result of this production and evaluation. These are the evaluation materials, the module itself, the Inquiry structure and *Dynamite*.

Evaluation Materials. Generally the evaluation materials--pretest and posttest--need more complex question types so as to avoid giving the participant answer cues. The item analysis revealed specifically that questions 1, 2, and 7 were answered correctly by 100% of the participants both on the pretest and the posttest. All three questions were a true/false format. Although True/False questions provide objectivity and standardization, they also allow a 50% chance of a correct answer. The three questions and other true/false questions need to be examined and rewritten or discarded. One way of lessening or even eliminating cues in these three questions is to include a more complex question

format such as short answer or fill-in-the-blank. However, the author chose the true/false and multiple choice format for the tests for future implementation reasons: the test structure in the *Dynamite Authoring System* supports point-and-click type answers. Eventually these tests are to be implemented via *Dynamite*.

The Module and Exercise. As indicated by the reactions and comments of the participants, the module can be improved by adding embedded questions regardless of whether or not they are tracked. Each menu could easily accommodate another option called "questions"-- a branch that would present some instructionally reinforcing material to the trainee. Currently, Inquiry allows four levels of menus which can be structured for multiple choice questions. A correct answer would lead the trainee down to the next question on the succeeding level. An incorrect answer, or menu option, would provide a sequence of remedial screens in the form of an information node. Once completed, the trainee would automatically return to the original question.

Specific improvements of the instruction focuses on the *Author-Menu-Chart* section of the Inquiry module. The posttest results, general comments, and course map notes all indicate deficiency in this area. The material appears confusing which the author attributes to trying to squeeze too much graphic information into the screens. The illustration of the use of charts in Inquiry requires the reproduction and reduction of three different types of charts. The large character resolution also contributed to this difficulty.

The participants rated (4.4 out of 5) the exercise very useful and "fun." There should be a examination of why two of the participants did not complete the exercise correctly.

Inquiry. Several suggestions made by the participants focus on improving Inquiry as a development and delivery strategy. A delivery improvement to Inquiry would be to include an on-line navigational map indicating the trainee's progression through a module. A paper course map was provided as a visual tool and was used by all participants. Both

the comments and evidence of use indicated its usefulness.

A second improvement to Inquiry revolves around its lack of tracking capability. Due to the browsing/searching nature of the hierarchical structure, no tracking is provided. One principle of instructional programming is the program's ability to provide immediate knowledge of results and corrective feedback (Romiszowski, 1988). Multiple choice questions can be used with corrective feedback: A new tracking mechanism would have to be added to Inquiry to provide overall performance results.

Dynamite. There are several improvements to be made as a result of this evaluation and similar evaluations. The strengths of *Dynamite* are its menu-oriented interface for novices, "point and click" facility, compact graphics protocol and range of different instructional strategies. Many aspects of *Dynamite* can be improved and many of these improvements have been incorporated into new authoring systems designed and produced by Softworde.

One specific visual improvement concerns the screen resolution. Most of the participants were used to seeing an 80 by 25 character screen resolution or better. The 42 by 19 character resolution appeared second rate, even "horrible," especially to the graphic designer. At the time of its creation, *Dynamite* required the Norpak PCX6 NAPLPS decoder board for its speed and color versatility. Since then, software decoders have improved. As PCs become faster (25 MHz) and more graphically versatile (VGA), software decoders offer a more convenient and practical solution. They provide crisper graphics and text and more colors due to the higher resolution machines.

Author control is another feature that has been improved since the original *Dynamite* created in 1987. The tutorial, quiz and test now allow the author to define the size and position of the text box on the screen. The author is no longer restricted to only two screen formats--mixed- and full-page. Similarly, now the author has more freedom to design specific feedback to question options. For instance on a graphic matching question, if the

student clicks on a predetermined incorrect portion of a graphic screen, s/he will see unique feedback associated with that incorrect option, if the author chose to predefine it. Otherwise, a stock reinforcement statement is randomly presented from a pool of predetermined statements, as in the old *Dynamite*.

Increased interactivity is a third possible improvement. From an instructional standpoint, the more interactivity in courseware the better since the learner has increased active participation. For instance, when learning a new application such as a word processing program, learners need interaction since learning is an active process: learners create, explore and integrate knowledge (Carroll & Mack, 1987). Whether a word processor or an authoring system, this fundamental principle holds true.

Although increased interactivity is an instructional improvement, providing interactive on-line exercises during the delivery of Inquiry modules has inherent dangers that must be considered. From a practical point of view giving the student access to the authoring tool while running the module endangers the consistency of the courseware. That is, the student would not only be able to manipulate the exercise, but also any other training modules that exist on-line. Subsequent users may end up training on a faulty module. Milbase did not want to take the chance. Extensive programming modifications to all authoring strategies in *Dynamite* including Inquiry would be required to implement a safety mechanism to ensure restricted access to modules. Milbase has two other levels of CBT authoring tools available to them that would allow them to create and provide increased interactivity including active simulation.

Further to the improvements to *Dynamite* mentioned above, with the help of experienced CBT developers at a major American telecommunications company, and while assisting less experienced users at British Columbia Hydro and Workers' Compensation Board define their CBT requirements, Softwords has created a range of authoring systems. Each system is a refinement of the last based on instructional principles and lessons

learned in development, implementation, and validation of courseware and tools; sophistication of hardware and software; varied subject matter; organizational structures, politics, CBT development experience and maturity; cost; and technology. All these elements contribute to the effectiveness of any CBT implementation.

Summary

Some knowledge domains lend themselves more readily to the hierarchical Inquiry structure which is essentially an "Information Provider" in traditional videotex terms. It's interaction capabilities are limited but useful. Based on the outcome of this production and evaluation, the author suggests that with appropriate support materials an Inquiry-based module can be instructionally effective.

As a CBT development strategy, the next step for potential Inquiry authors would be to widen the scope of evaluation from one module to the full 70-hour course. In this course, the trainees would take CBT development process from the conceptualization of a small course to its full development. An in-depth course complete with CBT, paper and hands-on development would better determine whether or not Inquiry is a suitable strategy for novice CBT authors to develop when compared with other *Dynamite* and NATAL strategies. The scope of such an evaluation would include additional entry requirements such as knowledge of or experience in instructional design, screen layout and graphic design.

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Appendix A

Overall Course Objectives

OBJECTIVES FOR MILBASE TRAINING
August 19, 1988

Purpose:

The purpose of the following course is to train Milbase personnel about the basic principles of the CBT (Computer Based Training) development process so they can start to develop, implement and manage CBT courseware.

The main portion of the instruction is devoted to the CBT development process itself through hands-on practice. The theory and principles will be presented or discussed prior to practice.

Instruction related to the practical development of CBT will also be presented. These topics include graphics, implementation engineering, advanced issues in CBT, Videotex 1100, NATAL, and basic MS-DOS.

During the first presentation of the course (September 12 to September 23rd), the course itself will be under review as an example of formative evaluation.

Specific, practical production outcomes for each training group will be determined prior to the training or early within the training. These will vary according to needs, skills, time available and other factors. Everyone should leave the course with something they have created: a task analysis, a list of objectives, a sample simulation, a plan for a field trial, a Dynamite module, etc.

The formal learning objectives for the course are as follows.

By the end of two-week training course, the trainee should be able to:

---

1) CBT Development

1.1 The CBT Process

- 1.1.1 Identify the steps involved in the CBT development process.
- 1.1.2 Explain how the CBT development process is a cyclical, iterative process.

1.2 Goal Definition for a Course

- 1.2.1 State the problem of the training.
- 1.2.2 State the goal of the instruction (what the trainee will expect to know or do by the end of the instruction).
- 1.2.3 List the characteristics of the trainees that are important in determining the nature of the training.

1.3 Instructional Analysis for a Course

- 1.3.1 Gather Resource Materials.
  - 1.3.1.1 Identify at least five different resources.

1.3.1.2 State three risks involved in not collecting resource materials.
1.3.1.3 State the two primary uses of subject-relevant materials.

1.3.2 Generate and Organize Ideas.
1.3.2.1 List two reasons why a brainstorming session is useful.
1.3.2.2 List three steps involved in a brainstorming session.
1.3.2.3 Describe the biggest temptation in brainstorming and how it can be avoided.
1.3.2.4 Participate in a brainstorming session.
1.3.2.5 List at least two criteria by which elimination of ideas takes place.
1.3.2.6 Eliminate irrelevant ideas generated by a brainstorming session based on predetermined criteria.

1.3.3 Analysis
1.3.3.1 Define two areas of analysis for CBT (subject matter and strategy).
1.3.3.2 Define and describe two types of analysis for subject matter (task and concept).
1.3.3.3 Describe the steps in a task analysis.
1.3.3.4 Describe the steps in a concept analysis.
1.3.3.5 List the outputs of a concept and/or task analysis.

1.4) Objectives

1.4.1 List at least three different types of objectives.
1.4.2 Define an intermediate objective.
1.4.3 Define an enabling objective.
1.4.4 State the purpose of performance objectives.
1.4.5 List and identify the components of a behavioral objective.
1.4.6 Identify the six categories of objectives from Bloom's taxonomy.
1.4.7 Given the results of a task analysis, generate the objectives.

1.5) Lesson Design

1.5.1 Identify the three areas of lesson design (content, strategy, presentation).
1.5.1.1 Use the objectives to determine the content for the lesson.
1.5.1.2 Use the materials and resources previously gathered to write the content.
1.5.1.3 Divide the content up according to the following format: rule, example, non-example, exception.
1.5.2 Strategy
1.5.2.1 List five different strategies available in CBT.
1.5.2.2 List three advantages and three disadvantages of each strategy.
1.5.2.3 List the four strategies specific to Dynamite.
1.5.2.4 List three strategies available through NATAL but not available in Dynamite.
1.5.3 Presentation
1.5.3.1 List at least 10 presentation factors common to all CBT.
1.5.3.2 List five presentation factors already dealt with in Dynamite.
1.5.3.3 List five presentation factors that still need consideration in Dynamite.
1.5.3.4 State at least two rules associated with each of the factors listed above.

1.6) Pre-production.

1.6.1 Identify three areas of preproduction.
1.6.2 Name at least one tool used to establish the control of a courseware program and the advantage of using it.
1.6.3 Describe the storyboarding process.

1.6.4 Produce a storyboard (text and graphics) for each of the course types in Dynamite.

1.7) Production

1.7.1 Name three areas of production (coding, data content and graphics).
1.7.2 Describe the importance of each area for Dynamite and NATAL courseware.
1.7.3 List three key team members on a production team and their role.
1.7.4 Produce a course in Dynamite from the storyboards created in preproduction.

1.8) Evaluation.

1.8.1 List the two primary types of evaluation for CBT (formative and summative).
1.8.2 Describe formative evaluation and its purpose.
1.8.3 Describe two forms of formative evaluation.
1.8.4 Name at least three different types of people who should be part of the formative evaluation process.
1.8.5 Name the output of a formative evaluation and what to do with it.
1.8.5 Describe summative evaluation and its purpose

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2) Testing

2.1 Identify the correct time to test lesson material.
2.2 Describe criterion-referenced testing in training.
2.3 Describe at least three different types of testing in CBT.
2.4 Describe how to use the objectives to construct the different types of tests.
2.4.1 Construct multiple choice questions.
2.4.2 Construct true/false questions.
2.4.3 Construct graphic matching questions.
2.5 Describe the 5 basic considerations for testing on the computer.

---

3) The DYNAMITE Authoring System.

3.1 Describe the differences between an authoring system and an authoring language.
3.2 Identify and describe the different modes in Dynamite (author and delivery).
3.3 Identify and describe the hardware requirements for Dynamite.
3.4 Identify the different course types in Dynamite.
3.5 List six of the different command categories in Dynamite.
3.5.1 Describe the function of the COURSE commands.
3.5.1 Describe the function of the FORMAT commands.
3.5.1 Describe the function of the ANSWER commands.
3 5.1 Describe the function of the GRAPHIC commands.
3.5.1 Describe the function of the TEXT Editor commands.
3.6 Use the Dynamite commands to produce single screens.

4) Graphics

4.1 Theory and Practice.
- 4.1.2 Describe the use of symbols in graphic messages.
- 4.1.3 Describe the concept of perspective.
- 4.1.4 Describe the use of graphics in CBT.
  - 4.1.4.1 Describe the effectiveness of combining text and graphics.

4.2 NAPLPS graphics.
- 4.2.1 Define NAPLPS graphics.
- 4.2.2 NPT
  - 4.2.2.1 Describe the relationship between shapes and colors in NPT.
  - 4.2.2.2 Identify the mouse commands in NPT.
  - 4.2.2.3 Identify the keyboard commands in NPT.
  - 4.2.2.4 Describe the RBG color commands in NPT.
  - 4.2.2.5 Use NPT commands to produce NAPLPS simple graphic images.
- 4.2.3 GraphicsPower
  - 4.2.3.1 Identify and describe three differences between GP and NPT.
  - 4.2.3.2 Use GP to produce simple graphic images.
  - 4.2.3.3 Transport GP graphics to Dynamite courses.
- 4.2.4 IPS4
  - 4.2.4.1 Describe the six fundamental concepts related to creating graphics on the IPS4.
  - 4.2.4.2 Describe the function of each screen in the two-screen IPS4 system.
  - 4.3.4.2.1 Describe the three main areas of the graphics screen.
  - 4.3.4.2.1 Describe the three main areas of the alpha screen.
  - 4.3.4.3 List the seven major command categories that make up the IPS4 system.
  - 4.3.4.4 Identify and describe the IPS4 commands in the Picture category.
  - 4.3.4.5 Construct simple graphic images using the IPS4 system.

5) NATAL

5.1 Explain the purpose of NATAL.
5.2 List the similarities of NATAL to standard programming languages.
5.3 List the differences between NATAL and standard programming languages.
- 5.3.1 Identify NATAL display commands.
- 5.3.2 Describe NATAL answer analysis capabilities and commands.
- 5.3.3 Describe NATAL data file structures.

5.4 Use the NATAL commands to write programs.
5.5 Use the NATAL environment commands to compile and execute NATAL programs.
5.6 Describe the Scenario Structure driver written for Milbase training applications.
- 5.6.1 Identify the two different types of files used in the Scenario Structure.
  - 5.6.1.1 Describe and identify the records in the Events type file.
  - 5.6.1.2 Describe and identify the records in the Question type file.
- 5.6.2 Describe the function of graphics in the Scenario Structure.
- 5.6.3 Design and produce an application in the Scenario Structure.

6) Computer Managed Instruction.

6.1 List five basic principles of CMI.
6.2 Describe the purpose of OnTrack.
6.3 Identify the three different categories of users of OnTrack.
6.4 Describe the functions of OnTrack available for each of these types of users.
6.5 Identify three common features of stand-alone and networked CMI.
6.6 Describe three advantages of networked CMI.

7) Advanced Issues in CBT

7.1 Identify and describe the use of CBT simulations created in NATAL (ABO).
7.2 Identify and describe the use of expert systems in CBT (KC-135).
7.3 Describe the function of iterative prototype method of production.
7.4 Describe the concept of mental models.
7.5 Evaluate use of IVI versus CBT.
7.6 Evaluate use of CBT and IVI versus traditional training.
7.7 Evaluate models for cost-benefit analysis of training.

8) Implementation Engineering

8.1 Describe the main goal of the implementation engineering process.
8.2 List the seven major requirements for a successful implementation.
8.3 Identify and describe common stumbling blocks defined by implementation engineering.
8.4 Describe solutions for five common stumbling blocks defined by implementation engineering.
8.5 Relate three management/production levels to the implementation process.
8.6 Analyze a specific project in terms of implementation engineering principles.

9) MS-DOS

9.1 Describe and utilize the basic MS-DOS file commands.
9.2 Describe and utilize the basic MS-DOS directory commands.

10) VIDEOTEX

10.1 List the three main components of a videotex system.
  10.1.1 Define the purpose of using NAPLPS graphics in videotex.
  10.1.2 State three main rules of organizing information into a videotex database.
10.2 Describe the Dynamite Inquiry structure.
  10.2.1 Describe the relationship between videotex and the Inquiry structure in Dynamite
  10.2.2 Describe information storage in the Inquiry structure in Dynamite.
  10.2.3 Identify, describe and use the tools for building Inquiry courses in Dynamite
  10.2.4 Build an Inquiry course in Dynamite.

10.3 Videotex 1100

10.3.1 Identify three functional differences between the Videotex 1100 system and Inquiry.

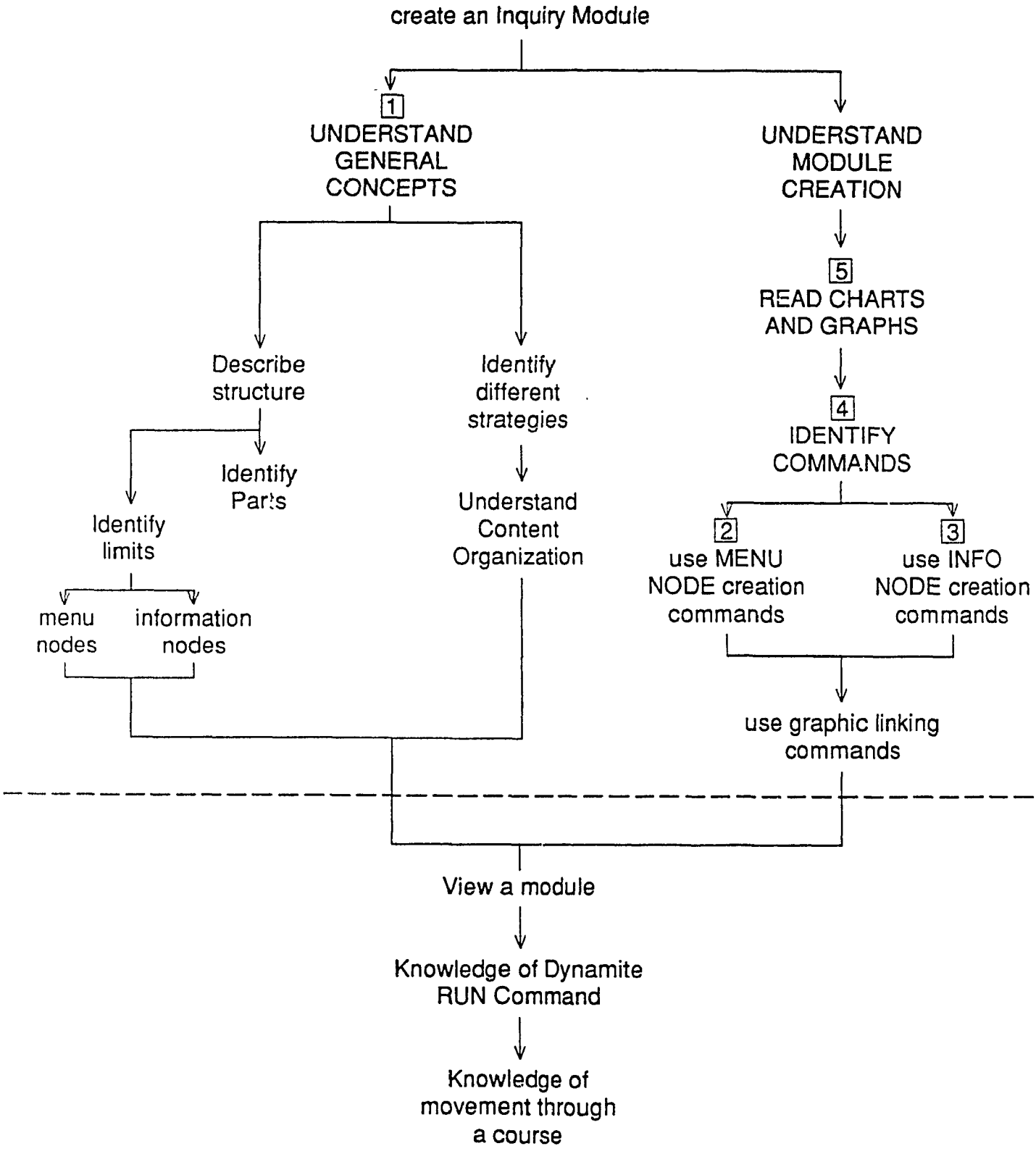
10.3.2 Describe the process of creating databases on the Videotex 1100 system.

10.3.3 Construct a small Videotex 1100 database.

Appendix B

Instructional Analysis Diagram

Inquiry Module Instructional Analysis



Appendix C

INQI Module Objectives

INQI Module Objectives

By the end of the course, given a 20-item test of multiple choice and true/false questions and an exercise to link ten prebuilt graphics the trainee will be able to:

1 Identify the general structure of Inquiry.
1.1 Identify the different components of an Inquiry structure.
1.2 Recognize how the different components of the Inquiry structure resemble an upside-down tree.
1.3 Identify the graphic and level limits in an inquiry structure.
1.4 Identify the different strategies that can be incorporated into an Inquiry course.

2 Recognize the function and purpose of a menu node.
2.1 Identify the option and graphic limits of a menu node.
2.2 Use the Menu Commands to make at least one menu node.

3 Recognize the function and purpose of a information node.
3.1 Identify the graphic and level limits of an information node.
3.2 Use the Information Commands to make at least one information node.

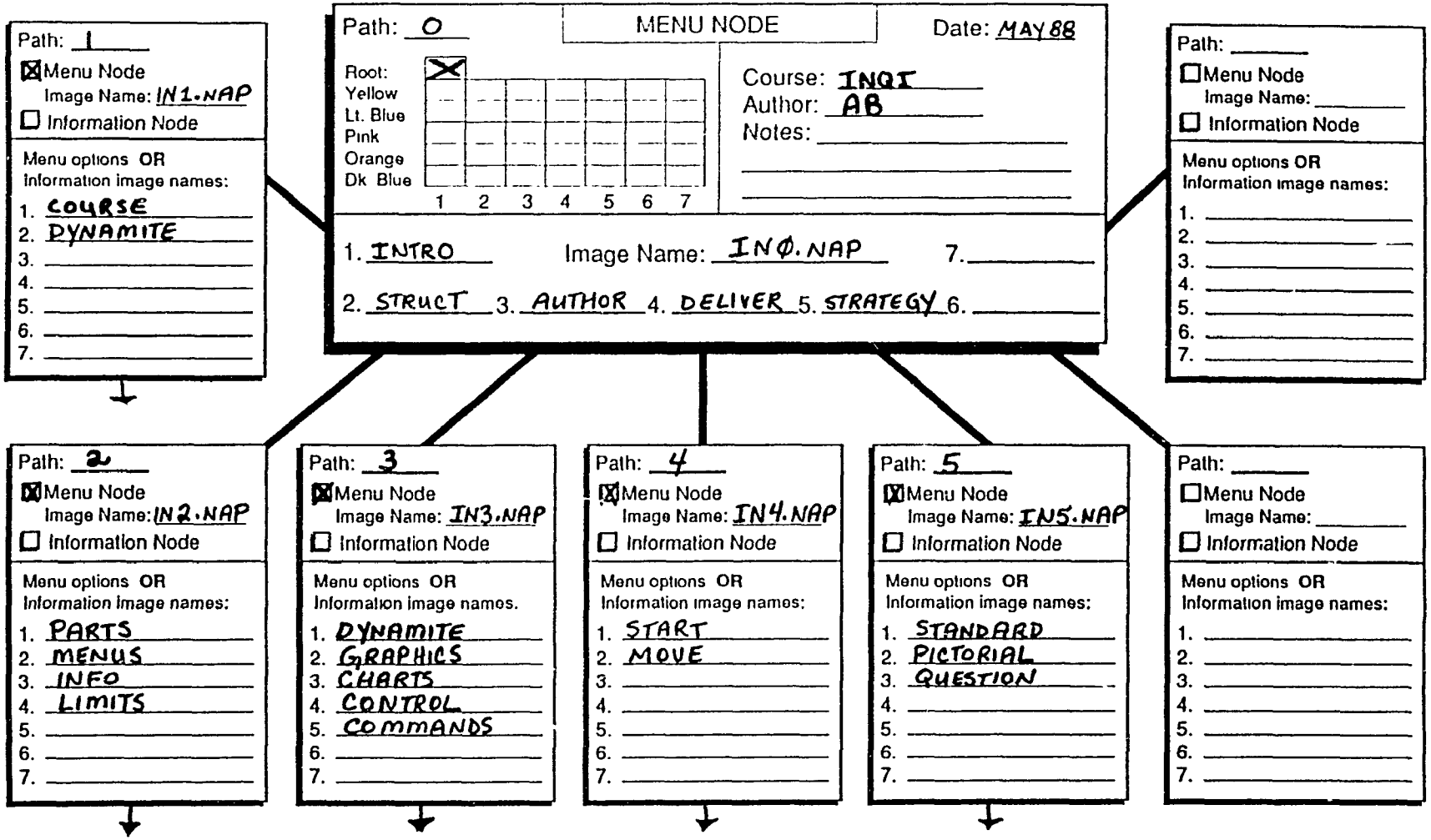
4 Identify and use the 7 different Inquiry commands.
4.1 Recognize how the commands differ for menu nodes and information nodes.
4.2 Correctly use at least 5 of these commands to link graphics into the menu and information nodes.

5. Read and use the 3 different charts necessary for navigation through and creation of Inquiry modules.
5.1 Recognize how and when to use information and menu node charts.
5.2 Use the Menu History chart to identify the path of an author's current position.
5.3 Identify the relationship between a path number and Inquiry levels.

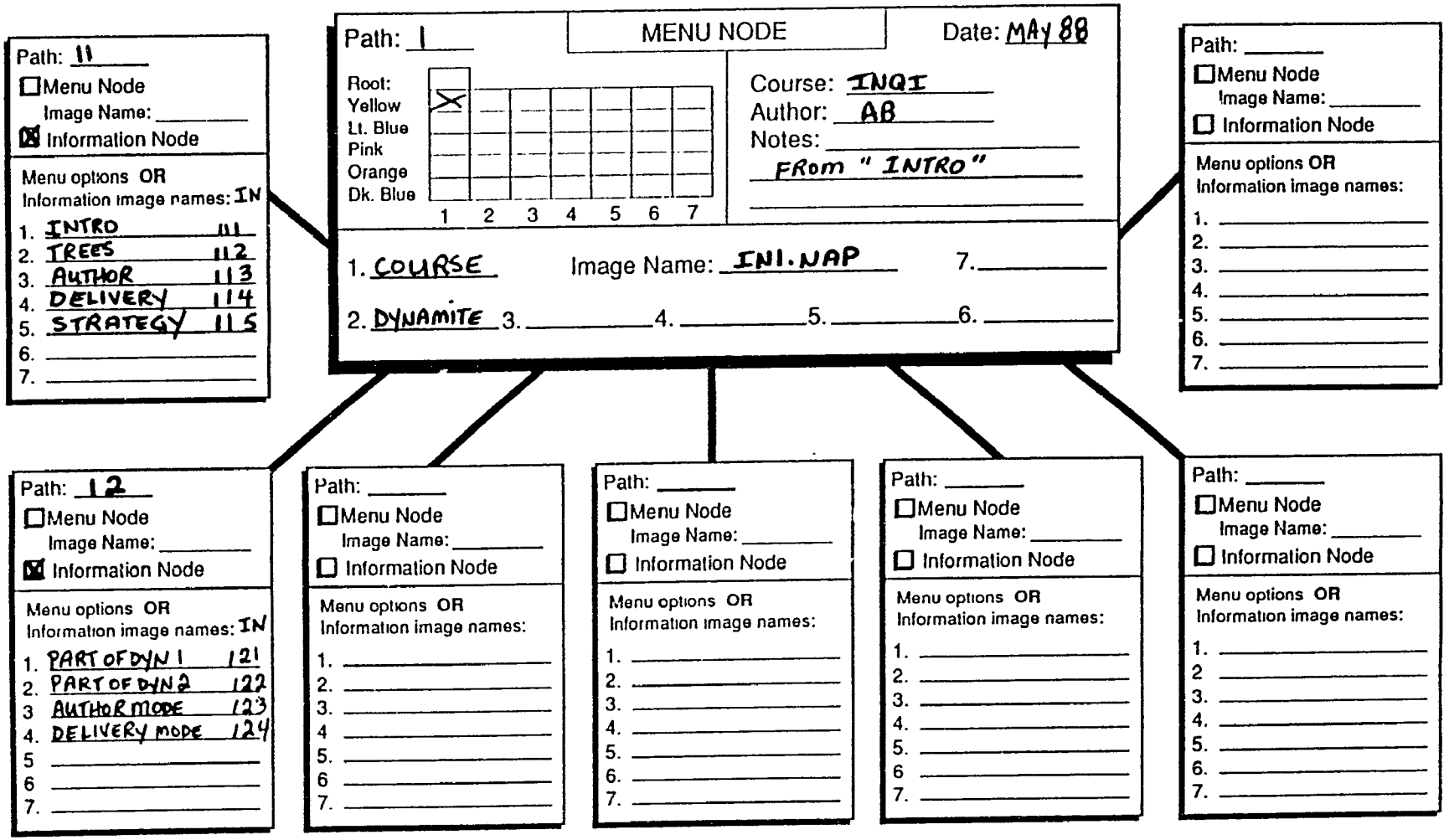
Appendix D

Inquiry Menu Planning Sheets

INQUIRY MENU STRUCTURE



INQUIRY MENU STRUCTURE



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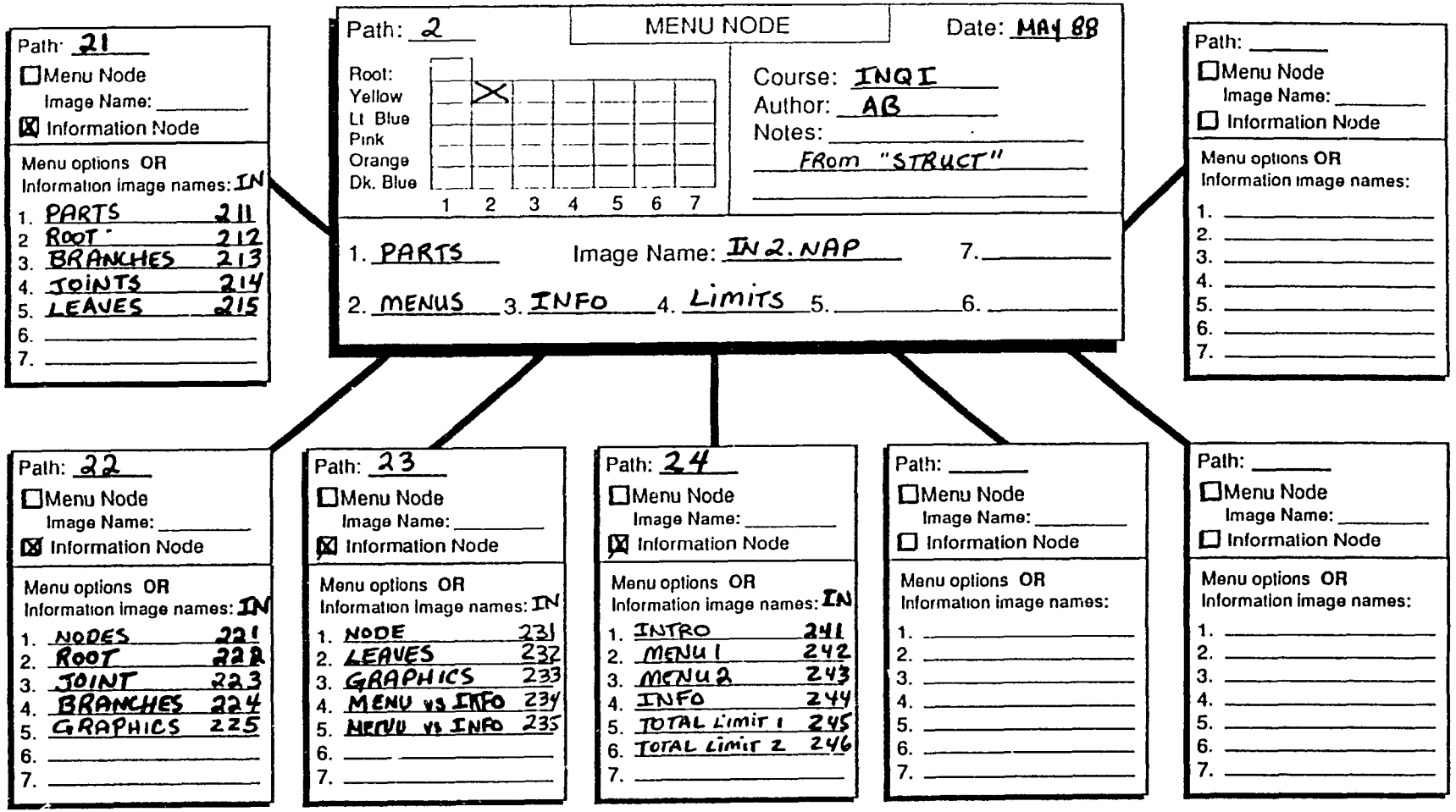

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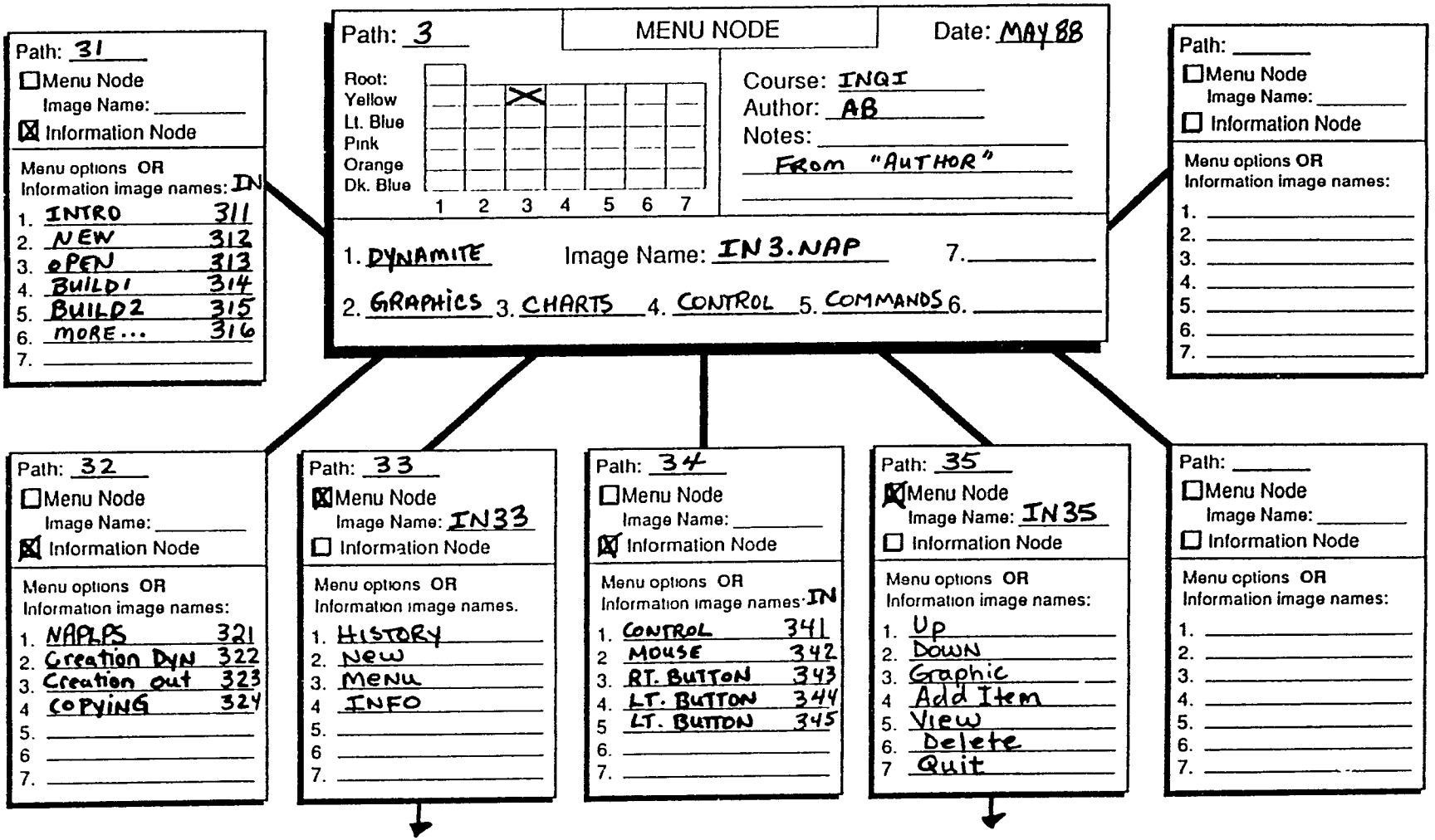

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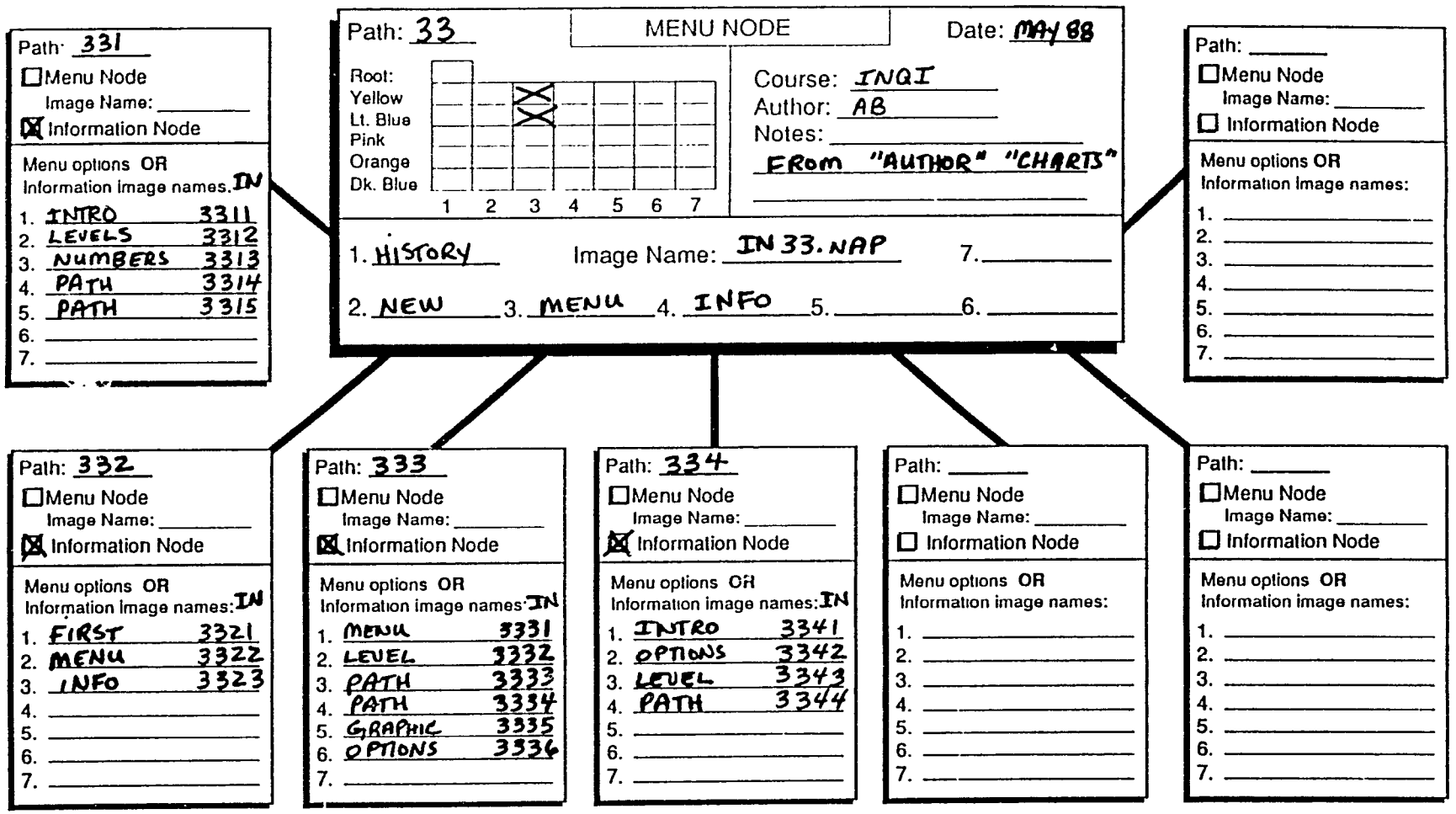

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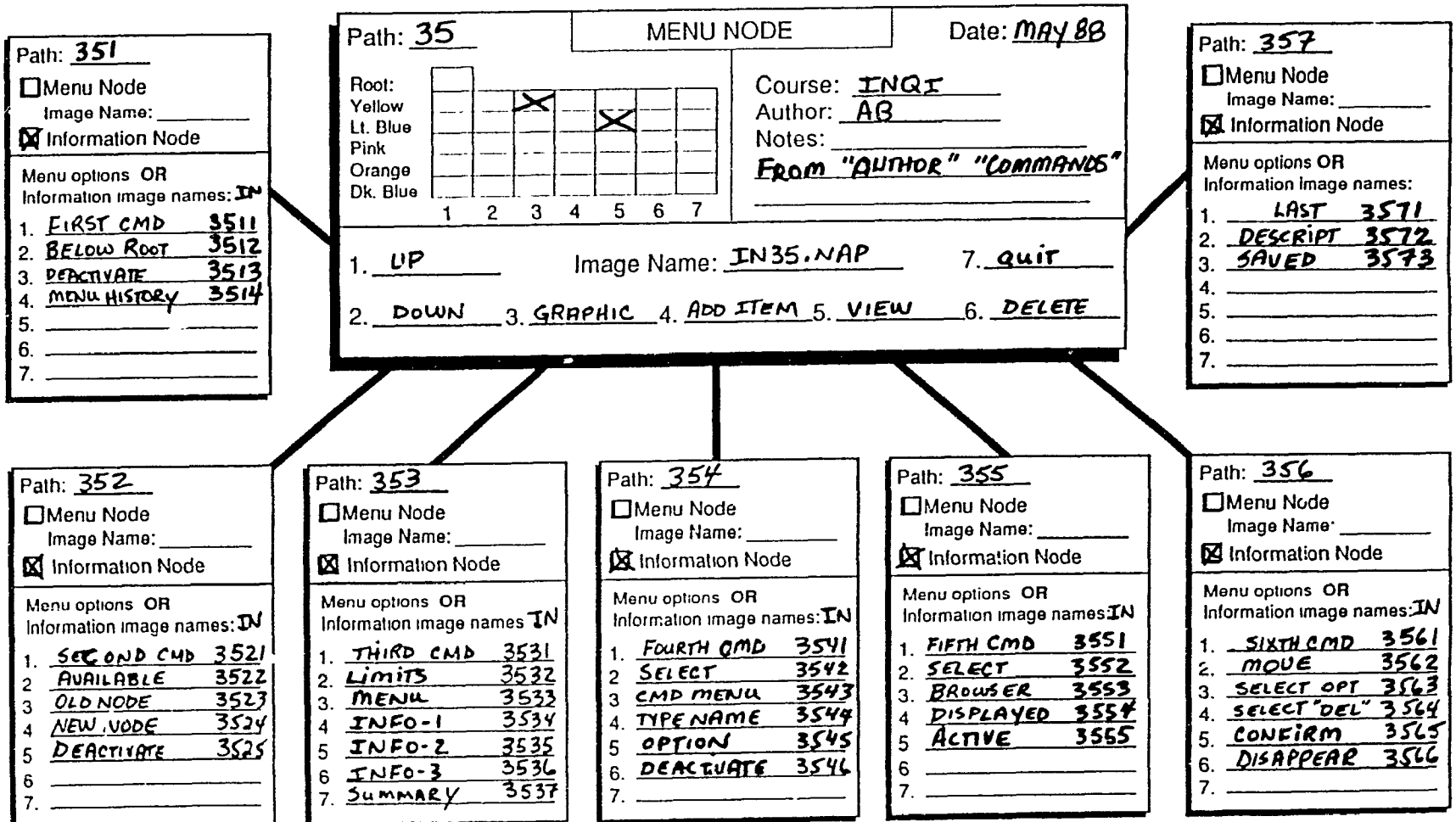

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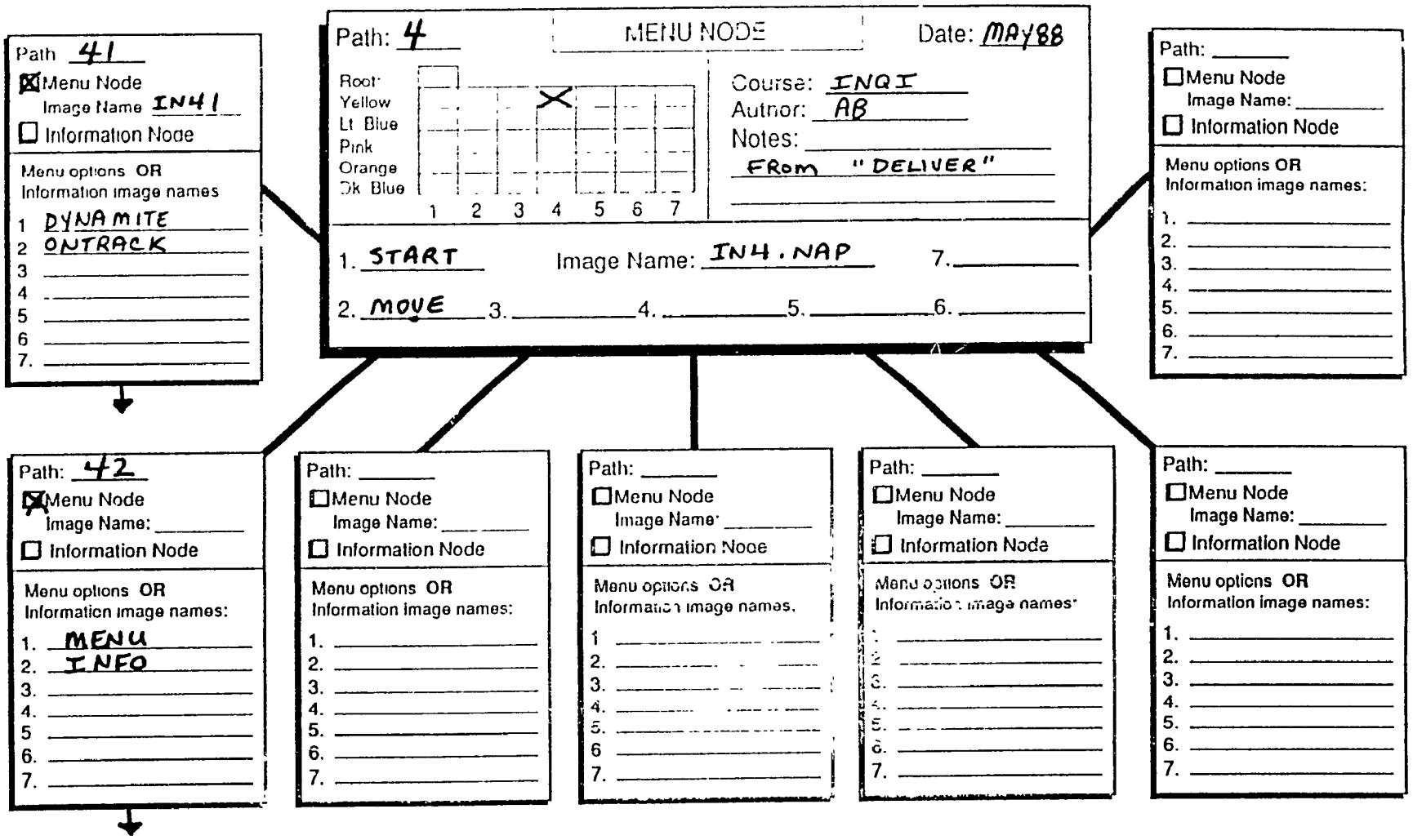
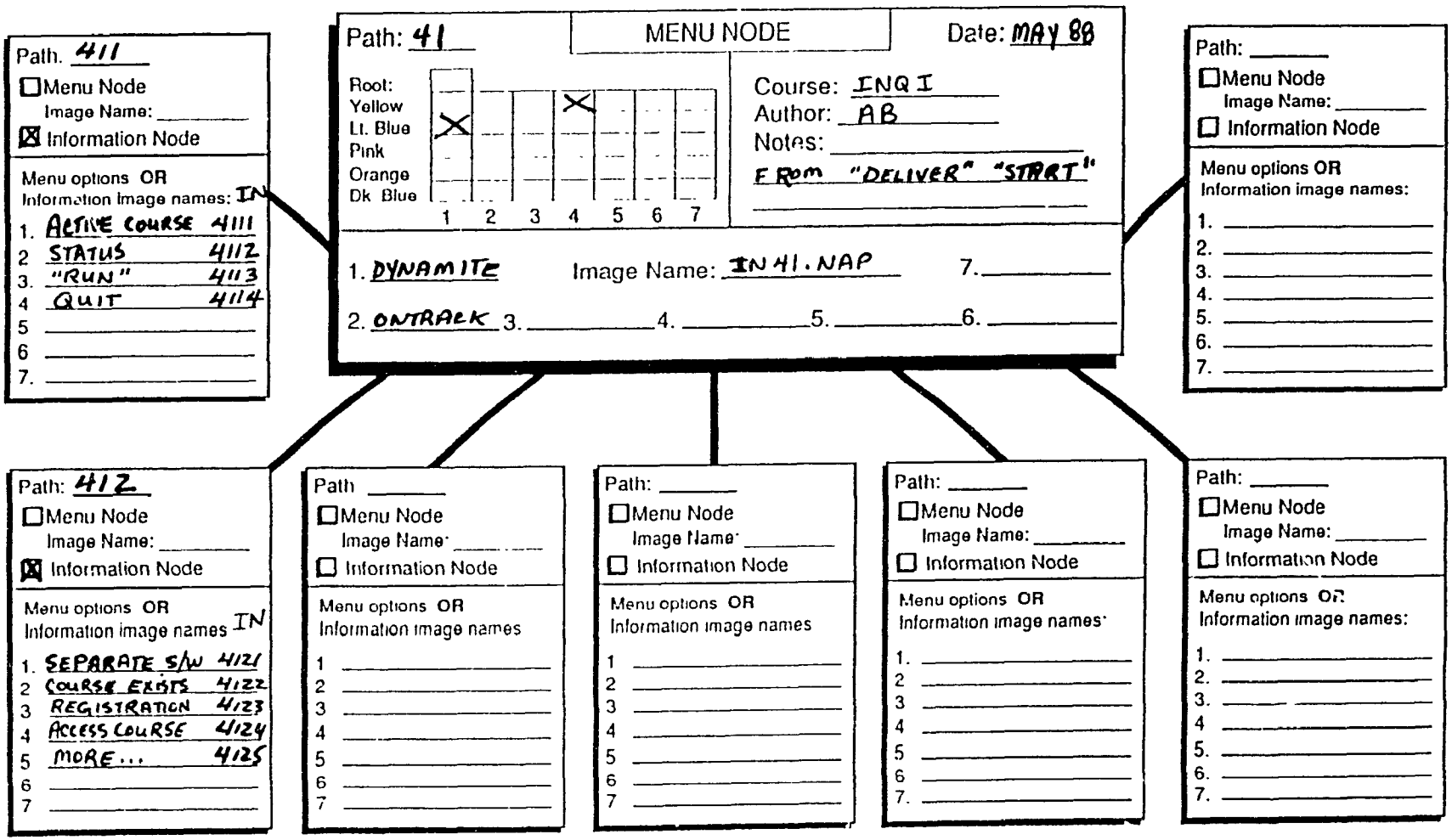


INQUIRY MENU STRUCTURE



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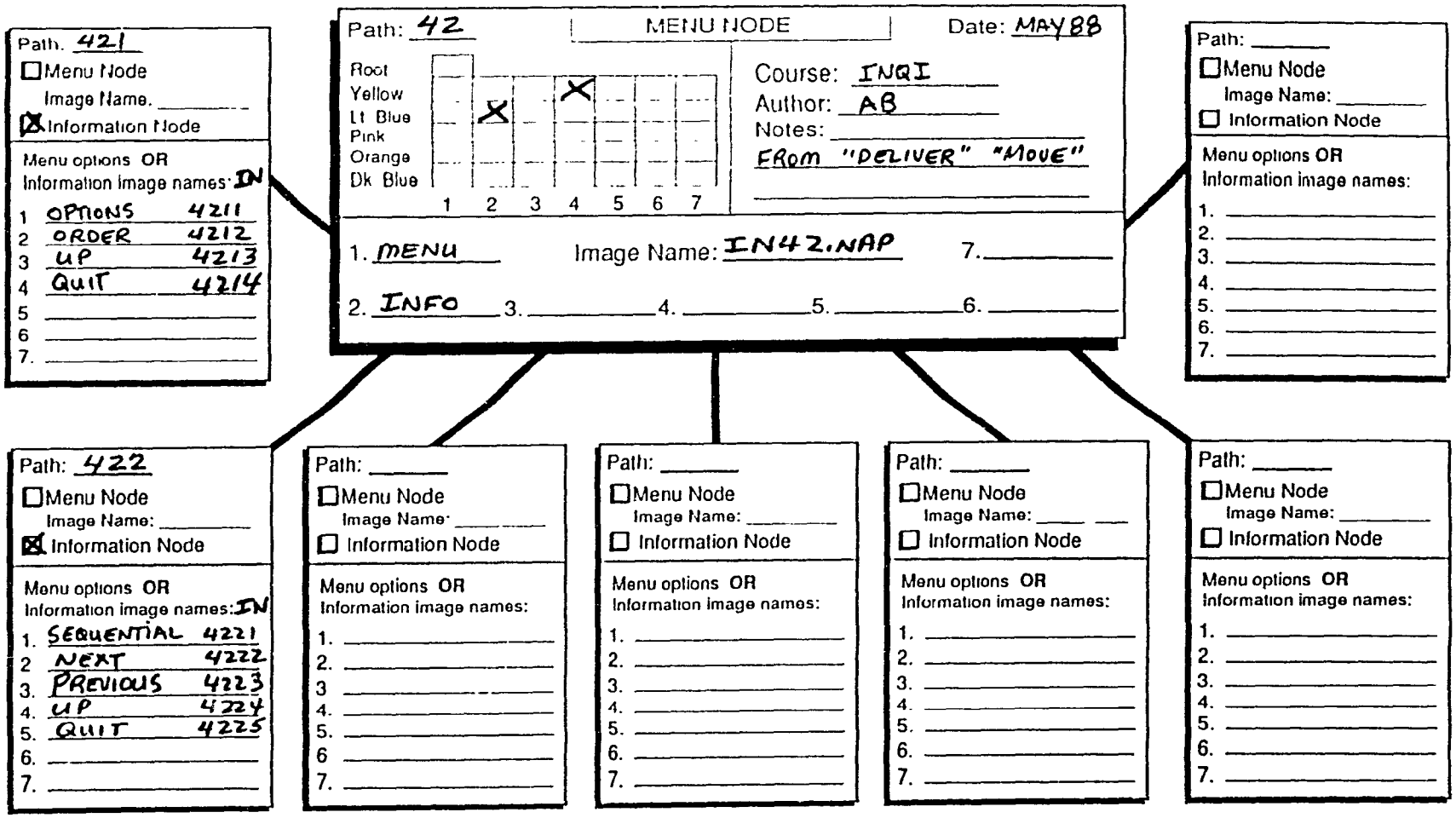

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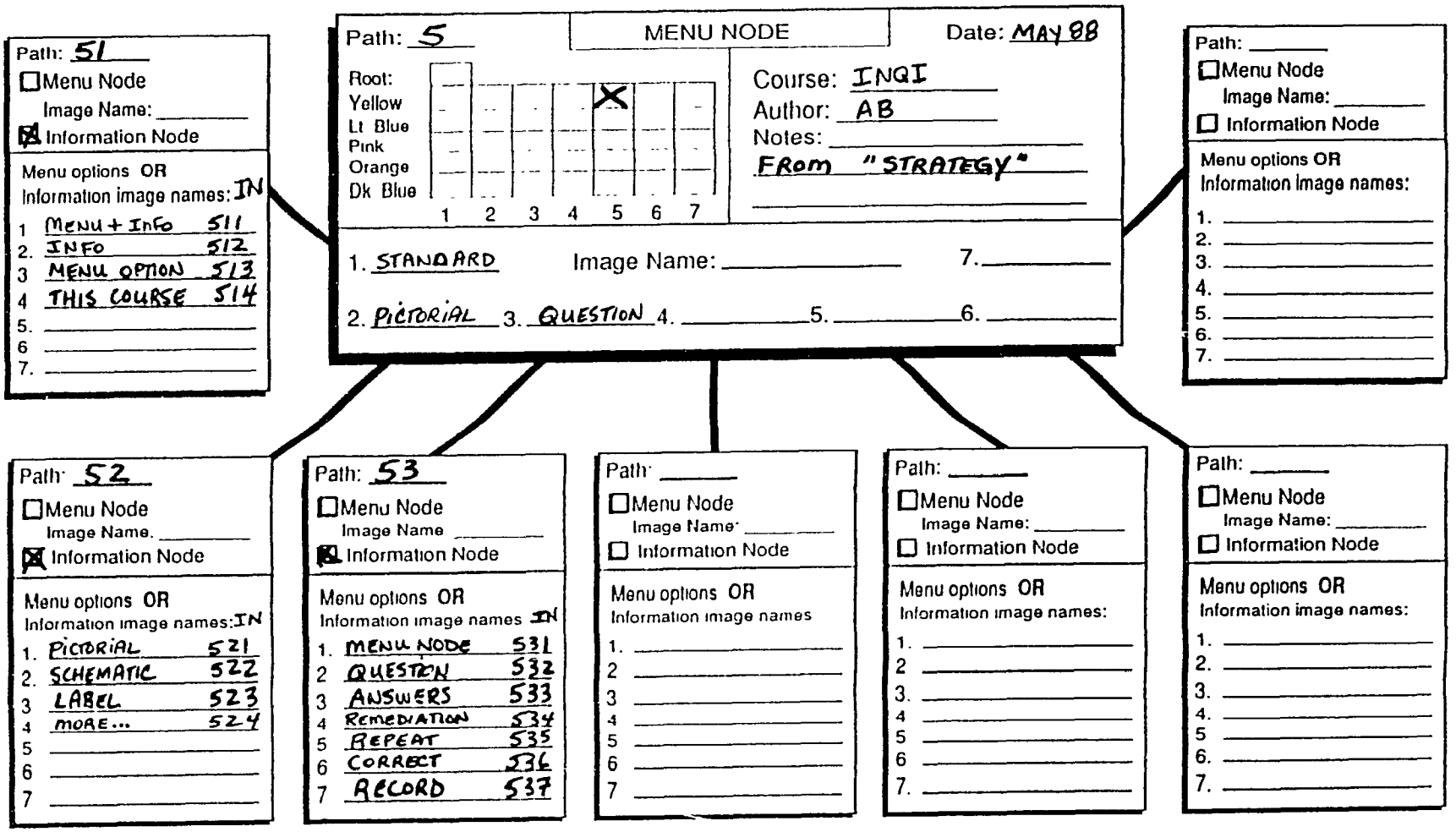


Appendix E

Sample Text Storyboards

Dynamite Storyboard - full graphic page

(200 x 256 pixels or 42 x 19 NAPLPS characters)

Course: _____ Item # : _____ Total Items: _____

☐ Tutorial ☐ Quiz ☐ Certification ☐ Inquiry

Answer: _____ Path: _____

Image One: _____ Image Two: _____

Notes: _____

_____

_____

Author: _____ Date: _____

Sample Text Storyboards

1) NAME: IN0.nap
PATH: 0
Welcome to the Dynamite course about the INQUIRY module.
The course is divided into 5 sections:

1) Introduction
2) Structure
3) Authoring Inquiry Courses
4) Delivering Inquiry Courses
5) Strategies

Choose the INTRO option if this is your first time.

2) NAME: IN11.nap
PATH: 11
This introduction is divided into two sections:
1) About this course.
2) Inquiry as part of Dynamite.

3) NAME: IN111.nap
ITEM: 111
This course will introduce you to the structure
and functions of an INQUIRY module. By the end of
the course, you should be able to create your
own inquiry module.

4) NAME: IN112.nap
ITEM: 112
Part 1 - Structure describes how an inquiry course
is organized like an upside-down tree.

5)NAME: IN113.nap
ITEM: 113
Part 2 - Authoring Inquiry Courses describes the Author Mode of the INQUIRY
structure. This part will explain how you create courses
in Dynamite using the INQUIRY structure.

6) NAME: IN114.nap
ITEM: 114
Part 3 - Delivering Inquiry Course describes the Delivery Mode of the INQUIRY
structure. This part explains how the trainee proceeds through
an inquiry structure (just as you are proceeding through this course).

7) NAME: IN115.nap
ITEM: 115
Part 4 - Strategies describes different strategies you can implement
in an INQUIRY structure, from straight exposition to question branching.

8) NAME: IN12.nap
PATH 12
Inquiry in Dynamite.
1) Part of Dynamite
2) Author Mode
3) Delivery Mode

9) NAME: IN121.nap
ITEM: 121
Part of Dynamite.
Inquiry is a course type in Dynamite. Unlike other course types - Tutorial, Quiz and Certification - Inquiry is a database of previously created graphic images. These instructional graphics are displayed to the user as linked by. you, the author.

10) NAME: IN122.nap
ITEM: 122
Author Mode.
In author mode, you use Dynamite to build an Inquiry course by linking graphic image files into menu and information sequences. You are presented with the prompts and charts for easy inquiry database construction.

11) NAME: IN123.nap
ITEM: 123
Delivery Mode.
In delivery mode, the instructional sequence you built in author mode is presented as a series of menu and information frames. The user is directed through the course by the menus you created.

12) NAME: IN2.nap
PATH: 2
Part 1: Structure
The structure of an Inquiry course can be described in 4 sections:
1) Parts
2) Menu Nodes
3) Information Nodes
4) Limits in Inquiry

PATH: 21

13) NAME: IN211.nap
ITEM: 211
An inquiry structure can be thought of as an upside down tree.
It contains a root, joints, branches, and leaves. Click on NEXT for Root.

14) NAME: IN212.nap
ITEM: 212
The Root.
The top of the upside-down tree is the root. It is where the course structure begins. From the root, the course grows down through the branches to the joints and leaves.

15) NAME: IN213.nap
ITEM: 213
The Branches.

In Inquiry, the branches are connections to points further down the course structure. As part of your course, these branches may represent ideas, answers to questions or other related information from the joint or root above.

16) NAME: IN214.nap
ITEM: 214
The Joints.
Joints in Inquiry are connections in the tree. A joint comes from one branch and has one or more branches extending downward from it.

17) NAME: IN215.nap
ITEM: 215
The Leaves.
The leaves are the bottom elements in your course tree. The leaves contain the course information. The course cannot extend further than the leaves.

PATH: 22

18) NAME: IN221.nap
ITEM: 221
The Menu Node.
The menu node is one of two types of nodes in the inquiry structure. A menu node is where you, the author, specify the choices available to the user in the course.

19) NAME: IN222.nap
ITEM: 222
The first menu node in your course is at the root. At the root, the course offers the user one or more choices to proceed through the course tree. The root is always a menu node. If there is no root, there is no tree.

20) NAME: IN223.nap
ITEM: 223
All joints in the tree are menu nodes in Inquiry. They are points in the course that offer the user a choice of direction and instruction through the course.

21) NAME: IN224.nap
ITEM: 224
The branches in a course represent the choices offered to the user from the root or joints. Every menu option in a menu node branches to another joint or to a bunch of leaves.

22) NAME: IN225.nap
ITEM 225
In Inquiry, each menu node in the structure can have a graphic image associated with it. In Part 2, Author Mode, you will learn how to link a graphic image to your menu node.

PATH: 23

23) NAME: IN231.nap
ITEM: 231
Information Node.

An information node is the second type of node available in Inquiry.
An information node is where the author presents information or instruction to the user.

24) NAME: IN232.nap
ITEM: 232
An information node in inquiry is equivalent to a bunch of leaves at the end of a branch in the course tree. An information node always stems from an option in a menu node. There are no branches in an information node, just leaves.

25) NAME: IN233.nap
ITEM: 233
An information node in Inquiry is a sequence of graphic images containing instructional information. As the author, you determine the order in which to present the instructional sequence.

26) NAME: IN234.nap
ITEM: 234
In contrast to a menu node, an information node contains one or more graphic images linked in an author-determined sequence. No choices are entered for the user. Alternately, a menu node contains only one graphic image and one or more choices are entered for the trainee.

PATH: 24

27) NAME: IN241.nap
ITEM: 241
Limits.
For manageablity and size constraints, Inquiry imposes limits on the number of menu nodes and information nodes you can have in an Inquiry course. Also, the size of the screen limits the amount of information on one screen.

28) NAME: IN242.nap
ITEM: 242
Limits for Menu Nodes.
Inquiry allows for a total of four levels of branches and joints.
That is, you can have four levels of menu nodes. At any level, you can have an information node, but after the fifth level, ONLY information nodes can be added.

29) NAME: IN243.nap
ITEM: 243
Limits for Menu Nodes (cont'd).
In Inquiry, each menu node can have up to seven branches.
That is, you can create up to seven menu options per menu node.

30) NAME: IN244.nap
ITEM: 244
Limits for Information Nodes.
Inquiry also allows for a total of seven leaves in an information node. That is, you can link up to seven instructional frames (graphic images) to an information node.

31) NAME: IN245.nap

ITEM: 245
Inquiry's limit of four levels of menu node, seven branches per menu and seven leaves (graphic images) per information node allows for a course of up to 17,000 frames. That is a big tree! Realistically, 100 frames is enough for a course where the user will not get lost or confused.

32) NAME IN3.nap
PATH: 3
Part 2: Authoring Inquiry Courses
How to construct an Inquiry course can be described in 5 sections:
1) From Dynamite
2) Graphic Images
3) Charts and Boxes
4) Control
5) Inquiry Commands for Creation

PATH: 31

33) NAME IN311.nap
ITEM: 311
As an author, there are three ways to enter (create/edit) an Inquiry course in Dynamite. The commands in Dynamite are New, Open and Build. Each of these commands will bring you into the Inquiry production mode.

34) NAME IN312.nap
ITEM: 312
The NEW Command.
Like any other new course created in Dynamite, a new Inquiry course can be created by selecting the NEW command from the COURSE menu in Dynamite, entering a name, and choosing the INQUIRY course type.

35) NAME IN313.nap
ITEM: 313
The OPEN Command.
An existing Inquiry course can be edited by selecting the OPEN command from the COURSE menu in Dynamite. Dynamite presents the browser of all available courses. You select the name of the Inquiry course you wish to edit.

36) NAME IN314.nap
ITEM: 314
The BUILD Command.
Once you've opened your Inquiry course, edited some nodes, quit from the Inquiry production mode, and returned to Dynamite, you have the option of going back into the Inquiry production mode.

37) NAME IN315.nap
ITEM: 315
The BUILD Command (cont'd).
To resume editing an Inquiry course, select the BUILD from the COURSE menu in Dynamite. The BUILD command in Dynamite is ONLY for Inquiry course types; it cannot be used for Tutorial, Quiz or Certification.

38) NAME IN316.nap
ITEM: 316
For more instruction on the commands available in Dynamite,
see course DYNI.

PATH: 32

39) NAME IN321.nap
ITEM: 321
Graphic Images.
Inquiry is a database of graphic images organized into menu nodes and
information nodes. The type of graphics used for Dynamite Inquiry are
NAPLPS graphics.

40) NAME IN322.nap
ITEM: 322
Dynamite has a built-in NAPLPS graphics editor called NPT. This editor
can be invoked through the GRAPHIC option in Dynamite. From GRAPHIC, you
can create, modify, and view the graphic images for your Inquiry course.

41) NAME IN323.nap
ITEM: 323
You can create NAPLPS graphic images outside of Dynamite using other
NAPLPS graphic editors like Graphics Power and IPS4. Just remember,
they must have a .NAP extension.
(c) Graphics Power by Softwords
(c) IPS4 by Norpak

42) NAME IN324.nap
ITEM: 324
When you create NAPLPS graphic images outside of Dynamite,
copy them into your course subdirectory in Dynamite from DOS.
In NPT, the graphic images are saved directly to your course subdirectory.

43) NAME IN33.nap
PATH: 33
Charts and Boxes.
When you are in the Inquiry production mode, you will
see charts and boxes to help you link your graphic image files.
1) Menu History Chart
2) New Node
3) Menu Node Box
4) Information Node Box

PATH: 331

44) NAME IN3311.nap
ITEM: 3311
Menu History Chart.
The menu history chart consists of rows and columns representing
the levels and menu options of the menu nodes. The chart enables
you to see where you are in the course at any time.

45) NAME IN3312.nap
ITEM: 3312

The Levels
The Menu History Chart consists of 5 color-coded rows.
Each row represents a menu level in the course tree.

46) NAME IN3313.nap
ITEM: 3313
The Numbers.
At the top of the Menu History Chart, there are the numbers
from 1 to 7. These numbers represent the menu options
for each menu.

47) NAME IN3314.nap
ITEM: 3314
As you move down the course tree, the
actual menu option names appear in the corresponding menu level-option position
in the Menu History chart. Also, the path you follow down
the tree is highlighted so you can see where you are in the course.

48) NAME IN3315.nap
ITEM: 3315
Paths.
A path is the sequence of menu nodes you must travel though
to get to another node in the course structure.

PATH: 332

49) NAME IN3321.nap
ITEM: 3321
New Nodes.
The first node in a course tree is a menu node since the root
branches down to the rest of the tree. This is level zero.

50) NAME IN3322.nap
ITEM: 3322
Once you branch down from the root to a new level via a menu option, you must
make a choice. Inquiry will present a menu
and wait for you to specify the new node as a menu node
or an information node.

51) NAME IN3323.nap
ITEM: 3323
If your tree will branch further, choose MENU NODE.
If you're at the end of the branch and wish to add
instructional frames, choose INFO NODE.

PATH: 333

52) NAME IN3331.nap
ITEM: 3331
Menu Node Box.
When you select a menu node, Inquiry will display a menu node box.
The menu node box contains all the information about that menu node.

53) NAME IN3332.nap
ITEM: 3332

The Level.
At the top left of the menu node box is a level number. This number tells you which level you are at. The number corresponds to the color of the menu in the Menu History Chart.

54) NAME IN3333.nap
ITEM: 3333
The Path.
At the top of the menu node box is a path number. This number tells you where you are in the menu history chart. The number of digits tells you the level and the value of the digits tells you the menu options chosen.

55) NAME IN3334.nap
ITEM: 3334
The Path (cont'd).
If you are at level one, the path will be one digit. If you choose menu option 3, the path number will be 3. If you go down to the second level via option 4, the path number will be 34, and so on.

56) NAME IN3335.nap
ITEM: 3335
The Graphic Image Name.
A menu node can have a graphic image linked to it. The graphic image name appears in the first slot of the menu node box.

57) NAME IN3336.nap
ITEM: 3336
The Options.
The menu node box contains seven slots with path numbers. Each slot stores the name of the menu option in that position. The color of the menu box corresponds to the level color in the Menu History Chart.

PATH: 334

58) NAME IN3341.nap
ITEM: 3341
Information Node Box.
When you select an information node, Inquiry will display an information node box. The information node box contains all the information about that information node.

59) NAME IN3342.nap
ITEM: 3342
The Options.
The information node box contains seven slots. Each slot stores the name of the graphic image. The color of the information node box corresponds to the level color in the Menu History Chart.

60) NAME IN3343.nap
ITEM: 3343
The Level.
As in a menu node, the top left corner of the information node contains a level number. The number corresponds to the color

of the menu in the Menu History Chart.

61) NAME IN3344.nap
ITEM: 3344
The Path.
At the top of the information node box is a path number. This number tells you where you are in the menu history chart. The path number represents the same information in information nodes and menu nodes.

PATH: 34

62) NAME IN341.nap
ITEM: 341
Control.
Inquiry is controlled by mouse input and keyboard input. The keyboard is used to enter menu option names and graphic image names.

63) NAME IN342.nap
ITEM: 342
The Mouse.
The mouse is used to select items from the menu boxes, information boxes and the command menu. It is also used to bring up the Inquiry command menu.

64) NAME IN343.nap
ITEM: 343
The Right Button.
When you click the right button on the mouse Inquiry displays a menu of commands. Use the left mouse button to choose the command.
These commands allow you to move through the tree, link graphic images and menu options, and quit the Inquiry production mode.

65) NAME IN344.nap
ITEM: 344
The Left Button.
The left button is used to select an item in a menu node. Before you can enter a graphic name into an information node or a menu option into a menu node you have to select one of the seven items.

66) NAME IN345.nap
ITEM: 345
The left mouse button is also used to select commands from the Inquiry command menu. The active commands are light blue. The inactive commands are in dark blue. When the cursor is positioned over the active menu options, they are highlighted.

67) NAME IN35.nap
PATH: 35
Inquiry Commands.
When you press the right mouse button, Inquiry presents a menu of the following commands.
1) Up
2) Down
3) Link Graphic File
4) Add Menu Item
5) View Graphic

6) Delete Node
7) QUIT

PATH: 351

68) NAME IN3511.nap
ITEM: 3511
The UP Command.
The UP command is the first command in the command menu.
When you click on this command (left mouse button), Inquiry will bring you up to the previous menu node.

69) NAME IN3512.nap
ITEM: 3512
The UP Command.
The UP Command is only available to you when you are at a node below the root. You can move UP from an information node or a menu node.

70) NAME IN3513.nap
ITEM: 3513
The UP Command.
The UP command, like all commands, is presented in a subdued blue color when unavailable. The UP command is deactivated when you cannot proceed further up the tree, that is at the root.

71) NAME IN3514.nap
ITEM: 3514
The UP Command.
When you travel up the tree, you can see the changes to the Menu History Chart. The menu information at that level disappears when you go up.

PATH: 352

72) NAME IN3521.nap
ITEM: 3521
The DOWN Command.
The second command in the menu is the DOWN command. When you click on the DOWN command, Inquiry will branch down the selected path.

73) NAME IN3522.nap
ITEM: 3522
The DOWN Command.
The DOWN command is only available to you when you are at a menu node. You must have an menu option selected in the current menu node before you can proceed down the tree.

74) NAME IN3523.nap
ITEM: 3523
The DOWN Command.
When you branch down to a node that already exists, Inquiry will display that node box. You will also see updated menu information appear in the Menu History Chart identifying the branch you took.

75) NAME IN3524.nap

ITEM: 3524
The DOWN Command.
When you branch down to a node that does not exist, you must choose to create a menu node or an information node. The menu history chart will be updated accordingly.

76) NAME IN3525.nap
ITEM: 3525
The DOWN Command.
The DOWN command is deactivated subdued when you are at an information node. If you go down at level 4 from a menu node option, you will automatically be taken to an information node.

PATH: 353

77) NAME IN3531.nap
ITEM: 3531
The LINK GRAPHIC FILE Command.
The third command in the Inquiry command menu is the LINK GRAPHIC FILE command. With the LINK GRAPHIC FILE command, you choose a graphic from the browser of available graphics.

78) NAME IN3532.nap
ITEM: 3532
The LINK GRAPHIC FILE Command.
You can link one up to one graphic file name to a menu node.
You can choose up to seven graphic files, one for each item in the node in an information node.

79) NAME IN3533.nap
ITEM: 3533
The LINK GRAPHIC FILE Command.
Menu Node.
When you select a graphic from the browser (left mouse button) to link to a menu node, the name of the graphic will appear just below the path number.

80) NAME IN3534.nap
ITEM: 3534
The LINK GRAPHIC FILE Command.
Information Node.
The four steps to link a graphic file to an information node are:
1) Select one of the seven items (left button).

81) NAME IN3535.nap
ITEM: 3535
2) Bring up command menu (right button).

82) NAME IN3536.nap
ITEM: 3536
Next you:
3) Select LINK GRAPHIC FILE (left button) from the command menu.
4) Select graphic file name (left button) from the browswer.
You will see the name of the graphic appear in the item slot.

83) NAME IN3537.nap
ITEM: 3537
The LINK GRAPHIC FILE Command.
Summary.
The LINK GRAPHIC FILE command links up to one graphic to
a menu node and up to seven graphics to an information node.
The graphics you link to menu and information nodes are
displayed during delivery mode.

PATH: 354

84) NAME IN3541.nap
ITEM: 3541
The ADD MENU ITEM Command.
This command allows you to create menu options in a menu node.
The menu options you create will branch to other nodes in the course tree.

85) NAME IN3542.nap
ITEM: 3542
The ADD MENU ITEM Command.
To add a menu item to a menu node, you must:
1) Select the menu item to add (1 through 7).
Move the cursor to the menu item you wish to
add and click the left mouse button.

86) NAME IN3543.nap
ITEM: 3543
The ADD MENU ITEM Command.
2) Click the right mouse button to bring up the Inquiry command menu.
3) Select the ADD MENU ITEM command from the command menu.

87) NAME IN3544.nap
ITEM: 3544
The ADD MENU ITEM Command.
4) At the prompt, type in (up to 8 characters)
a menu item name and press return.

88) NAME IN3545.nap
ITEM: 3545
The ADD MENU ITEM Command.
This command is only active for menu nodes. The command
is deactivated for information nodes.

PATH: 355

89) NAME IN3551.nap
ITEM: 3551
The VIEW GRAHPHIC Command.
When there are many graphic files in the course, it is easy
to forget the contents of a graphic image file.
This command allows you to look at any graphic in the course.

90) NAME IN3552.nap
ITEM: 3552
The VIEW GRAHPHIC Command.

To view a graphic, click on the VIEW GRAPHIC option (left button) in the Inquiry command menu.

91) NAME IN3553.nap
ITEM: 3553
The VIEW GRAHPHIC Command.
The Browser will be displayed and you can select the name of the graphic you wish to view by clicking on it (left button).

92) NAME IN3554.nap
ITEM: 3554
The VIEW GRAHPHIC Command.
Once you select the name of the graphic to view, the graphic is displayed over all inquiry information. Just click anywhere to redisplay the inquiry information.

93) NAME IN3555.nap
ITEM: 3555
The VIEW GRAPHIC Command.
The VIEW GRAPHIC command is active at all times. You can use this command with menu nodes and information nodes alike.

PATH: 356

94) NAME IN3561.nap
ITEM: 3561
The DELETE NODE Command.
This command allows you to remove an information node or a menu node from your inquiry course.

95) NAME IN3562.nap
ITEM: 3562
The DELETE NODE Command.
To delete a node, move to the menu node above the node to delete. Call this node the parent node.

96) NAME IN3563.nap
ITEM: 3563
The DELETE NODE Command.
The parent node has one option that branches to the node you wish to delete. Select that option.

97) NAME IN3564.nap
ITEM: 3564
The DELETE NODE Command.
Once you have selected the node you wish to delete,
Bring up the Inquiry command menu and select DELETE NODE.

98) NAME IN3565.nap
ITEM: 3565
The DELETE NODE Command.
Inquiry prompts you to confirm the deletion of the selected node.
If you are sure, respond with Y for yes.

99) NAME IN3566.nap

ITEM: 3566
The DELETE NODE Command.
You will notice that the option name will disappear.
You can re-enter an option name using the ADD MENU ITEM command.
From there you can go down and create a new node.

PATH: 357

100) NAME IN3571.nap
ITEM: 3571
The QUIT Command.
The last command in the menu bar is the QUIT command.
QUIT brings you back to Dynamite. From there you can re-enter your
inquiry course via BUILD or create
the graphic images for your course.

101) NAME IN3572.nap
ITEM: 3572
The QUIT Command.
When you invoke the quit command, all the work from the last session is
automatically saved to your course directory.

102) NAME: IN4.nap
PATH: 4
Part 3: Delivery Mode
Once an Inquiry course is completed, it is ready for presentation.
1) Start Up
2) Moving Through a Course

Select START then MOVE.

103) NAME: IN41.nap
PATH: 41
There are two ways to start an Inquiry course.
1) Dynamite
2) OnTrack

Select DYNAMITE or ONTRACK.

PATH: 411

104) NAME: IN4111.nap
ITEM: 4111
Dynamite.
Before you run an Inquiry course in Dynamite, make sure
the course is active. You may have just QUIT from the
Inquiry production mode or just opened the course.
Look at the Dynamite status line for the course name plus the .INQ extension.

105) NAME: IN4112.nap
ITEM: 4112
Like any other course in Dynamite, you can run
the course as it would be presented to the student.
Simply choose the COURSE command in Dynamite and
click on RUN.

106) NAME: IN4113.nap
ITEM: 4113
When you quit from RUN, you will return to Dynamite
exactly as you left it.

PATH: 412

107) NAME: IN4121.nap
ITEM: 4121
OnTrack is a separate program that controls trainees' access
to Dynamite courses. Trainees never need to see Dynamite.

108) NAME: IN4122.nap
ITEM: 4122
To deliver inquiry courses in OnTrack, first
you must ensure that your course is copied
into a course subdirectory in OnTrack. The name of the course
directory must be IDENTICAL to the one in Dynamite.

109) NAME: IN4123.nap
ITEM: 4123
To deliver inquiry courses in OnTrack, the instructor
or manager must register the course and the student in OnTrack.

110) NAME: IN4124.nap
ITEM: 4124
Once the course is copied to its own subdirectory and registered in OnTrack
and trainees registered, the trainees can access the course.
All they have to do is select the name of the course from the browser.

111) NAME: IN4125.nap
ITEM: 4125
For a more detailed description of OnTrack, consult
your Ontrack Instruction Manager's Guide.

112) NAME: IN42.nap
PATH: 42
Movement through an Inquiry course is different for:
1) Menu Node
2) Information Node

Choose MENU or INFO.

PATH: 421

113) NAME: IN4211.nap
ITEM: 4211
Clicking on menu options bring the trainee down the tree.
These options were created by the author and are
contained in the menu nodes.

114) NAME: IN4212.nap
ITEM: 4212
The menu options in delivery mode will appear in the

same order as they were entered in author mode.

115) NAME: IN4213.nap
ITEM: 4213
The UP option is an additional option built in by Inquiry. Clicking on UP will bring the trainee to the previous menu frame (or node).

116) NAME: IN4214.nap
ITEM: 4214
The trainee ALWAYS has the option to quit. A second built-in option available is QUIT. Clicking on this option will end the run session.

PATH: 422

117) NAME: IN4221.nap
ITEM: 4221
Movement through an information node is sequential. A trainee moves one by one through the graphic frames until all the instruction is viewed.

118) NAME: IN4222.nap
ITEM: 4222
The NEXT option will bring the trainee to the next frame in the sequence.

119) NAME: IN4223.nap
ITEM: 4223
The PREVIOUS option will bring the trainee to the frame last viewed.

120) NAME: IN4224.nap
ITEM: 4224
The UP option operates the same way for an information sequence as it does for a menu page - it brings the trainee to the previou menu frame.

121) NAME: IN4225.nap
ITEM: 4225
The QUIT option also operates the same way for an information node as it does for a menu node - it ends the run session of the course.

122) NAME: IN5.nap
PATH: 5
Part 4: Strategy
Here are three of MANY different strategies you can use in your Inquiry course.
1) Standard
2) Pictorial
3) Multiple Choice Questions.

Select an option.

PATH: 51

123) NAME: IN511.nap
ITEM: 511
The Standard Strategy.
The standard inquiry strategy is to construct a course
using a combination of Menu and Information nodes to display instructional
information.

124) NAME: IN512.nap
ITEM: 512
The Standard Strategy.
The standard inquiry strategy is to present all the instruction
in information pages. The menu pages are a means of getting
to the instructional sequence via path choices.

125) NAME: IN513.nap
ITEM: 513
The Standard Strategy.
The material in an instructional sequence is directly related
to the menu option to which it is connected.

126) NAME: IN514.nap
ITEM: 514
The Standard Strategy.
You have witnessed the standard strategy at work in this Inquiry
course on the inquiry structure.

PATH: 52

127) NAME: IN521.nap
ITEM: 521
The Pictorial Strategy.
Another strategy you can implement in the Inquiry structure is
the pictorial strategy.

128) NAME: IN522.nap
ITEM: 522
With the pictorial strategy, you present the user with a labelled
drawing or schematic. Each label in the drawing corresponds to
a menu option in the menu node.

129) NAME: IN523.nap
ITEM: 523
With the pictorial strategy, the author directs the user to choose
a part of the drawing. That is, to select a menu option that corresponds
to the label in the drawing.

130) NAME: IN524.nap
ITEM: 524
Once user selects an option, the course could present another
labelled drawing or a related instructional sequence.

PATH: 53

131) NAME: IN531.nap
ITEM: 531

The Mulitple Choice Question.
Another strategy is to imbed multiple choice questions into your inquiry course.
To build a multiple choice question, simply use a menu node.

132) NAME: IN532.nap
ITEM: 532
The question part is presented in the graphic image (text and/or graphic) that is linked to the menu node using the LINK GRAPHIC command.

133) NAME: IN533.nap
ITEM: 533
The answers to the multiple choice question are presented in the form of menu choices.

134) NAME: IN534.nap
ITEM: 534
The remediation to the question takes the form of an information sequence stored in an information node. If the trainee chooses the wrong answer s/he is automatically branched to a remedial instructional sequence.

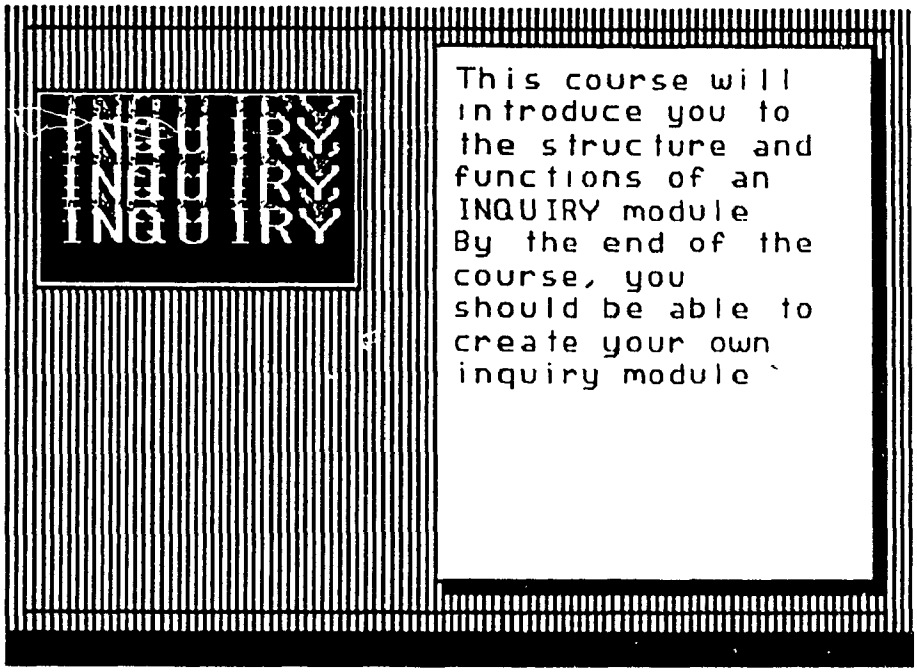
135) NAME: IN535.nap
ITEM: 535
When the remediation sequence is completed, the trainee will return to the original question and can answer it again (or go UP).

136) NAME: IN536.nap
ITEM: 536
For correct answers, you may want to lead the trainee on to another question or advanced instruction.

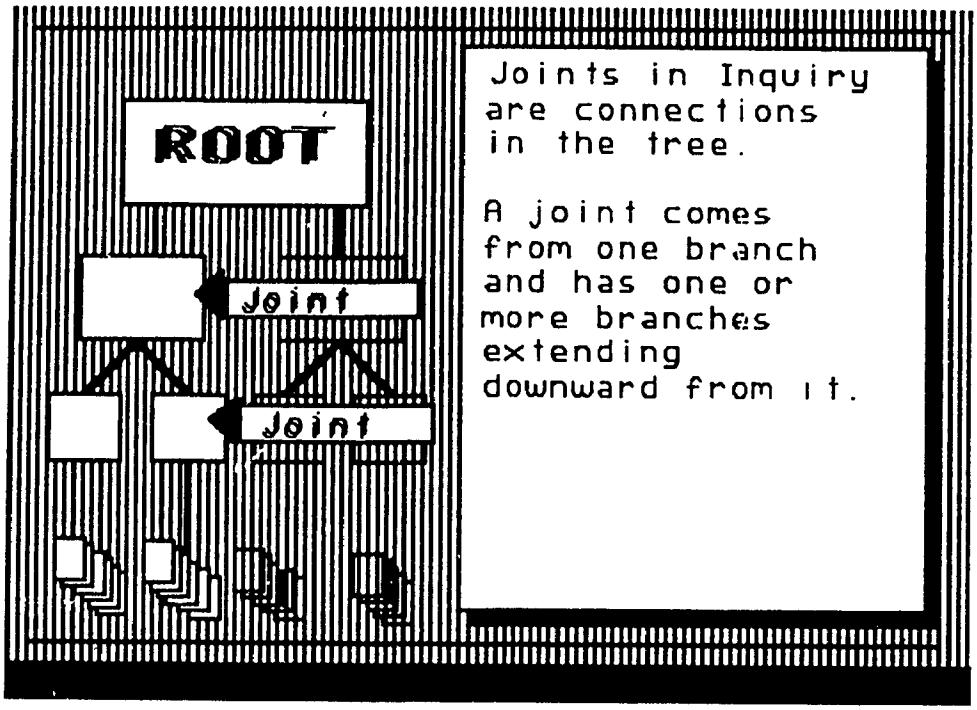
137) NAME: IN537.nap
ITEM: 537
There are many ways to pose questions to a trainee using the inquiry mode. Remember that no responses are recorded for questions posed in Inquiry courses.

Appendix F

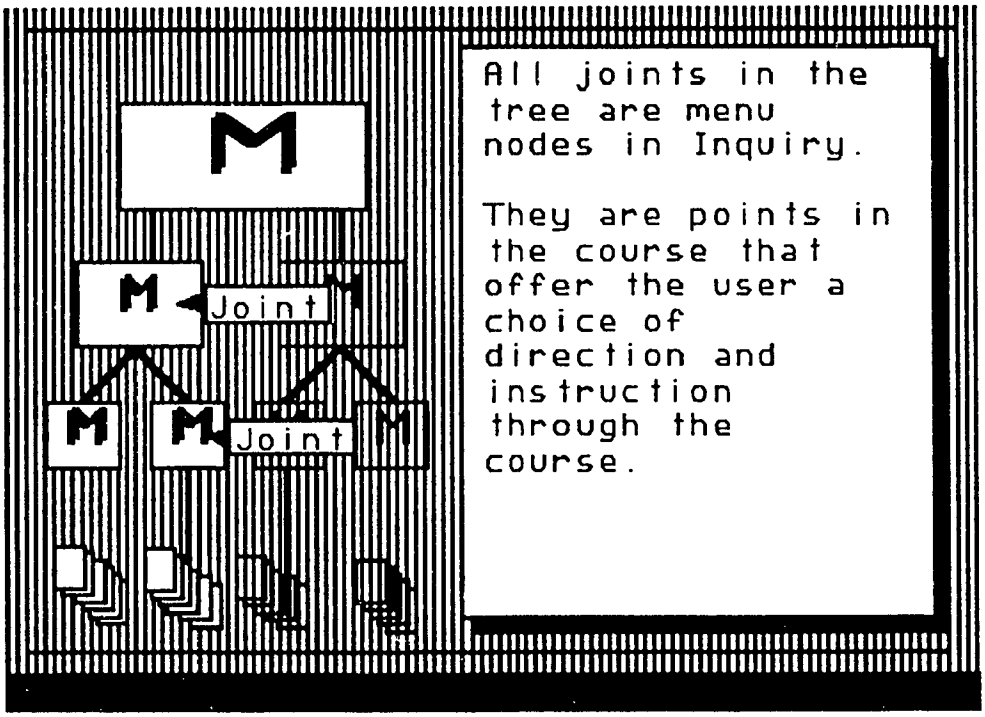
Sample Graphics



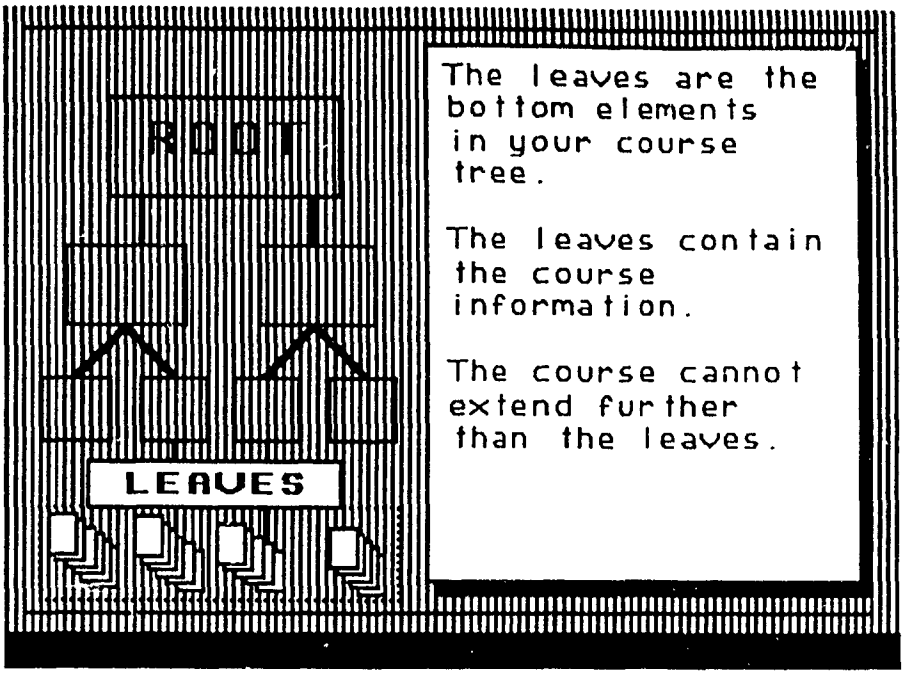
IN111.nap: Objectives



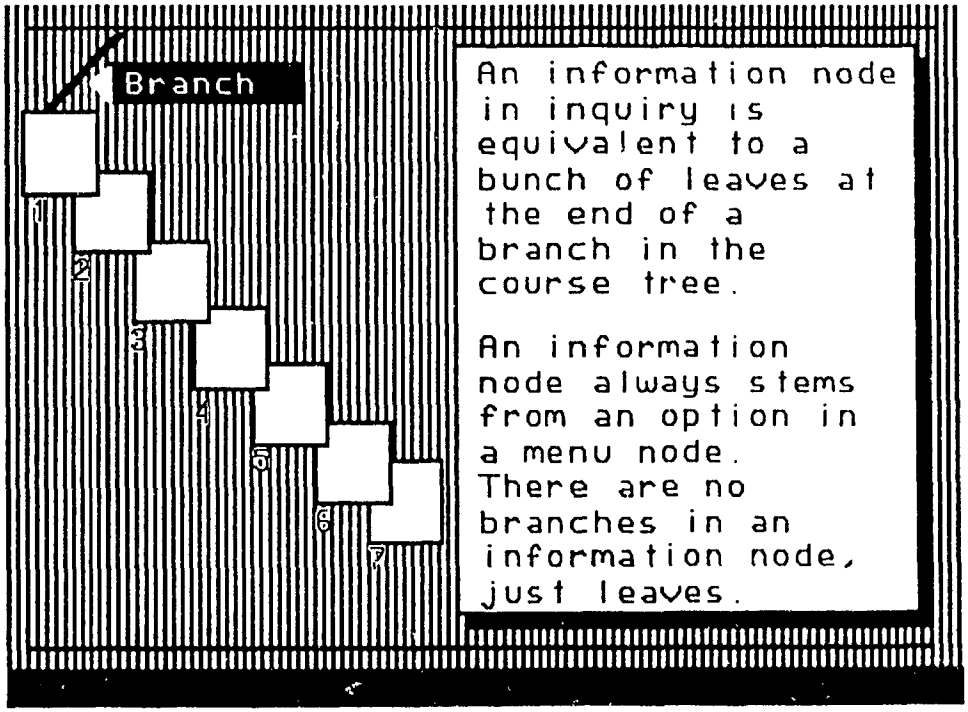
IN214.nap: Tree Analagy - Joints



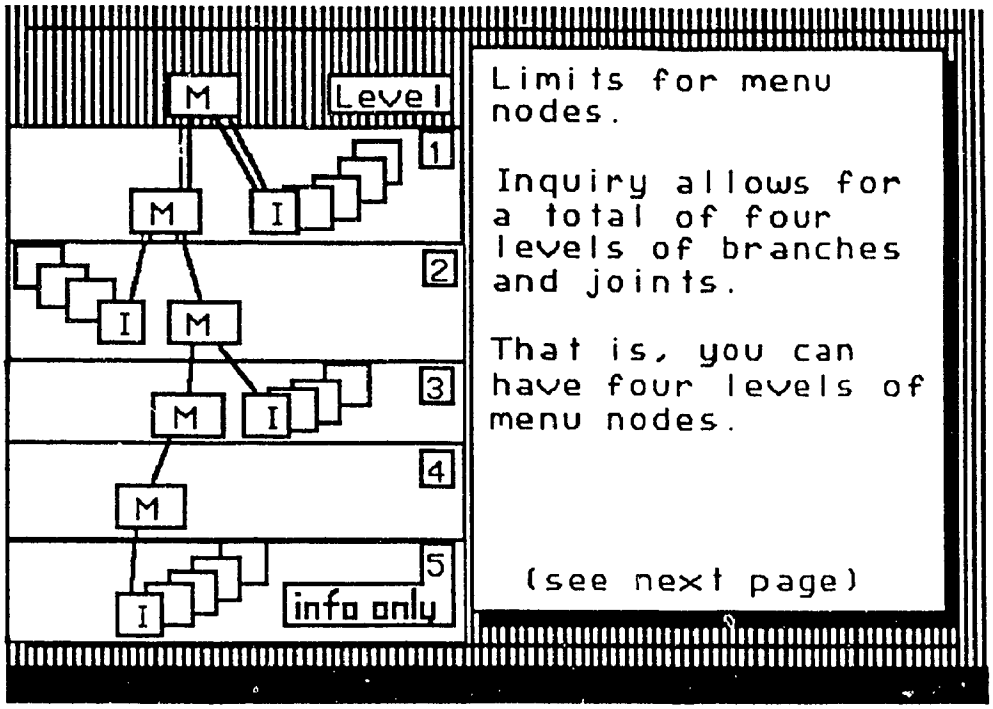
IN223.nap: Menu Nodes - Joints



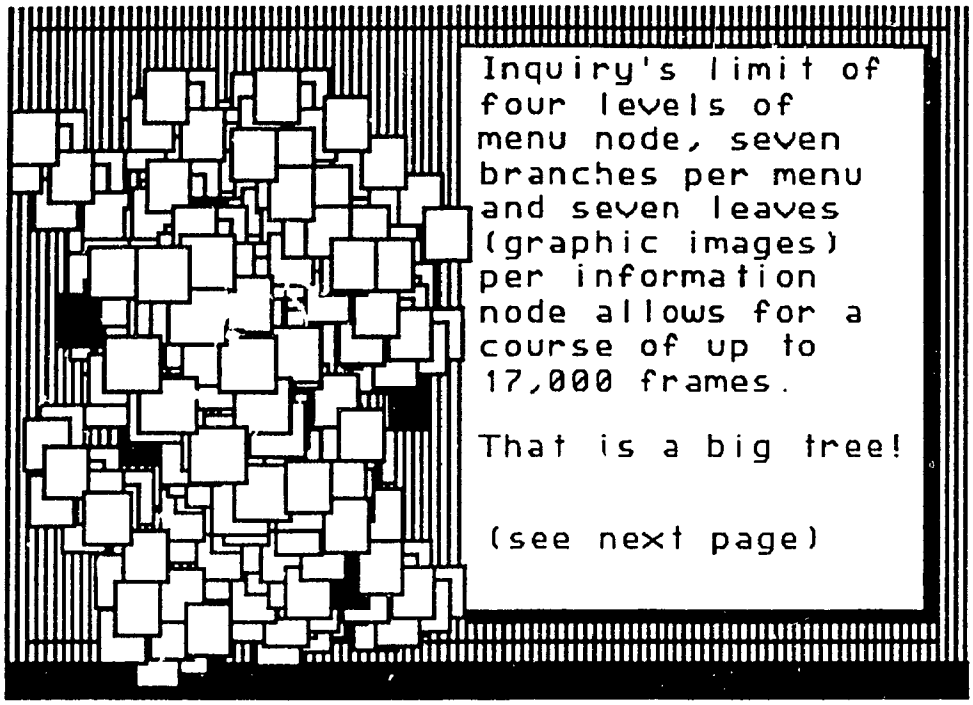
IN215.nap: Tree Analagy - Leaves



IN232.nap: Information Nodes - Leaves

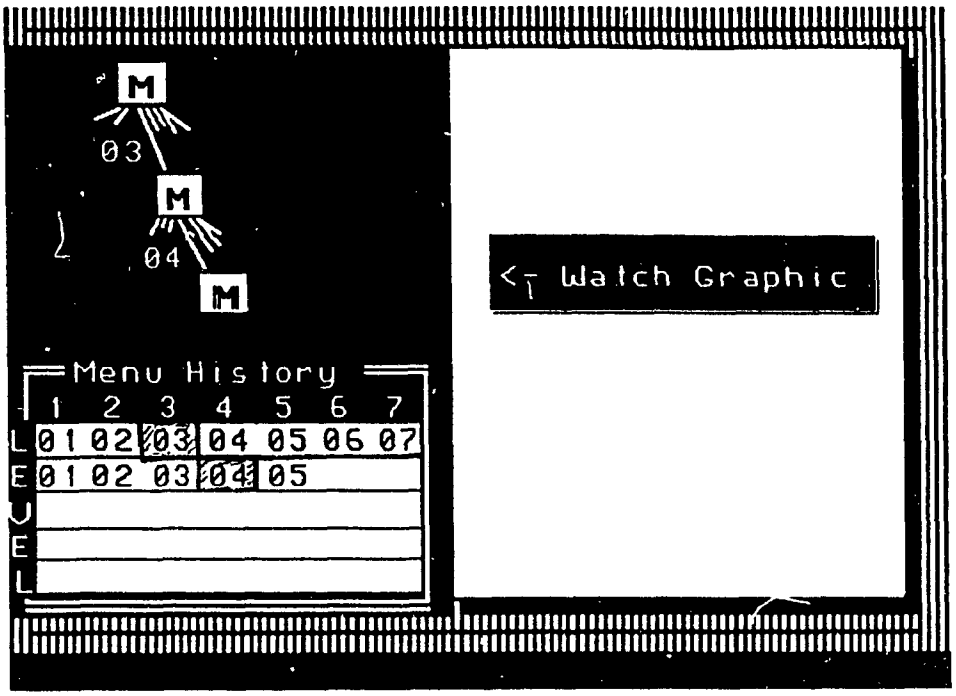


IN242.nap: Limits - Menu Nodes



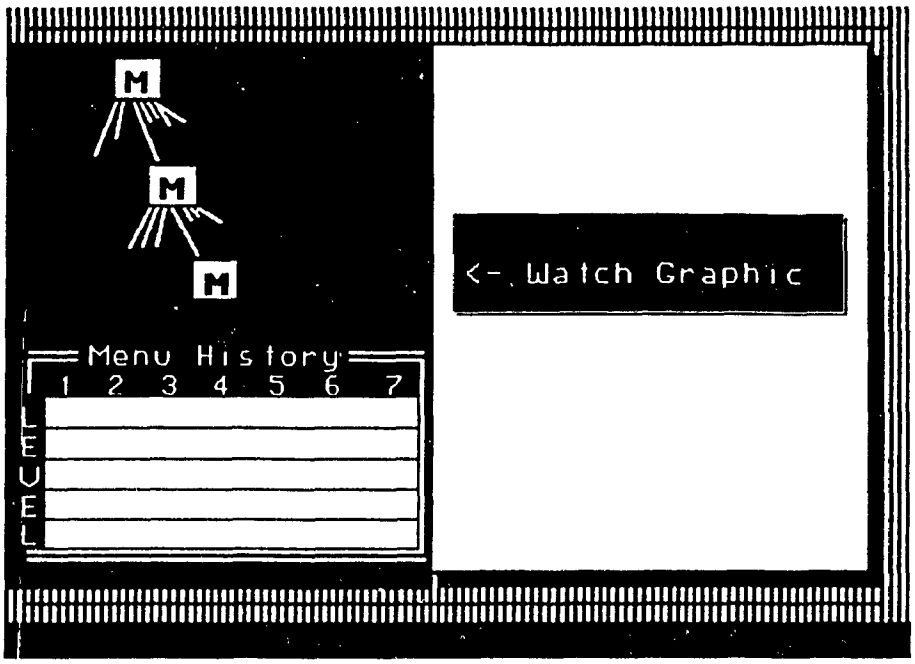
IN245.nap: Limits - Inquiry Tree

This graphic depicts the potentially large size of an Inquiry module. The animation effect had all the pages (squares) dynamically appear one over the other until they were all displayed. The final effect is above.



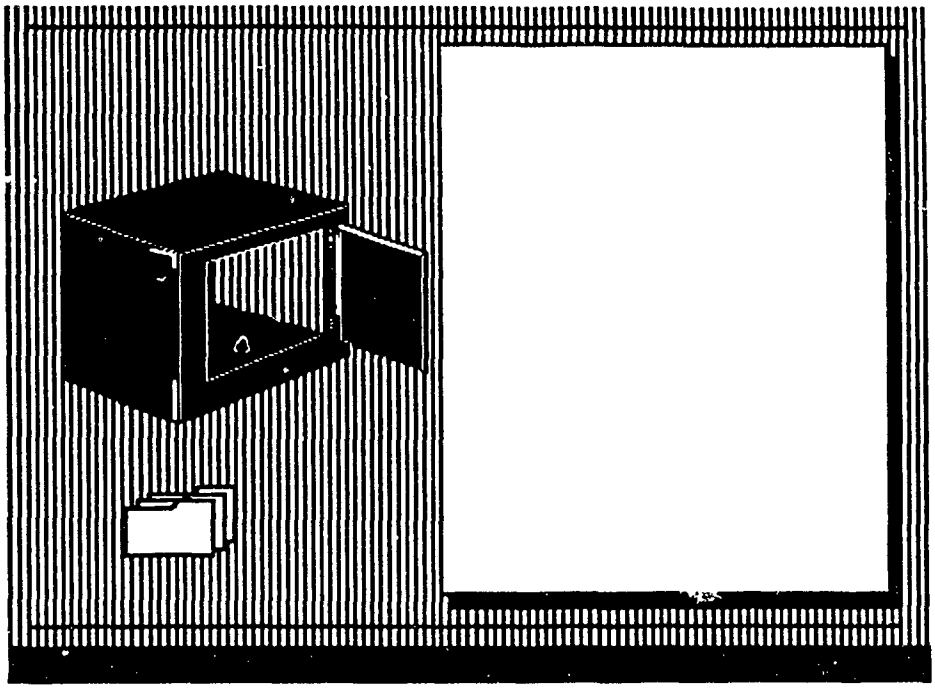
IN3514.nap: Movement - Charts

This next couple of graphics was used to depict the effect of movement through and Inquiry tree as represented in the Menu History Chart. Animation in the form of color change and blinking demonstrated movement down option "3" and then option "4" in a time sequence. At level 1, both the 3rd branch on the tree and the "03" on the chart blink green simultaneously. After a few seconds, the same happens at level 2 for the 4th branch and option "04."



IN3523.nap: Movement - Charts

The reverse animation effect to the previous graphic, IN3415.nap, is used here. Movement back up the tree is represented by simultaneous blinking of a branch and its correspondi ,g option. The resultant graphic, when at the root, reveals an empty Menu History Chart.



IN3573.nap: Save

This "snapshot" was taken mid-way through the graphic's normal presentation sequence depicting an Inquiry "save." In the rest of the presentation sequence, the file folders move into the safe and the safe door is closed.

Appendix G

Sample Evaluation Package

INQI Module Evaluation
November 14, 1989

Introduction:

Before you start I would like to thank you for participating in this course evalation. Your input and feedback are invaluable for improving the module.

The Course:

The course you are evaluating is called INQI. It was developed in the Dynamite Authoring System and is designed to teach you about the Inquiry structure - one of the four strategies available in Dynamite.

What to do:

The session proceeds as follows:

1. Introduction	5 min
2. Pretest questionnaire	5 min
3. The INQI module and exercise	60 min
4. Posttest questionnaire	10 min
5. General Information questionnaire	5 min
6. Debriefing	5 min

The whole process should take no more than 1.5 - 2 hours

Thanks, have fun and Good Luck!

INQI Module Evaluation

Step 2

Pretest

1. Inquiry is a course strategy in Dynamite that is structured linearly as opposed to hierarchically.

   a. True b. False

2. Inquiry is made of two types of nodes: information and menu.

   a. True b. False

3. What is the approximate total number of graphics that you can link in an Inquiry course?

   a. 1
   b. 5
   c. 7
   d. 17,000

4. What is the maximum number of graphics you can link to a menu node in an Dynamite Inquiry structure?

   a. 1
   b. 5
   c. 7
   d. 17,000

5. What is the maximum number of graphics you can link to an information node in an Dynamite Inquiry structure?

   a. 1
   b. 5
   c. 7
   d. 17,000

6. Which Inquiry authoring command would you use to create menu options?

   a. Up
   b. Down
   c. Link Graphic File
   d. Add Menu Item
   e. View Graphic
   f. Delete Node
   g. Quit
   h. None of the above

7. An information node marks the last level of a path.

   a. True b. False

8. The items added using the Add Menu Item command appear as menu items at the bottom of the screen during delivery when the student takes the course.

   a. True b. False

9. A menu node is a sequence of graphic information pages.

   a. True b. False

10. If an information node indicates a path of 243, what was the menu choice at level 2?

    a. 2
    b. 3
    c. 4
    d. 0
    e. None of the above

Step 3
The INQI module and exercise.

To take the module:

1. Click on **COURSE** (left mouse button).

2. Click on **RUN** (left mouse button).

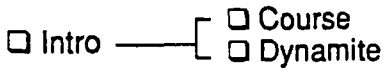
   You will see the first page of the module. Use the *INQI Menu Structure* sheet (next page) to follow through the module. I recommend you go through the module as suggested by the structure sheet - left to right, top to bottom. Check the squares off as you finish each topic. Feel free to make notes on this sheet if you need to.

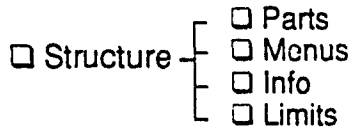
   Take as long as you want and move backwards and forwards through the module. "UP" will take you back to the main menu. You may have to click on it a few times depending on the module level you are at.

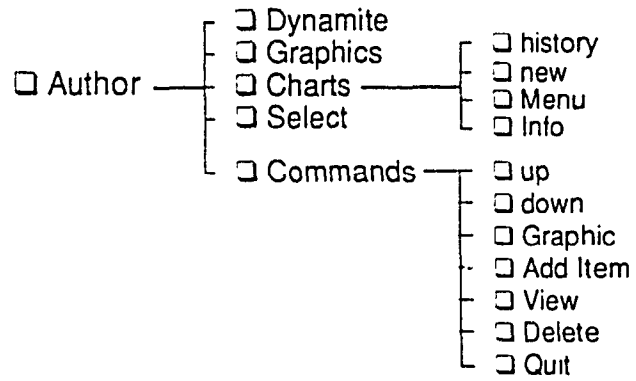
3. Once you have completed the module to your satisfaction get out of the module by selecting the **QUIT** option. You are now ready to complete the exercise.

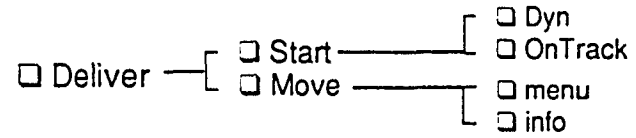
INQI Menu Structure

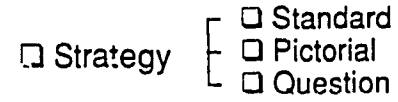
Check off menu choices as you proceed through the course.











Step 3 - Continued
SANDWICH
The exercise:

This exercise involves linking some previously constructed graphics into an Inquiry module. The module is called **SANDWICH**. To construct the SANDWICH module, you must open it, create the appropriate MENU and INFO nodes, and link the graphics using the SANDWICH structure sheet (next page) as your guide.

Please do not laugh at the graphics created for this exercise as they were not produced by our talented graphic artists, but by me.

1. Click on the **COURSE** option (left mouse button).

2. Click on the **OPEN** option (left mouse button).

   You will see the menu history chart and a blank menu node. You are now ready to proceed with the exercise.

REMEMBER:

- *Select* items with the left mouse button.
- Bring up the *command* menu with the right mouse button.

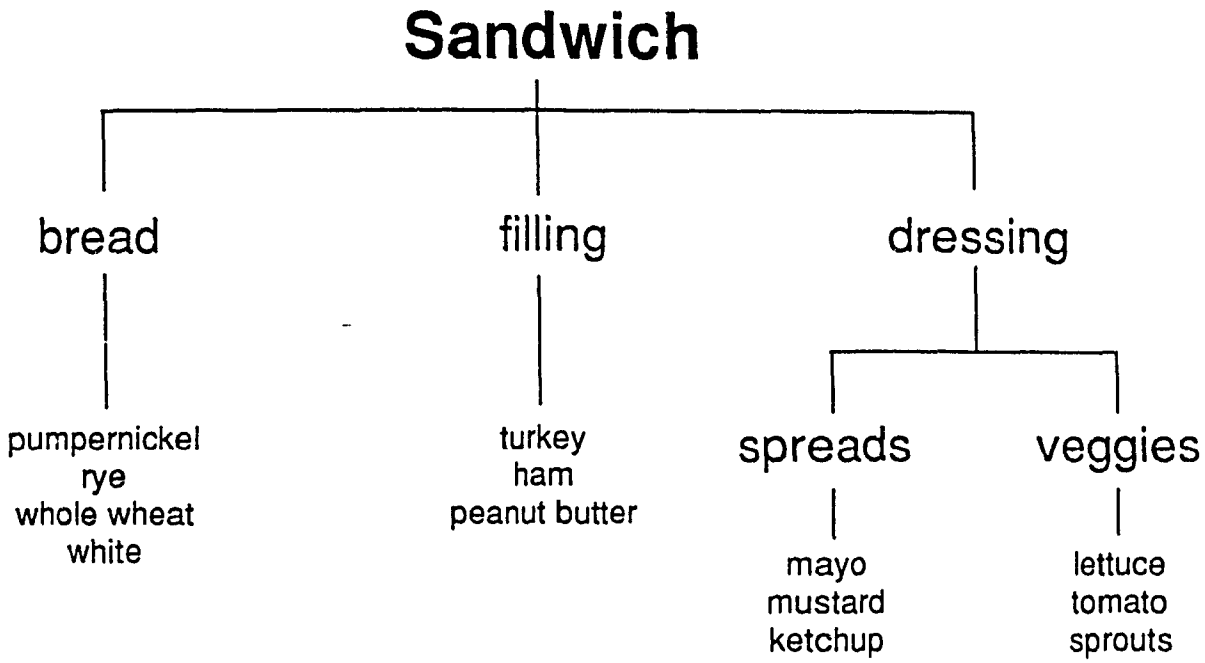
If you want to see how your module works once you've linked the graphics and created the nodes, do the following:

1 Quit from the Inquiry build commands (right mouse button to bring up menu, left mouse button to select quit.)

2. Click on the **COURSE** option (left mouse button).

3. Click on the **RUN** option (left mouse button).

Time for the Posttest and General Information questionnaire.


Sandwich
bread
filling
dressing
pumpernickel
rye
whole wheat
white
turkey
ham
peanut butter
spreads
veggies
mayo
mustard
ketchup
lettuce
tomato
sprouts

INQI Course Evaluation

Step 4

Posttest

1. Inquiry is a course strategy in Dynamite that is structured linearly as opposed to hierarchically.

   a. True b. False

2. Inquiry is made of two types of nodes: information and menu.

   a. True b. False

3. What is the approximate total number of graphics that you can link in an Inquiry course?

   a. 1
   b. 5
   c. 7
   d. 17,000

4. What is the maximum number of graphics you can link to a menu node in an Dynamite Inquiry structure?

   a. 1
   b. 5
   c. 7
   d. 17,000

5. What is the maximum number of graphics you can link to an information node in an Dynamite Inquiry structure?

   a. 1
   b. 5
   c. 7
   d. 17,000

6. How many menu options can you define per menu node?

   a. 1
   b. 5
   c. 7
   d. 17,000

7. Which Inquiry authoring command would you use to create menu options?

a. Up
b. Down
c. Link Graphic File
d. Add Menu Item
e. View Graphic
f. Delete Node
g. Quit
h. None of the above

8. Which Inquiry authoring command would you use to see a forgotten graphic?

a. Up
b. Down
c. Link Graphic File
d. Add Menu Item
e. View Graphic
f. Delete Node
g. Quit
h. None of the above

9. An Inquiry structure can have how many levels?

a. 1
b. 5
c. 7
d. 17,000
e. None of the above

10. To delete a menu or information node you must move to the level below the offensive node and select the Delete Node command.

a. True b. False

11. An information node marks the last level of a path.

a. True b. False

12. The items added using the Add Menu Item command appear as menu items at the bottom of the screen during delivery when the student takes the course.

a. True b. False

13. A menu node is a sequence of graphic information pages.

a. True b. False

14. In an Inquiry course, what is an information node considered if a menu node is considered a joint?

a. branch
b. bunch of leaves
c. root
d. twig
e. None of the above

15. Where does the UP command bring you in your inquiry course?

a. To the previous menu node
b. To the previous information node
c. Niether a. nor b.
d. Both a. and b.
e. None of the above

16. When faced with a choice of creating a new node, and you need one that will branch further down the course tree, you will choose Menu Node.

a. True b. False

17. If an information node indicates a path of 243, what was the menu choice at level 2?

a. 2
b. 3
c. 4
d. 0
e. None of the above

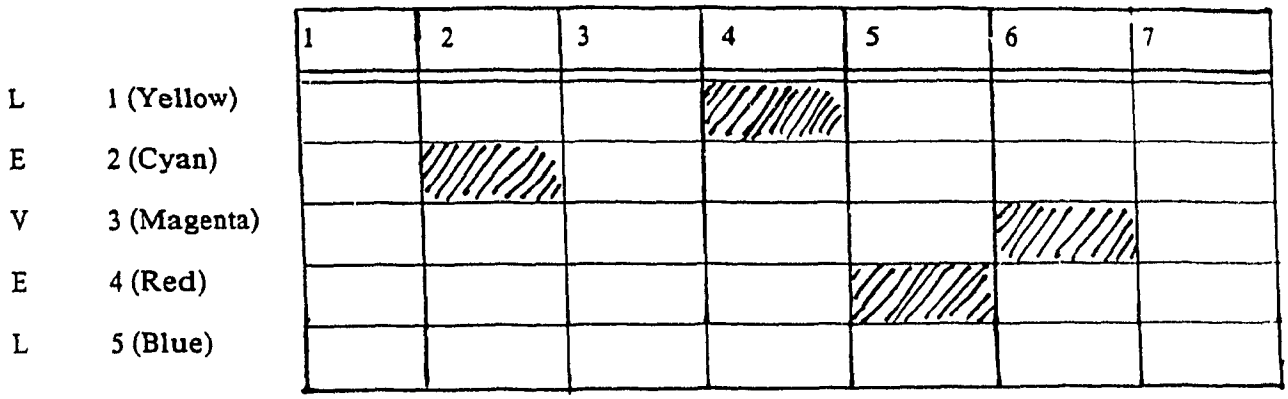
18. The right mouse button is used to bring up the Inquiry command menu and the left mouse button is used to select items.

a. True b. False

19. The INQI course used which strategy?

a. Standard
b. Pictorial
c. Question
d. None of the above

20. Given the Menu History Chart below, what is the path?



INQI Module Evaluation

Step 5

General Information and Attitude Questionnaire
Name: _____ **Date:**_____
Sex(M/F): _____ **Age:**_____

Please answer the following questions to help me understand what you think about the INQI module. Your responses will assist in improving the module.

A. Motivation

1. Did you enjoy the INQI course?

   Very much _____ _____ _____ _____ _____ Not at all

2. Would you take another course as a result of taking this course?

   Very much _____ _____ _____ _____ _____ Not at all

3. Would you like to create a course as a result of taking this course?

   Very much _____ _____ _____ _____ _____ Not at all

4. What kind of course would you like to create?

   _____

B. Objectives

5. Did you realize the purpose of this course was to teach you how to construct Inquiry courses?

   _____ Yes
   _____ No

C. Background

6. Have you ever created any computer-based instruction?

   _____ Yes
   _____ No

7. Have you ever taken any computer-based instruction?

_____ Yes what subject? _____
_____ No

8. Have you ever designed/produced any kind of instruction?

_____ Yes what kind? _____
_____ No

D. Testing

9. How clear did you find the questions on the **pretest**?

Very Clear _____ _____ _____ _____ _____ Very Confusing

10. How clear did you find the questions on the **posttest**?

Very Clear _____ _____ _____ _____ _____ Very Confusing

E. Instruction

11. How interesting was the instruction?

Very Interesting _____ _____ _____ _____ _____ Very boring

12. How clear was the instruction?

Very Clear _____ _____ _____ _____ _____ Very Confusing

If you found any parts of the instruction confusing, please indicate those parts on the **INQI Menu Structure** sheet attached or state them here.

_____
_____
_____
_____

13. How useful did you find the exercise SANDWICH?

Very Useful _____ _____ _____ _____ _____ Irrelevant

F. Overall

14. Generally, did you like the INQI course?

Very much _____ _____ _____ _____ _____ Not at all

15. Did you learn something from the course?

Very much _____ _____ _____ _____ _____ Nothing

16. What do you think would improve the course the most?

_____
_____
_____
_____
_____
_____

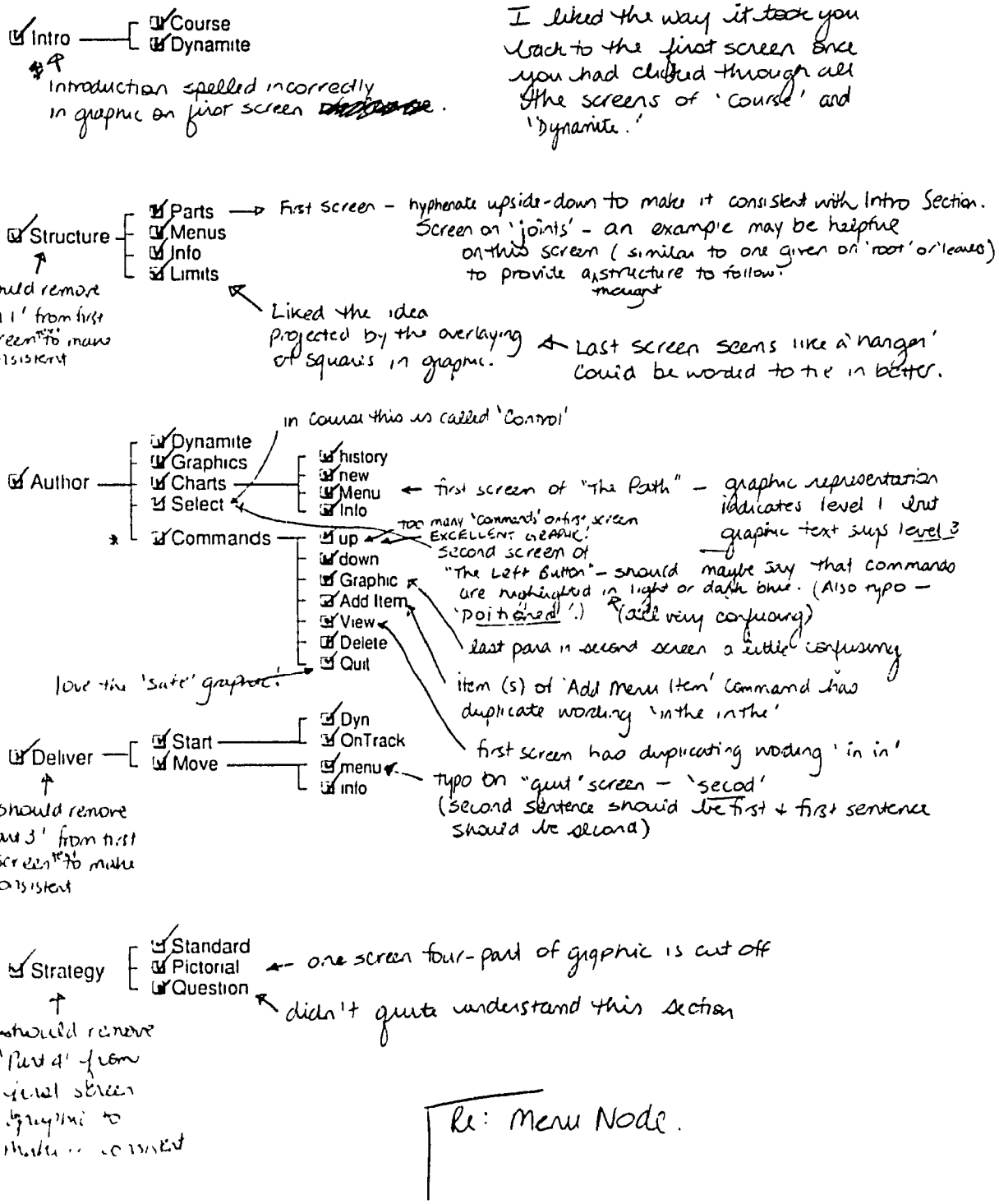
That's it, That's All - Thanks for your contribution!

Appendix H

Sample Course Map

INQI Menu Structure

Check off menu choices as you proceed through the course.



Appendix I

Pretest, Posttest and Exercise Results

Pretest Results

Objective		1			2		3		4		5	# Items passed	%	# Obj passed	%
Item		1	2	3	4	13	5	11	7	12	17				
Student	1	1	1	0	1	1	0	0	1	1	0	6.0	60	1	20
	2	1	1	0	1	1	0	0	1	0	0	5.0	50	0	0
	3	1	1	1	0	1	0	1	1	0	1	7.0	70	2	40
	4	1	1	1	0	1	1	0	1	1	1	8.0	80	3	60
	5	1	1	0	0	0	0	1	1	1	0	5.0	50	1	20
	6	1	1	0	0	0	1	0	1	1	1	6.0	60	2	40
	7	1	1	1	1	1	0	1	1	0	0	7.0	70	2	40
	8	1	1	1	0	1	0	1	1	1	1	8.0	80	3	60
	9	1	1	0	0	1	0	0	1	1	1	6.0	60	2	40
	10	1	1	1	0	1	0	1	1	0	1	7.0	70	2	40
Total Correct		10	10	5	3	8	2	5	10	6	6	6.5	65	2	40
% correct		100	100	50	30	80	20	50	100	60	60				
Average per obj based on item		83			55		35		80		60				
% students passed obj		50			30		0		60		60				

Exercise Results

Student	1	2	3	4	5	6	7	8	9	10
Score	3	10	10	10	10	10	10	2	3	8
Average	8									

Posttest Results

Objective		1					2			3			4						5			# Items passed	%	# Obj passed	%
Item		1	2	3	9	19	4	6	13	5	11	14	7	8	10	12	15	18	16	17	20				
Student	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	18.0	90	4.0	80
	2	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1	17.0	85	3.0	60
	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	20.0	100	5.0	100
	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	20.0	100	5.0	100
	5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	19.0	95	4.0	80
	6	1	1	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	17.0	85	3.0	60
	7	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	19.0	95	4.0	80
	8	1	1	1	0	0	1	1	0	1	1	1	1	1	0	1	1	0	1	0	1	14.0	70	1.0	20
	9	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	19.0	95	4.0	80
	10	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0	1	1	18.0	90	3.0	60
Tot Correct		10	10	8	8	9	8	9	9	10	10	10	10	10	9	10	10	9	7	5	10	18.1	90	3.6	72
% correct		100	100	80	80	90	80	90	90	100	100	100	100	100	90	100	100	90	70	50	100				
Average/obj item-based		90					87			100			98						73						
% students passed obj		80					60			100			90						30						