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The Development, Production, and Evaluation of a Style Manual for
Courseware Production Teams

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A Thesis Equivalent

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ABSTRACT

The development, production, and evaluation of a style manual for courseware production teams

Satrohan Mangal

Much has been said about maintaining consistency in courseware; yet very little has been written on how to ensure consistency, especially among members of a courseware development team working on a common courseware development project. This thesis identifies the main factors which the author feels contribute to consistency, and prescribes a set of guidelines for ensuring consistency as well as the production of acceptable quality courseware. These guidelines constitute the major portion of a style manual which the author has developed to guide the development of courseware to support training for the Tribal Update and Modernization Program (TRUMP), a courseware development team effort involving the development of 300 hours of courseware. The utility of the style manual is not limited to TRUMP alone; other courseware developers may find it useful to the extent that it provides an off-the-shelf set of guidelines to ensure consistency; although some guidelines may have to be slightly modified to accommodate differences in hardware and software capabilities of the computer-based training system selected.

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CHAPTER ONE

STATEMENT OF THE THESIS EQUIVALENT PROBLEM

Every courseware developer has his or her own idiosyncrasies which eventually gets filtered into the courseware he or she creates. While each courseware developer may apply presentation techniques consistently across different pieces of courseware he or/she creates, it is important that consistency in the implementation of certain presentation techniques be maintained across all courseware designers assigned to the same project.

Why Consistency?

There are two main reasons to maintain consistency among courseware developers. First, consistency minimizes the confusion and frustration trainees may experience when they are required to adapt to the idiosyncrasies of different developers as they move from one lesson to another. As trainees interact with new materials, a consistent approach to presentation and cuing enables them to easily concentrate on the instructional message being conveyed. Second, standards for consistency provide direction for courseware developers -- directions which dictate courseware quality and ensure ease of maintenance.

Statement of the Problem

At Litton Systems Canada Limited (LSL), we are engaged in a team effort to produce the 300 hours of courseware for the Canadian Department of National Defence. Among our team are several courseware developers and instructional designers. It is, therefore, necessary for us to take the appropriate measures to ensure that there is consistency among the team members responsible for courseware development. In addition, it is also necessary to prescribe courseware design guidelines which would promote the production of courseware of acceptable quality. Our goal is to develop courseware that is consistent, instructionally sound, and easy for the trainee to use.

LSL is committed to using the Canadian Forces Instructional Systems Design (ISD) model described in the Canadian Forces Manual of Individual Training (CFP) 9000, Volume 1, Part 2 to support training and development for the TRUMP; however, in its current state, the CF ISD model does not prescribe formal guidelines for the development of computer-based training materials. In view of the inadequacy identified in the Canadian Forces Instructional

Systems Design model, there is a requirement for LSL to prescribe their own guidelines with which to maintain consistency across TRUMP courseware and through which to promote the production of courseware of acceptable standards. As Senior Instructional Designer, one of my responsibilities is to prescribe such guidelines. The development, production, and evaluation of a style manual for courseware production teams is the problem of this thesis equivalent.

Solution to the Problem

Based on his experience, the author has concluded that the key factors which support consistency in courseware are: **lesson structure, instructional strategies** and **screen design**. To ensure consistency, as well as the production of courseware of acceptable quality, the author has developed a style manual to guide the development of TRUMP Courseware. This manual contains guidelines which will provide a consistent structure for lesson development. The guidelines contained therein will provide courseware developers with a specific set of organizational and instructional strategies that are easy to understand and implement. Such a structure is critical to the successful completion of any courseware development project. Although there will be many authors writing, reviewing, and revising lessons and several instructional designers critiquing the lessons, all of these activities will occur within the organizing structure of the design guidelines. The design of the resulting courseware will, at least at the gross level, be consistent across lessons. In addition, the style manual contains guidelines which specify the structure and format of the computer-based training (CBT) lessons. Moreover, it provides specifications to guide the design and development of screen displays.

The guidelines have been derived from a review of reports, manuals, articles and book chapters which address stylistic and organizational elements of computer-based training, and from the author's experience. While adherence to these style conventions and guidelines does not guarantee effective courseware, it will ensure that courseware developers apply design techniques which enhance the learning process while avoiding those which obstruct the learning process.

CHAPTER TWO

DESIGN METHODOLOGY

Hartley (1985) pointed out that there has been a resurgence of interest in the topic of writing. Most current work is concerned with how children learn to write but there has also been an interest in how to produce instructional text. The TRUMP Courseware Style Manual is not purely an instructional product as one would view a self-instructional module designed to teach, assess performance, and remediate/enrich. It is intended to be used more as a reference manual than as an instructional product per se. As such, a particular instructional systems design model was not followed in its entirety in the production of the style manual; nevertheless, certain instructional systems design principles inherent in typical instructional systems design models (Andrews and Goodson, 1980; Dick and Carey, 1985) have been applied in the production and evaluation of the style manual. What follows is a description of the design methodology followed to create the style manual. Instructional systems design principles are included in italics in this description.

Hartley (1985) has published a useful description of the process involved in producing instructional text; a process which constitutes the design methodology the author has followed to produce the style manual. Hartley distinguishes between three stages: **pre-design, design, and post-design.**

Pre-design

The pre-design stage is concerned with planning. It is concerned with making decisions about the scope and purpose of the document (*identifying the instructional goal*). The writer needs to know who the document is for (*identifying entry, behaviours and learner characteristics*), how it is likely to be used, what constraints will operate in its use, and what constraints will operate on him or her as writer of the document.

Design

The design stage is concerned with producing the document (*developing and selecting instruction*). It involves writing the appropriate text, organizing it clearly, and presenting it in a clear and simple language with appropriate illustrative materials (*selecting an instructional strategy*).

Post-design

The post-design stage is concerned with editing the document, with testing it with users and revising it on the basis of the results obtained (*formative evaluation*). The aim of post-design is to improve the document -- so editing, testing and rewriting are all positive procedures.

A description of the activities the author performed during each of the above design phases is provided below.

Pre-design

The first task to be completed was the identification of the purpose of the style manual. After a discussion with the CBT supervisor of the TRUMP courseware development team, it was agreed that the objective of the style manual is to set standards of acceptance for TRUMP courseware, and to promote consistency among TRUMP courseware developers in terms of the application of certain courseware design principles. The target audience was, therefore, identified as TRUMP courseware developers.

Learner characteirstics

An analysis of the target audience indicated the following common characteristics:

- have computer science background,
- have courseware development experience,
- have computer programming experience,
- possess no knowledge of the Instructional Quality Inventory (Wulfeck, Richards, Wood, and Merrill, 1978), and
- possess a knowledge of the authoring system and supporting software packages used to produce TRUMP courseware.

In view of the fact that the courseware developers lacked knowledge of the Instructional Quality Inventory, each of them was required to study the manual and seek clarifications from the developer of the style manual.

It should be pointed out that although the style manual was designed with the above learner characteristics in mind, the only prerequisites the intended user should have are:

- knowledge of the Instructional Quality Inventory
- knowledge of the authoring system and supporting software packages used to produce TRUMP courseware.

How the style manual is intended to be used

It was agreed among the decision-makers of the courseware development team that the manual should be used in two ways. Courseware developers will use the manual as a reference for guidelines to follow when producing courseware. On the other hand, in-house CBT experts will use the manual to guide their review of courseware to determine whether the expected standards have been achieved, and whether consistency in the application of certain courseware design principles have been maintained across all courseware developers.

Constraint on the use of the style manual

The primary constraint operating on the use of the style manual relates to the fact that a substantial number of the screen design principles included in the style manual are specific to the TRUMP CBT system hardware and software capabilities.

Constraint on the developer of the style manual

The primary constraint the writer faced when producing this manual was time. A set of guidelines was needed before courseware production commenced; otherwise, there would be a cost impact arising out of revising courseware produced before the guidelines were developed -- courseware which would have not confirm to the standards subsequently set out in the style manual.

Design

The design phase is characterized by two main activities: selecting the content to be included in the style manual, and selecting the appropriate instructional strategy through which to present the content.

Content selection

A somewhat pragmatic approach was taken towards the design of the TRUMP Courseware style manual. Having identified the factors which contribute to consistency and acceptable courseware standards: lesson structure, instructional strategies, and principles of screen design; an analysis was done to identify the key elements associated with each factor. These elements are delineated below.

Lesson Structure
- Components of tutorial lessons
- Components of part-task simulation lessons

Instructional Strategies
- Purpose-objective consistency
- Objective adequacy
- Objective-test consistency
- Test adequacy
- Test-presentation consistency
- Presentation adequacy

Screen Design
- Text presentation
- Graphic/video presentation
- General guidelines for highlighting
- Specific guidelines for highlighting
- Interactivity
- Interactive sequences
- Interactive techniques

In addition, a section on writing style was included in the TRUMP Courseware Style Manual. Although good writing style is not a contributor to consistency, the author felt that suggestions for improving writing style would be beneficial to those who lack experience in writing for electronic media. The elements of writing style which have been considered are:
- Simplicity
- Tone
- Integration
- Sequential arrangement
- Development of relationships
- Transitional techniques

The list of all factors which contribute to consistency and acceptable courseware quality, and their associated elements was submitted to the computer-based training supervisor and the interactive videodisc expert to be reviewed for adequacy. After concurrence was reached on adequacy, a review of the computer-based training literature was conducted in search of empirical data and suggestions which prescribe how to implement these elements. A review of the empirical data and suggestions upon which the design guidelines provided in the style manual were based is provided in the next chapter.

Instructional strategy

After all data and suggestions from the literature were gathered, the next step was to identify an appropriate strategy through which to present the contents of the style manual. Since the style manual is designed to be used primarily as a reference manual, and not an instructional product per se, the author felt that a proper combination of a statement of the guideline, example(s), when appropriate, and illustrations would be adequate information to enable the courseware developer to implement the guidelines contained in the style manual. With the content identified and an instructional strategy selected, the author proceeded to develop a draft of the TRUMP Courseware Style Manual.

Post-design

Post-design activities included a formative evaluation of the style manual. The formative evaluation methodology followed is described in Chapter Four. A summative evaluation was not conducted because of time constraints; but a summative evaluation plan for the Canadian Department of Defence to follow to evaluate the style manual is provided in Chapter Five.

CHAPTER THREE

DERIVATION OF GUIDELINES

In the previous chapter, a list of the factors which contribute to consistency as well as the elements associated with those factors was provided. The elements associated with those factors form the basis of the design guidelines prescribed in the TRUMP Courseware Style Manual. Derivation of these guidelines was guided by empirical data as well as other suggestions made in the CBT literature. This chapter summarizes the empirical data and suggestions made in the CBT literature fromwhich the design guidelines were derived.

Lesson Structure

To facilitate a better understanding of the rationale behind the structure of CBT lessons, a description of the instructional methodology that is currently employed to provide training on equipment/system operation and maintainence procedures in conventional training is provided below.

The trainer first explains the theory behind operation and maintenance procedures, after which he demonstrates to the trainees how to perform the procedure. If the procedure is complex and a part-whole sequencing approach is taken and the equipment is available at the training facility, the trainees may perform the tasks while the instructor demonstrates. After the instructor's demonstration, the trainees will be left alone to perform the task with or without aids as specified in the conditions section of the performance objective. Guidance is provided by the instructor only when necessary. After the trainees have completed the practice exercise, they are required to take a test under the conditions specified in the performance objective. If the equipment is unavailable at the training facility, the demonstration and practice components of training will be provided during on-the-job training.

The approach to training on operation and maintenance procedures described above is a valid one because it contains all of the essential instructional events to facilitate the trainee's acquisition of the lesson objective; the events being:

- explanation of the theory behind operation and maintainence procedures,
- demonstration of the procedures,
- practice of the procedures, and

- testing.

For TRUMP training, whenever there is no equipment/system to support training at the Fleet School in Halifax, computer-based simulations will be used as a substitute for the practical exercise and test. There may be instances in which computer-based training (CBT) lessons may consist of theory alone while in other cases, a CBT lesson may embody both theory and practice. There are, therefore, two types of CBT lessons: one type is a tutorial on theory alone while the other is a combination of a tutorial on theory, and part-task simulations. Part-task simulations refer to simulations designed to provide training on sub-tasks. Military personnel may be required to perform one or more duties. Each duty may encompass several tasks which can be broken down into sub-tasks. Training for some of these sub-tasks will be provided through CBT simulations; hence the term part-task simulation.

The lesson objective of a theory lesson is knowledge-based whereas that of a lesson which comprises both theory and part-task simulations is knowledge-based as well as performance-based. The structure of tutorial lessons is, therefore, different from that of part-task simulation lessons; nevertheless, the components of both types of lessons incorporate the events of instruction recommended by Gagne, Wager and Rojas (1981), namely:

- gaining attention,
- informing the learner of the lesson objective,
- stimulating recall of prior learning,
- presenting the stimulus material with distinctive features,
- providing learning guidance,
- eliciting performance,
- providing informative feedback,
- assessing performance, and
- enhancing retention and transfer.

Appendix I contains the section of the TRUMP Courseware Style Manual which prescribes guidelines for structuring lessons. Underlined sentences, and paragraphs identified by sidebars are not included in the style manual. They are included in this document to support the rationale behind prescribing these types of lesson structures.

The presence of the prescribed components for a particular type of lesson ensures consistency only to the extent that lessons belonging to a particular category will have a common organizational structure. More important, however, is the requirement to ensure consistency

at the lower levels of lesson design. Instructional strategies and principles of screen design are the key contributors to consistency at the detailed lesson design level.

Instructional Strategies

Consistency across courseware is further enhanced when there is uniformity in the instructional methodology adopted by courseware developers. Consistency in instructional methodology promotes quality in instructional design across CBT lessons. This does not prompt; however, a requirement to specify guidelines for the detailed approach to instruction. Such low-level standardization would result in the creation of CBT lessons that are stereotypic to the extent that they invite boredom; not to mention that it would inhibit the creativity of the courseware developers. Courseware developers should be encouraged to apply their unique approaches and different styles to lesson development. The guidelines pertaining to instructional strategies which have been included in the TRUMP Courseware Style Manual; therefore, suggest only general broad-based rules. Nevertheless, when followed, they would ensure that courseware developers adopt instructional strategies which enhance the learning process while avoiding those that hinder learning.

The instructional strategies suggested in the TRUMP Courseware Style Manual have been adopted from the Instructional Quality Inventory (IQI) developed by Wallace, Wulfeck, Ellis, and Richards(1978). The history of the IQI begins with the work of Merrill, Richard, Schmidt, and Wood (1977) who developed the Instructional Strategies Diagnostic Profile (ISDP) under contract to the U.S. Navy Personnel Research and Development Center. Since then, the ISDP procedures have been extensively evaluated through workshop trials (Merrill, Wood, Baker, Ellis and Wulfeck (1977), Merrill and Wood (1977), Wood, Ellis and Wulfeck (1978). As a result of these evaluations, the ISDP was revised and retitled The Instructional Quality Inventory (Wulfeck, et al., 1978).

The reason the IQI was selected to be the basis of the guidelines governing the use of the appropriate instructional strategies in the design of TRUMP courseware is that it in a review of various instructional design models currently being used, this model has been found to be the most comprehensive, thoroughly tested, and adequately documented. The goal of the IQI is to ensure that all elements of a lesson are consistent with all other elements and that each element is adequate in terms of a specific set of criteria established in the IQI. Figure 1 summarizes the essence of this goal. Consistency and adequacy of lesson elements are ensured by analyzing six aspects of instruction.

1 Purpose-objective consistency.- Are the objectives justified? In other words, is the substance of the objective consistent with the purpose of the course?

2. <u>Objective adequacy</u>.- Is the objective adequate? In other words, does the objective contain the characteristics that make it useful for guiding the design of test items and instructional presentations?

3. <u>Objective-test consistency</u>.- Are the test items consistent with justified objectives. In other words, are we measuring the real goals of our instruction?

4. <u>Test adequacy</u>.- Are the test items adequate? In other words, do the test items have the characteristics necessary to ensure that they will adequately test the objective with which they are consistent?

5. <u>Test presentation consistency</u>.- Are the instructional presentations consistent with their corresponding test items? In other words, do the instructional presentations provide the kind of information necessary for the trainee to learn how to perform as required by the test?
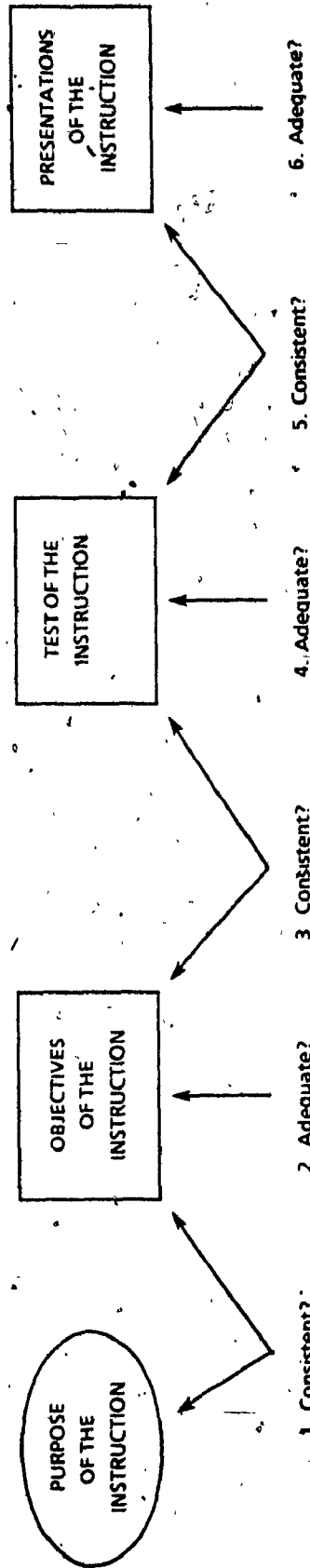
Figure 1

THE GOAL OF THE INSTRUCTIONAL QUALITY
INVENTORY
(from Merrill, Reigeluth, Faust, 1979, p.166)

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6. **Presentation adequacy**.- Is the presentation adequate for effective and efficient learning to occur? In other words, has the student been presented with a complete, concise, easily studied, adequately illustrated and sufficiently elaborated presentation to enable him or her to acquire the desired performance efficiently?

Consistency in instructional methodology ensures that instructional presentations incorporate the required instructional components. Not all task/content levels require all components. Figure 2 identifies which presentation components are required for the three task levels. This means that the presentation must contain certain components depending on the task/content level. There are four main presentation components:

1. **Statement**.- The trainees are given a statement of a fact, a category definition, the steps of a procedure or rule, or a statement of a principle.

2. **Example**.- The trainees are told or shown how a statement of a category, procedure, rule, or principle applies in a specific case.

3. **Practice Remembering**.- The trainees are asked to supply part or all of a fact statement, category definition, the steps of a procedure or rule, or a statement of a principle. The trainee is also given feedback about the correctness of his answers.

4. **Practice Using**.- The trainees are asked to use a category definition, procedure, rule, or principle on a specific case to which it applies, and is given feedback about the quality of his performance.

A component is regarded as being present in the instruction only if it is complete. Figure 3 specifies the elements which must be included in a presentation component before it can be regarded as being complete. In addition to incorporating the appropriate components, a presentation must also meet the following criteria to be consistent:

- Statements must be complete.
- Examples must show application of complete content.
- Examples must match or reflect the conditions and standards required of the objective and test as closely as possible.
- Practice must include feedback.
- Practice must be of the same task/content level as the test item and objective.

- Practice must match or reflect the conditions and standards required of the objective and the test as closely as possible, or be designed to help the student gradually learn to the final task.

TASK LEVEL	STATEMENT	PRACTICE REMEMBERING	EXAMPLES	PRACTICE USING
REMEMBER	required	required	not required	not required
UNE-UNAIDED	required unless the asociated REMEMBER objective was taught recently.		required	required
USE-AIDED	the aid replaces statement	not required	required with aid	required with aid

Figure 2. Required Presentation Components for Task Levels

PRESENTATION COMPONENT	CONTENT TYPE OF THE				
	FACT	CATEGORY	PROCEDURE	RULE	PRINCIPLE
STATEMENT	complete fact presented	all critical characteristics and their combination are given	all steps are given in the correct order	all steps and branching decisions are given in the correct order	all causes, effects, and relationships are given
PRACTICE REMEMBERING	recall or recognition required	recall of concept definition required	recall of all steps in correct order required	recall of all steps and branch decisions in correct order required	recall of all causes, effects, relationships required

For all content types. Practice Remembering items must be the same as the test item. They must be the same format as the test item. All practice items must include feedback.

	FACT	CATEGORY	PROCEDURE	RULE	PRINCIPLE
EXAMPLES	not applicable	examples show all critical characteristics required for classification; non-examples show absence or critical characteristics.	application of the procedure must be shown and steps must be shown in the correct order	application of each step or branching decision must be shown in the correct order	interpretation or prediction based on causes, effects, and relationships must be shown
PRACTICE USING	not applicable	classification of both examples and non-examples is required	all steps must be performed in the correct order	all steps and branching decisions must be performed in the correct order	explanation or prediction based on the principle is required

For all content types: Practice Using items must reflect what is to be done on the job or in later training. The task/content level, conditions, and standards must match the test item and objective. The practice item format must be the same as the test item format. All practice items must include feedback.

For CONCEPT, RULES, and PRINCIPLES: Some practice items should be different than either the test items or the examples. (*Common error items might be the same.*)

Figure 3. Elements Required for a Presentation Component to be Complete.

(Adopted from Wallace, Wulfeck, Ellis and Richards, 1978)

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Instruction can be consistent, but still not teach effectively as it should. In addition to being consistent, a presentation must be adequate. Adequacy procedures incorporate a number of instructional design principles which have been shown to promote learning. These include guidelines for formatting information so that trainees can find it easily, and for communicating it clearly and effectively so that trainees can understand it. The following instructional elements ensure that presentations are adequate.

- Statements, Examples, and practice components must be separated.
- Statements, Examples, and practice components must be labelled so that the trainees know what they are and can locate them.
- The entire presentation must be clearly stated so that the trainees can understand statements, examples and practice.
- Examples should range from easy to hard.
- Examples should be representative of the job the trainee will do after training.
- Examples should show clearly why common errors are wrong.
- Practice items must be free of hints that would not be present in the test or on the job.
- Practice items should have the same format as the format of the test items.
- Practice items should range from easy to hard.
- Practice items should be typical of the job to be performed after training.
- Practice items should include the opportunity for common errors.

The guidelines for instructional strategies provided in the TRUMP Courseware Style Manual are contained in Appendix II.

Screen Design

Effective and successful CBT systems require more than state-of-the-art hardware, adequate content, and effective student evaluation modules- they also require well-designed computer interfaces. The fundamental requirement for formatting display screens is that the student-interface be clearly organized, structured in a form appropriate to the task, easy to understand, and consistent with the knowledge level of the student. Simply providing students with the *right* content and disregarding its presentation may prove to be a waste of time, causing errors to be made both in reading and interpretation. This could lead to student frustration and eventually, disenchantment with CBT. Courseware developers should, therefore, strive for the creation of an interface that provides a friendly medium between the learner and the electronic learning environment through the use of aesthetically pleasing,

cognitively effective, and instructionally accurate screen displays. Well designed screens can be a motivating factor for the student.

Presenting lessons effectively on the screen is one of the central problems in computer-based training. Yet the literature on the design of screen layout to maximize comprehension, and, hence learning, is very small. The literature on screen design consists mainly of one book devoted to the subject (Heines, 1984); a scattering of journal articles, references to screen design in books on computer-assisted instruction and books and papers on designing the user interface for computer use in general.

A small group of researchers (Sherr, 1979; Shoutleff, 1980; and Galitz, 1981) have, over the past decade, exerted significant efforts on the area of screen and human factors design. They have proven that good screen design can represent a critical factor in the interface between man and machine. As a result, thoughtful utilization of text and graphics has proven to be beneficial in aiding insight and understanding the relationship between concepts; and valuable in illustrating processes (Kearsley and Hillelsohn, 1982). Hence, the quality of screen design has been shown to be a strong encouragement to improved performance when it maintains the interest of the user while also lowering the chances of confusion' eye strain and fatigue caused by poorly designed information displays. From this we can gather that screen design should involve fundamental design principles and visual factors related to visual attributes and locations of textual and graphic elements.

Fifty to sixty per cent of TRUMP courseware will incorporate interactive videodisc sequences. The instructional design of interactive videodisc courseware should reflect many of the screen qualities of any other form of instruction or training, including the proper sequencing of content, as well as the necessary visual considerations. Visual communication principles and visual factors research findings must be used when developing computer screen displays for interactive videodisc systems.

In creating the TRUMP Courseware Style Manual, emphasis was placed on guidelines governing the presentation of two types of content on the screen: text, and graphics/video.

Text Presentation

Allison and Trollip (1985); Fleming and Levie (1984); and Merrill, (1982) suggest that textual screens should be pleasing, and easy to read, with no annoying features. Heines (1984),

identifies four factors contributing to the readibility of text: **type style, line length, justification, and break points**.

Type style.- Tinker (1963) points out that text which is printed completely in upper case is less legible than text printed in lower case, or normal mixed-case. Legibility here means the visual factors related to how well text can be seen and physically read with ease. Levels of legibility are higher when lower case or mixed-case text is used for screen design because variation in text introduces variation of shapes; words are perceived by shape and outline and not letter by letter. Mixed-case text, therefore, provides optimum levels of legibility when used for titles, subtitles and bodies of text.

Line length.- Heines (1984) points out that the shorter a line is, the easier it is to read. Since long lines require excessive eye movement and it is difficult to move in a smooth way from the end of one line to the beginning of the other; about eight to ten words per line seems best for a computer screen, bearing in mind the problems with the medium (relatively uncomfortable viewing angle and luminous screen display with a fair amount of screen glare.

Justified or unjustified text.- Research on the justification of text has produced mixed results. Biggs (1968) suggested that unjustified text is harder to read than justified text. Some research results, however, suggest that unjustified text is no more difficult to read (Hartley and Burnhill, 1971; Hartley and Mills, 1973). Zachrisson (1965) and Gregory and Poulton (1970) found that justified text hinders less proficient readers but has no effect on good readers. Muncer, Gorman, Gorman, and Bibel (1986) found that the decrement in reading speed for justified text to be greater for good readers than for poor ones (but there was a decrement for both types of readers). In another study, Trollip and Sales (1986) compared the reading rate of two groups of university students reading ragged-edge and fill-justified (all lines printed with their left and right lines aligned). The groups reading the fill-justified text read significantly more slowly than their counterparts who read ragged-edge text It seems that fill-justified text is disruptive to fluent reading.

Line-break points.- The question of justification is to a large extent confounded with the question of where in the text to break the text into lines. Phenomena which are attributed to the presence or lack of justification in text may in fact be due to the good or poor choice of points at which to end lines. Some suggestive evidence is evinced by Hartley (1980) who claims that line breaks should follow the syntax of the text rather than being determined solely by the width of the page. Bork (1982) produces evidence to support this claim, and that

evidence shows that poor readers are more favourably affected by this layout than good readers.

In addition to Heine's four factors, **leading** also influences the readibility of text. Leading is the insertion of space between lines. Leading is often referred to as single or double spacing of lines of text. Early research with printed text supported the notion that leading improves legibility, though often the improvement was not found to be significant (Huey, 1908). The results of recent research, however, have revealed that leading has an important influence on the legibility of text. It may increase perceptual span by reducing the effects of **lateral masking** Tinker, 1963). Lateral masking distractions are caused by characters in adjacent lines, thereby interefering with peripheral vision (Kruk and Muter, 1984; Van Nes, 1986). Peripheral vision is important since it may help to guide the reader's eye movements and integrate information from one fixation to another (Rayner, 1978).

Studies related to the effects of leading on reading computer displayed text generally support the findings from printed text. Hartley (1979) stated that for printed text the optimum space between lines of text is obtained by inserting a line of space equal in height to the width used for word spacing. Reading efficiency has also been shown to improve when text presented on a computer screen display is double-spaced as opposed to single-spaced (Hathaway, 1984; Kolers, Duchnicky & Ferguson, 1981; Kruk & Muter, 1984). With single spacing, more fixations per line are required. Each fixation contains fewer words and , consequently, reading time is increased.

The following questions were considered when precribing guidelines for text presentation in the TRUMP Courseware Style Manual:
- How much text should appear on a screen?
- Should text be justified (filled by spacing so that text runs completely form one margin to the other)
- What principles should determine the overall layout, that is, the way blocks of information are placed on the screen?
- How can colour be used for highlighting text?

Several guidelines pertaining to the formatting of textual displays were derived from the literature and incorporated into the TRUMP Courseware Style Manual. These guidelines are presented in Appendix III.

Graphics/Video

So far in this chapter, guidelines pertaining to text presentation have been considered. The next aspect of screen design to be addressed is the presentation of graphic/video materials. Marcus (1977) defines computer graphics as *any kind of imagery mediated or generated by computer control and most appropriately, but not exclusively, displayed on cathode ray tube screens*. From time to time, we are forced to abandon words and adopt graphical means of communication because of our own mental limitations. There is a simple explanation for this: our capacity to remember raw, unprocessed information is very limited. The limited capacity of working memory (usually referred to a s short-term memory) can frequently impair our ability to understand information, to solve a problem, to investigate and explore, or to carry out other kinds of thinking. The importance of graphic information is that it frequently removes this memory limitation. Graphic displays are thinking aids. We often use them because they communicate ideas which are too difficult to put across in words alone. Phillips (1986) recommends that the incorporation of graphics in courseware should be guided by three principles: parsimony, accessibility, and reflection.

Parsimony.- A display should present no more information than is necessary. There is no doubt that the more information a screen contains, the harder it becomes to locate any particular information.

Accessibility.- The design should allow the trainee to switch attention between the different parts of the display with minimum effort.

Reflection.- The trainee must have the time to reflect upon and interpret the display.

In view of these recommendations as well as others suggested by Braden 1982,1986; Braden & Walker, 1983; Dwyer, 1983; Miller, 1956; and Olson & Miller, 1985; the prescriptions contained in Appendix IV (underlined text excluded) have been included in the TRUMP Courseware Style Manual to guide the display of graphics/video materials:

Highlighting

Another design principle which impacts good screen design is the use of colour for highlighting text and graphics. Colour can be a powerful communication tool when used properly. Colour has the dynamic power to change the entire condition and atmosphere of a screen display and can motivate and evoke a large range of physiological responses. Colour can aid memory and enhance the understanding of instruction. Unseasoned use of colour selections and

combinations may interfere with the real intention to communicate information. Colour can enhance the effectiveness of information. Improper use of colour; however, can seriously impair communication. Misuse and misunderstanding of the use of colour is common. Effective use of colour requires an awareness of certain principles. It is, therefore, important to establish and follow some basic guidelines for effective colour usage.

The use of colour is partly a subjective matter; people have their own preferences. Nevertheless, there are some factors which have an objective basis. In particular, questions of perceived sharpness, contrast, and saturation profoundly affect reading from the computer screen for long periods. Basically, effective colour usage depends upon matching the physiological, perceptual, and cognitive aspects of the human visual system. On the basis of some well documented aspects of the visual system capacities, Murch (1985) suggests some basic principles to guide the effective use of colour. These principles have been grouped into three categories: **physiological, perceptual,** and **cognitive.** Murch's recommendations constitute the majority of the guidelines governing colour usage included in the style manual. Guidelines regarding the use of colour that have been included in the TRUMP Courseware Style Manual are presented in Appendix V. The reader should take note that underlined text have not been included in the style manual. Moreover, final decisions yet to be made are identified as TBD. These decisions will be made shortly and will be incorporated into the final submission of the thesis.

Interaction Techniques

Interactivity. Another screen design principle which contributes to the creation of a good computer-learner interface is the use of interaction. Interactive lessons are those in which the learner actively or overtly responds to the information presented by the technology which in turn adapts to the learner, a process more commonly referred to as feedback (Jonassen, 1985). Interactivity encourages active learning. The learner becomes an active participant, rather than a passive observer, making significant decisions and encountering their consequences. Interactivity enables learners to adjust the instruction to conform to their needs and capabilities.

One measure of how courseware engages the learner in the instructional sequence so that he or she is actively engaged with the content is the number of interactions occurring per unit time. Some CBT authors recommend one interaction for every three minutes; others suggest an interaction for every three screen displays. It is the author's experience that these

guidelines can be impractical at times in that they place unnecessary restrictions on the courseware developer. A courseware developer should not have to design a lesson around frequency of interaction. A more important factor to be considered is how important it is to verify that the trainee has understood the content of the current segment of the lesson before proceeding to the next segment. If the content covered in the current segment is deemed a prerequisite to learning that in the next segment, then one should provide interaction through questions and/or graded practice exercises to ensure mastery. Although the quantity of the learner's responses is a significant indicator of interaction, if most of those interactions are motor responses and not tied in with the learning, then the interaction rate loses its importance. Interaction must be directly related to the objective of the lesson; yet not be trivial. Hall, Comer, and Merrill (1982) captured the essence of this principle when they said:

> Research has consistently shown that deep cognitive processing by the learner is a prerequisite for learning. Deep cognitive processing does not necessarily take place while the learner watches a program execute on a computer; rather asking questions which causes the learner to manipulate the content material in ways that he has not been directly taught is a more reliable method of causing deep cognitive processing. Questions which cause the learner to perform at successively higher and higher levels of cognitive activity are the hallmark of CBT materials.

Bork (1982) has stressed that the quality of the interaction in courseware can be assessed in terms of the type of input required of the learner during the interaction, the method of analyzing the response, and the action taken by the courseware after the input. Bork maintains that the quality of the interaction in the design of the courseware is the important determinant of the quality of the courseware produced. Thus, the effectiveness of the courseware is a function of the quantity and quality of interactivity techniques which must function together to ensure comprehensible instruction.

The methods for providing interaction have been included in the TRUMP Courseware Style Manual are reproduced in Appendix VI.

Writing Style

Strunk and White (1979) define style as a quality of sentence structure and word choice that demonstrates a writer's sensitivity to the rhythms and richness of language. Strunk and White 1979; and Bell and Corbett (1982) identify various factors which, when taken together, are thought of as contributors to good writing style. Of these, there are three factors which

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seem to be most important when developing text: **simplicity, tone, and integration**. Attention paid to these factors during the scripting and storyboarding phase of development will reduce the amount of time spent on revision. The first factor to be considered is simplicity.

Simplicity

Simplicity is a clear and concise style of expression. It is a clean-cut, precise method of communication. It results in short, uncomplicated sentence structure. Well written text exhibits simplicity of sentence structure as its dominant characteristic. Simplicity of sentence structure results in clarity of meaning. Complicated, unclear sentences force the trainee to hunt for the content; thereby increasing the time, effort, and concentration involved in learning- - to the detriment of lowered motivation. By keeping the sentence structure simple, the content is made readily available to the trainees, allowing them to concentrate on that alone. There are three ways in which simplicity can be achieved.

1) Based on studies by Caldwell (1980) in the area of typography and screen design, an emphasis should not be placed primarily on reading speed, but on the ability of the courseware designer to make reading easier and at the same time maintain the interest of the reader in the CBT environment. Hence, *chunking* large portions of course materials into smaller units has been shown to improve visual clarity and result in improved retention of information in a complexly structured instructional segment. One of the easiest ways to keep the text simple, therefore, is to present the information in small, succinct units. Thus, the courseware developer must make several statements, each concise and clear, instead of one or two elaborate, complicated, and potentially confusing statements.

2) Another method used to simplify text is to review it after writing, primarily for removing unnecessary verbiage.

3). Unnecessary repetition is another source of poor sentence structure. Common examples of repetition are the use of modifiers which are redundant.

Tone

The second factor which contributes to good writing style is tone. The feeling evoked by the language used in a presentation is determined by its tone. How a statement sounds to the reader is the tone of the statement. Tone is entirely under the writer's control. Tone can be flowery, pretentious, imposing, or informal.

Tone can be used to motivate the trainee and to generate a favourable attitude towards the lesson; and can be used to provide the interest required for the trainee to actually participate in the learning process rather than merely having the process applied to him.

If the presentation is flowery, the trainee will have trouble perceiving the relevant content, will find it hard to concentrate only on the necessary information, and will encounter difficulty in organizing and recalling the material presented.

If the presentation is pretentious, the trainee will quickly see through it and wonder what it is you are hiding. This will lower your credibility to the trainee.

If the presentation is too imposing, the trainee will become discouraged, will feel that the presentation is over his head, and will ultimately feel that he has been left behind; Recovery from these circumstances is doubtful and poses an unnecessary hardship to the trainee.

An informal tone will set the trainee at ease and enhance the transmittal of information. It will eliminate confounding factors such as misunderstanding, inattention, irritation, or boredom.

Integration

The third factor which contributes to good writing style is integration. Integration of material means that the parts of the material form a unified, harmonious whole. Integrated material is tied together in various ways. No matter how much knowledge you possess within your subject area, the trainees will think your presentation is bad if your text is not well organized. Integration of the material into an orderly presentation enhances organization The integration of subject matter within a presentation has a direct bearing upon how well the trainee is able to perceive your intent. The three most common methods of integrating material are sequential arrangement, development of relationships between items of specific content, and use of transitional techniques between items of text.

Sequential arrangement

Sequential arrangement of the material cues the trainees about the relative importance of specific items and helps them to organize the material for later synthesis. The sequential arrangement of material is one of the most flexible aspects of developing text; as such, only a few guidelines have been included in the style manual. These guidelines may seem obvious; nevertheless, they are important and should be noted.

Development of relationships

The development of relationships between specific content items also facilitates synthesis and will help the trainee retain the information imparted. Poor development of the relationships give the various elements of the presentation the appearance of random, disjointed ideas.

Transitional techniques

A sentence or a paragraph rarely stands alone. Transitional techniques are used to tie the text together and mould it into a cohesive presentation. Lack of transition makes it difficult for the trainee to view the presentation with a sense of continuity.

In view of the recommendations made in the literature, the prescriptions contained in Appendix VII were included in the TRUMP Courseware Style Manual to promote effective writing style:

CHAPTER FOUR

EVALUATION METHODOLOGY

Evaluation has been defined as the systematic assessment of the worth of something in order to provide a base for informed decision-making. In the early phases of development, evaluation is used to identify those aspects of an innovation that require revision. Its purpose is to provide feedback to the developer, on the basis of which, the innovation will be revised. Evaluation serving such a role has been called concurrent, formative, or process evaluation (Dyer, 1966; Scriven, 1967).

After the innovation has been developed and its procedures defined, data must be gathered to assess its utility. In such a role, evaluation is concerned primarily with effects of the innovation procedures in the target population. The data gathered serve as inputs to the developer, on the basis of which, the developer may decide to disseminate, redevelop, or phase out the innovation. In any case, a value judgement concerning the worth of the innovation is made. The type of evaluation that serves this role has been called *ex post facto*, summative, or product evaluation (Dyer, 1966; Scriven, 1967).

Formative Evaluation

Formative evaluation is a critical component of the systematic design of instruction -- indeed it is this element that most distinguishes systematic design from other methods of developing instruction (Geis, 1987). The literature on formative evaluation indicates that instructional materials should be reviewed during their development in order to improve them (e.g., Andrews and Goodson, 1980). Geis (1987) reminded us that although our intuitions, our practices, and the literature strongly suggest that formative evaluation improves the product, there is relatively little research evidence to support such faith. Weston (1986), in a comprehensive discussion of formative evaluation, mentions few studies which show in general that formative evaluation leads to a more effective instructional product (e.g., Abedor, 1971; Baker, 1970; Wager, 1983). In conclusion, although the evidence is supportive, it is still meagre.

Almost every heuristic for the systematic design of instruction includes the activity of formative evaluation (Andrews and Goodson, 1980). Standard textbooks on instructional

design such as Dick and Carey (1985) and many articles (e.g., Geis, Burt and Weston, 1984; Henderson and Nathenson, 1976; Komoski, 1983; Stolovich, 1982; Thiagarajan, 1978) contain descriptions of how to formatively evaluate instructional materials. Included in these textbooks and articles are discussions of aspects such as what types of subjects to use, how many to use, how often to conduct tryouts, what data gathering techniques to use, and what kinds of data to collect. Several aspects of formative evaluation are summarized below.

Test population

Test subjects should be representative of the target population. Furthermore, it is suggested that the subject-pool include high, low, and medium ability learners.

Size of test group

While some authors prefer one-to-one , others opt for small groups. More often, however, the recommendation is to use both both one-to-one and small groups during formative evaluation. Several one-to-one sessions should be conducted, each using a different subject. Small groups generally consist of three to ten subjects.

Role of participants

A number of authors suggest a clinical approach to the test-sessions. Subjects are asked to go through the instructional materials, indicating difficulties when they occur; commenting on possible causes of such problems; and even acting as co-authors by suggesting changes which would improve the materials (Scott and Yelon, 1969). In such sessions, the developer is likely to actively engage the subject; probe for problems and sources of confusion; and request suggestions for improvement. Data emerging from the clinical approach are informal and qualitative.

At the other extreme, the subject is treated as a traditional student. A pre-test is administered after which the subject is asked to go through the materials the best way he or she can. The subject may be asked to write comments on the pages of the materials as he or she progresses. After completing the instructional materials, the subject is given a post-test. The developer's role is generally perceived as passive; he or she simply monitors the session. Data gathered from this approach are primarily quantitative.

Debriefing

After the tryout session, the developer should meet with the subjects for a discussion of the comments the subjects have made and/or the test results. Attitudinal data may also be gathered during the debriefing session.

Types of data

Subjects may have written down their comments or they might have been noted down in writing by the developer. Additional observations might have been noted by the developer, e.g., that subjects always seem to stop and look puzzled at a certain point in the materials. *Soft data* of this type may require extensive analysis before thet can be utilized in the revision process. Attitudinal data may be collected informally, by asking subjects during the debriefing or formally through a questionnaire. Test data may be gathered through pre- and post-tests. Demographic data such as years of experience on the job or other courses taken may be collected.

When to stop?

Typically after completing a session and debriefing, a revised version of the instructional materials is prepared and it is then tested in another subject or group. At what point does the developer conclude that enough formative evaluation has been conducted and that the material has been satisfactorily revised? These are two different but related questions. Revision might occur after each session, or if the clinical approach is taken, several trials might be conducted in successive one-to-one sessions before changes are made. It is sometimes suggested that formative evaluation be continued until redundancy of comments made by subjects is observed.

Use of experts

So far in this discussion of aspects of formative evaluation, emphasis has been placed on the use of members of the intended target audience as the key source of revision data. As Weston (1987) points out, while some authors suggest that materials should be tried out with a sample of the target audience or learners for whom the materials are intended (e.g., Henderson and Nathenson, 1976); others (e.g., Montague, Ellis and Wulfeck, 1983) recommend that various types of experts be asked to review the materials . Traditionally, developers of instructional materials have relied on review by experts. It appears to be cost-effective when compared with evaluation with intended users. Furthermore, since it enlists leaders and decision makers as reviewers, it may positively affect the acceptance of the new materials. In addition, it is possible that reviewers may reveal errors of fact, inappropriate emphases, and omissions. As

Markle (1983) has pointed out, there is no subsitiute for certain kinds of expert review. Potential users of the instructional materials cannot, for example, judge the accuracy of the materials or how up-to-date they are.

Reliance upon experts only or learners only would not provide the developer with a complete picture of the problems with the materials. There seems to be some consensus among authors (Dick and Carey,1985; Geis, 1986; Kandaswamy, 1980; Stolovich, 1982; Thiagarajan, 1978; Weston, 1986) that a combination of experts and learners be involved in formative evaluation because each can provide different kinds of feedback. Both practice (Burt and Geis, 1986) and the literature (e.g., Stolovich, 1983, Thiagarajan, 1978) suggest a number of different types of resource people who might review and comment upon instruction that is under development. Weston (1987) summarizes the range of information which experts can provide:

- Subject-matter expert: content accuracy, up-to-dateness, comprehensiveness
- Pedagogical expert: appropriateness of level of language , objectives and content for the target population, suitability for use within a specific instructional setting
- Instructional design expert: clarity of objectives, sequence and relationship of ideas within the content
- Presentation expert: technical quality, media, graphics
- Curriculum expert: compatibility of materials with program and other instructional materials

Formative Evaluation of the TRUMP Courseware Style Manual

It was decided early that it was important to evaluate the style manual from the perspectives of the various parties concerned. TRUMP courseware developers, managers and supervisors of the TRUMP courseware development team, and the client all had interests in the production of a useful manual and, therefore, should be involved in the formative evaluation. The inclusion of these personnel in the development and evaluation of the style manual was viewed as a means of permitting product ownership to be dispersed and to assist in the diffusion of the style manual. The approach to the conduct of the formative evaluation of the TRUMP courseware style manual, therefore, involved the participation of a group of users representative of the target population as well as in-house subject-matter experts and client subject-matter experts.

Three constraints prevented the conduct of the formative evaluation in accordance with the formative evaluation methodologies described in the evaluation literature. The first constraint relates to the purpose of the style manual. The style manual is not intended to

serve a purely instructional purpose as one would expect of a self-instructional module. It was not designed to instruct, assess performance and enrich/remediate. Being a set of design guidelines, it is intended to be used more as a reference manual. In the initial stages of courseware development, a courseware developer would use the style manual to guide the design of courseware to to ensure certain set standards are met. Subsequently, they may refer to the manual as one would do to a job-aid to remind them of how to implement particular courseware design principles. Keeping in mind that the style manual was designed to be used as a reference manual, there was no feasible way to collect quantitative data to guide the revision process.

The second constraint on the full implementation of documented formative evaluation methodologies was time. It was not feasible to conduct several one-to-one trials and small group sessions. Courseware development is a time consuming process. It would have not been cost-effective for the developer of the style manual to observe the use of the style manual by courseware developers either on a one-to-one basis or as a group. Due to time constraints and partly also because of the unavailability of other groups of users representative of the target population, the conduct of several small group trials was also impossible.

In consideration of the abovementioned constraints, the activities performed during the formative evaluation of the style manual were:

- Initial edit and review,
- In-house expert evaluation, and
- Client expert evaluation.

At the end of this chapter, a description of the formative evaluation methodology that would have been followed had there been no constraints is provided. A description of the formative evaluation activities that were actually performed follows.

Pre-developmental Activities. Having determined a need for establishing guidelines to ensure consistency among TRUMP courseware developers, the author then proceeded to identify those factors which, based on his experience, have been shown to contribute to consistency and good quality courseware; namely: lesson structure, instructional strategy, and screen design principles. Each of these factors was then further analyzed to identify those elements which must be considered before consistency can be achieved. The results of this analysis constitute a list of elements from which the guidelines contained in the **TRUMP Courseware Style Manual** were derived. The list of elements was reviewed by the CBT

supervisor and the interactive videodisc expert, both of whom found the list to be adequate. A review of the CBT literaturewas then conducted to gather data which prescribe how to implement each of these elements. After all data and suggestions in the CBT literature were collected, the author commenced developing the draft of the TRUMP Courseware Style Manual.

Formative Product Evaluation Activities. Three activities were conducted during this phase: initial edit and review, in-house expert evaluation, client expert evaluation, and a small group trial.

<u>Initial edit and review</u>. The initial edit and review of the TRUMP Courseware Style Manual was conducted by the author. The purpose of this review was to:

- verify the accuracy of the content,
- assess the relevance of the content to the goal of the style manual,
- determine the appropriateness of the style of langauge used,
- determine the suitability of the level of language used
- assess the visual appeal of the graphic materials, and
- determine the utility of the *Table of Contents* in terms of the extent to which it facilitates easy access of materials within the style manual.

The data gathered during the initial edit and review phase did not indicate major revisions; some minor revisions were required in sentence structures, spacing between paragraphs, and location of graphics. Sentences were rewritten to improve clarity. Spacing between paragraphs was adjusted so that it remains consistent throughout the document. Graphics were relocated closer to the text they support.

<u>In-house expert evaluation</u>. The CBT supervisor and the interactive videodisc expert served as experts during this evaluation phase. These evaluators were selected to participate in this review not only because they had previously participated in the decision of what design guidelines should be included in the style manual but because they have indepth knowledge of:

- the capabilities of the authoring system being used to create TRUMP courseware,
- other software packages used to support TRUMP courseware production,
- training applications of interactive videodisc technology,
- the hardware and software capabilities of the TRUMP CBTS system, and

- the complexity of the CBT simulations to be created.

In view of their computer-based training background as well as the specific abilitties outlined above, it was felt that they would be able to assess the possibility of implementing the guidelines as described in the style manual as well as the ease with they can be implemented.

No evaluation checklist was provided to these evaluators. They were asked to review the style manual to determine whether all elements pertaining to the design guidelines that were previously agreed upon were adequately described in the style manual. Each evaluator had a copy of the document which listed all elements that were previously agreed upon to be included in the style manual. In addition, they were asked to conduct the same editorial review as was done by the developer in the *Initial Edit and Review Phase.*

They made two recommendations for improvements. The first was the use of consistent type style for the different levels of headings used within the document. They expressed the view that in some areas, the layout of the document resulted in some confusion as to which headings were subheadings and which were sub-sub headings.

To eliminate this problem, the following identification system was employed:
- All main headings were placed in bold upper-case.
- The first subheading was placed in bold mixed-case and underlined.
- A sub-subheading was placed in bold mixed-case but not underlined.
- The next level of heading was placed in mixed-case, plain text and underlined.
- The last level of heading was placed in mixed-case, plain text.

The second recommmendation was to include the following in the style manual:
- a more detailed description of an advance organizer
- an example of an advance organizer
- an example of a summary
- examples of all types of content structure diagrams

The author has accommodated all of these suggestions in the revised version of the style manual.

<u>Client expert evaluation</u>

Client evaluation constituted a review of the style manual by three representatives of the Department of National Defence: the Training and Development Officer of the Department of National Defence Detachment located at LSL, and two other senior officers from the Canadian Fleet School in Halifax who are responsible for CAL development. The inclusion of client

subject-matter experts in the evaluation activities was viewed as a means of permitting product ownership to be dispersed and to assist with diffusion of the style manual.

The client was asked to have their experts and product acceptors review the style manual to determine whether:

- the style manual would satisfy the needs of their courseware developers or whether modifications should be made before this goal can be achieved, and
- guidelines pertaining to military standards such as, for example, use of acronyms were technically correct.

Their comments were collated and returned to the author.

The document containing their responses cannot be retained in the thesis; has, however, be shown to all members of the thesis committee. The reviewers expressed a desire to have a copy of the TRUMP Courseware Style Manual to guide their courseware development efforts. They felt that the style manual will be of great assistance to present and future courseware developers to produce effective and consistent on-line materials. More important, however, is their statement that the style manual provides the structure and guidance which removes the need for decisions in areas in which their subject-matter experts have little training or experience.

In addition to these comments, they requested that some changes be made to the style manual.

- They have noted that up to that point in time, colour coding standards were not finalized. In the draft of the style manual submitted for them to review, each reference to the use of colour was labelled TBD (to be determined). The author did recognize this shortcoming but nothing could have been done at that time as he was awaiting further developments in the authoring system. The author will address the standardization of colour usage in the near future.

- Their next observation was that standards for windows and borders were not included in the style manual. The author has not included such standards because from experience, he knows they will be difficult to maintain. Windows may vary in size and location depending on the complexity and dynamic nature of TRUMP courseware simulations. Nevertheless, it has been emphasized that whenever the windowing technique is used in a presentation sequence, all efforts should be made to display the window in the same location throughout the sequence.

- A request was made to include a section on user-control in the style manual. It is the author's opinion that the concept of user-control pertains more to instructional design, a topic beyond the scope of the style manual. As such, a section on user control will not be included.

- The rewiewers felt that the topic of punctuation was not treated sufficiently. They requested references to an external punctuation standard. This request has been accommodated; three references (Bell and Corbett, 1982; Rosen, 1985; *The Canadian Style: a guide to writing and editing*. Secretary of State-Canada, 1985) were provided in the style manual.

- Their final observation to be addressed pertains to the fact that the designation of numerals as digits or words did not confirm to CFP 121(3), Article 12. The author has effected all changes in the section on numerals to be in agreement with CFP 121(3), Article 12.

Small Group Trial

Seven TRUMP courseware developers who are representative of the target population participated in this evaluation phase. Each courseware developer was responsible for authoring a different piece of courseware. They were asked to follow the guidelines suggested in the style manual while authoring courseware and to advise the developer of the style manual of any problems they encounter while implementing the guidelines. The developer made note of these comments and met with the team members on a weekly basis to clarify implementation issues. Individual debriefing sessions were not conducted as in this case, it was more cost-effective to resolve the design guidelines issues as a group. A group discussion approach has the other benefit of soliciting from all team members possible solutions to implementation problems. Some of our courseware developers have more expertise in the authoring system than others, and as such, in many instances, they were able to suggest other techniques to implement some design guidelines. Periodically, the developer inquired from the courseware developers how useful they have found the style manual to be. The response was that although to some extent the design guidelines restrict the way they would like to do things individually, it does help to maintain consistency, particularly in screen design, lesson structure, and instructional strategies.

Courseware produced was reviewed by in-house experts to determine whether acceptable standards were met. The reviewers used the style manual as a guide to review the

courseware. Their conclusions were that the courseware produced did meet acceptable standards and the expected level of consistency in the application of courseware design principles was also achieved.

At the end of the small group trial, all suggestions for changes to the style manual were made. It was felt that the style manual did achieve its intended purpose. Moreover, the client made a positive response towards the acceptance of the style manual. A decision to release the manual to the client could not be made because of its scheduled delivery date. There is a good side to this as it is the authors belief that as TRUMP courseware development progresses, there might be a requirement to add more guidelines to the style manual; so in the end the manual would be more comprehensive. Throughout the development and evaluation of the style manual, the client has always been provided with a copy of the revised version to review and offer comments.

As was previously pointed out, the conduct of the formative evaluation of the style manual was restricted by time and cost. Outlined below as a formative evaluation methodology that would have been followed had there not been these constraints.

Evaluation Methodology for No-Constraints Condition

This evaluation methodology is characterized by use of both in-house experts, client experts, and several small group sessions.

The previously described phases of *Initial Edit and Review* and *In-House Expert Evaluation* would be performed in the same order and by the same people; however, in this instance, checklists would be developed for the in-house experts to use while evaluating the style manual as well as courseware developed following the guidelines suggested in the style manual. The use of checklists would reduce the time taken to evaluate these products and result in a more focused approach to evaluation. There will be two checklists: one for evaluating the style manual, the other for evaluating the courseware developed following the guidelines prescribed in the style manual. The questions in the checklist for evaluating the style manual will focus on aspects of adequate content coverage, ease of use, technical accuracy of the content, clear statement of design guidelines, appropriate use of examples, and general layout of the document. Questions in the courseware evaluation checklist would pertain to adherence to screen design principles, lesson structure and instructional straytegy. These questions will be derived from the design guidelines stated in the style manual.

Depending upon the nature of the comments received, expert review would be followed by individual and/or a group discussion. Prior to individual debriefing sessions, the developer would review all comments made to ensure that he understands them. If comments lack clarity, clarification would be sought during the individual debriefing sessions. Should a review of all comments indicate that there seems to be a lack of consensus on any aspect of the style manual, a group discussion will be held to clarify issues and reach a consensus. A list of recommended changes would then be compiled after which the changes to the style manual would be implemented.

The style manual would then be submitted to the client for their experts and product acceptance personnel to review. They would be provided with a checklist, the questions of which will focus on whether the style manual would satisfy the needs of their courseware developers, whether the content is in accordance with Canadian Military Standards, and whether they have any suggestions for improving the style manual so that it would better satisfy their needs.

Comments received from the client would be reviewed, after which a group discussion will be held with all client personnel who offered comments. Should there be requests for changes which cannot be implemented because LSL is not contractually obligated to make such changes, then LSL's training manager would be asked to attend this discussion as the issue becomes a contractual one. Should there be request for changes to the style manual which cannot be accommodated because of hardware and software limitations, then the in-house CBT experts would be asked to attend the discussion. At the end of the discussion, all agreed upon changes will be documented and implemented in the style manual which would then be ready for the first small group trial.

Small Group Trials

Several small group sessions would be conducted. Each session would involve ten participants who are representative of the target population. At the beginning of each session, participants would be informed of the purpose of the style manual as well as that of the small group trial. They would then be asked to use the style manual to author CBT lessons. Each participant would be given a different lesson. The contents of the lessons would be representative of the complexity of simulations comprising TRUMP courseware.

Participants would be advised to write their comments on the appropriate pages of the style manual and to consult with the developer when they encounter problems in implementing any

guideline suggested in the style manual. Since participants would be authoring courseware on terminals located in their own cubicles, it will be difficult for the developer to observe them while using the manuals; to besides, this may prove to be too distracting for the participants. Moreover, implementation of a substantial number of design guidelines could take several days. Participants would also be asked not to seek clarification on any aspect of the style manual from anyone other than the developer; however, should that be necessary, (as when the developer is not around) the source of confusion as well as the guidance they received should be written down in the style manual.

After each lesson has been completed, two activities will commence. The first is a debriefing session with each participant during which the comments they have made will be discussed. The second would be the administration of an attitude questionnaire. The attitude-uqestionnaire would include questions based on the following aspects of the style manual:

- The guidelines and the examples are relevant to the type of courseware they create.
- The guidelines can be learned quickly.
- The guidelines, when applied make a dramatic difference in the comprehensibility and appearance of the courseware.
- The layout and typography of the style manual enhance comprehension of the guidelines.
- It was easy to locate specific guidelines in the style manual.
- Guidelines are clearly stated.
- The examples used to illustrate some guidelines are relevent and adequate in number.

In addition, participants would be asked to state any other areas for which they think guidelines should be produced.

After the debriefing sessions have been completed with each participant and all comments (including those made during the debriefing session) have been clarified, the developer would then review all comments and responses to the attitude questionnaire to identify commonalities among comments and responses. A list of comments and responses with high frequency would then be compiled and used to revise the style manual before it is used by the next group. The remaining comments and responses with a low frequency would be kept on a separate list which would be used with data gathered from subsequent trials to determine if their frequency would increase, in which case, they may be used in the revision process.

The second activity which will be conducted concurrently with the debriefing sessions is a review of the courseware produced by the participants. In-house CBT experts would use the previously referred to checklist for courseware evaluation to review each lesson in an effort to

determine whether the courseware meets the desired standards and whether there was consistency across all participants in terms of the implementation of courseware design principles. This courseware review phase will be followed by a debriefing session with each reviewer to discuss their observations and conclusions on the basis of which revisions may be to the style manual. For example, if it was discovered that there is inconsistency in the colour, size and location of the forward arrow (used to advance to the next screen presentation) and no guidelines are currently in the style manual, a guideline pertaining to what the colour of the forward arrow should be, its dimensions, and where it should be located, would be included in the style manual.

The same procedure would be repeated with other small groups of the same size until comments which are considered to have a significant impact on the implementation of the design guidelines stated in the style manual are no longer made. At this point in the formative evaluation phase, the manual would be in a state to undergo a summative evaluation.

Summative Evaluation

Since the style manual is not scheduled to be released to the Canadian Department of Defence until May, 1990 it is not possible to conduct a summative evaluation at this point in time. Nevertheless, a summative evaluation plan for the TRUMP Courseware Style Manual is provided in the *Recommendations* section of Chapter Five.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIOMS

Conclusion

The primary goals of the guidelines provided in the TRUMP Courseware Style Manual are to ensure consistency in lesson structure, instructional methodology and screen design to assure a good quality of instructional design across TRUMP courseware. The guidelines contained in the TRUMP Courseware Style Manual specify only general broad-based prescriptions and as such direct the design of courseware at a general level. Within these guidelines, TRUMP courseware authors must define their own detailed approach to instruction. Courseware authors are, therefore, responsible for using their individual experiences and knowledge to create courseware that is interesting and motivating to the trainees. TRUMP courseware authors have been encouraged to apply their own unique approaches and different styles to courseware development.

It is concluded that on the basis of the formative evaluation data, the TRUMP Courseware Style Manual has been adequately revised to warrant distribution. In addition, the results of the summative evaluation have shown that the style manual is indeed a valuable document in terms of its intended purpose. Furthermore, not only has the style manual been well accepted by the TRUMP courseware developers, but they have also been using it and would continue to use it to guide their courseware development efforts. Finally, based on the report received from senior officers responsible for courseware development at the Canadian Fleet School in Halifax, they will be using the TRUMP Courseware Style Manual after it has been formally delivered to them to guide their courseware development efforts.

Recommendations

Two sets of recommendations are made here: one for potential developers of style manuals for courseware development teams; the other for the conduct of a summative evaluation of the style manual by the Canadian Department of Defence.

Potential Developers of Style Manuals

Several recommendations can be made to others who have intentions of developing style manuals for courseware development teams.. The first is to recognize the importance of maintaining consistency within as well as across lessons. The guidelines prescribed in this manual are not *cast in stone*; nevertheless, they can be used as good starting point. Keep in

mind that the guidelines pertaining to lesson structure are specific to TRUMP; the two types of lessons were structured that way in order to ensure a smooth transition between conventional training and computer-based training as they complement each other. Although both types of lesson structures contain the essential instructional events, you may have to modify them to suit the instructional context for which you are developing courseware.

Some of the guidelines pertaining to screen design were prescribed in consideration of the capabilities of computer-based training system used for TRUMP. You should evaluate the capabilities of the computer-based training system you are using to verify whether adoption of these guidelines result in the production of aesthetically pleasing screens. A good way to do this is to try them out and have others look at the end product.

Summative Evaluation Plan

It is highly recommended that the Canadian Department of Defence conduct a summative evaluation of the TRUMP Courseware Style Manual such that they can collect data on the basis of which they can decide whether to adopt the style manual to guide their courseware developers, phase out the style manual, or subject it to re-development. Outlined below is a plan of a sequence of activities which should be performed during the summative evaluation.

Selecting the Evaluator

The first task to be accomplished would be to select someone to perform the role of the evaluator. The person selected must possess the following capabilities:

- have an indepth knowledge of the Instructional Quality Inventory upon which the instructional strategies suggested in the style manual are based.
- have an indepth knowledge of the authoring system and all supporting software packages used to create TRUMP courseware, and
- have some experience in conducting summative evaluation.

The ideal candidate for this position would be one of their senior courseware developers who would be completing the course LSL will be conducting in the first quarter of next year to train Canadian Forces personnel to use the authoring system and the other supporting software packages.

Selecting Subjects

The subjects who would participate in the summative evaluation must possess the first two capabilities stated above for the evaluator.

Procedure

The evaluator should familiarize himself or herself with the TRUMP Courseware Style Manual to the extent that he or she understands the purpose of the manual, how it is intended to be used, and the contents of the manual. In the event that he or she needs clarification on any aspect of the manual, he or she should contact the developer. In addition, he or she should review the courseware evaluation checklist accompanying the manual and seek clarification from the developer should there be any confusion as to how it should be used. This courseware evaluation checklist would be the same one used by in-house experts to evaluate TRUMP courseware for acceptable standards and consistency.

The evaluator should then distribute a copy of the style manual to each participant and inform them of its purpose and how it should be used. The participants should then be allowed to use the style manual to create courseware on the job. After each set of complete courseware is completed, the evaluator should use the courseware evaluation checklist to evaluate the courseware to determine whether it meets acceptable standards. It is recommended that several pieces of courseware be reviewed before a decision is made to adopt, phase out or re-develop the style manual.

Summary

To summarize, the TRUMP Courseware Style Manual was developed to ensure that there is consistency among members of the TRUMP courseware development team in terms of the application of certain courseware design principles, and to promote the creation of acceptable quality courseware. To date, at LSL, it is our observation that the style manual does achieve its purpose. It is hoped that the said purpose is achieved when the style manual is implemented by the Canadian Department of National Defence.

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APPENDIX I

LESSON STRUCTURES

LESSON STRUCTURES

Components of a Tutorial Lessons

Tutorial lessons consist of five components (Figure 4): Introduction, review, tutorial, summary, and lesson check. A brief description of each of these components is provided below.

Introduction

The purpose of the introduction is to prepare the trainee for the instruction and provide an overview of the topic(s) covered. It should contain an advance organizer, a rationale for teaching the topic(s), and/ or instructions to the trainee on how to proceed. The introduction should include statements which indicate what the trainees are expected to achieve; however, such statements should be expressed in much more general terms than those normally found in statements of performance objectives. In addition, trainees should be made aware of the level of mastery expected of them.

Advance Organizers

Since the early work of Ausubel, several variations of advance organizers have been studied. Advance organizers act as subsumers of information whereby input can be collected into a more meaningful schema (Ausubel, 1960). In effect, proponents suggest that advance organizers provide a vehicle through which new information can be subsumed meaningfully within individual cognitive structures. This can be an important technique for making instruction uniquely meaningful to individual learners.

Advance organizers assume various forms, including comparative textual pages in the form of brief paragraphs (Ausubel & Yousef, 1963), thematic titles or title sentences (Merrill & Stolurow, 1966), and lists which guide the performance of a task (Mayer, 1977). For each of these applications, organizers are presented prior to new instruction to orient learners to information. Several other advance organizers have been studied. These include graphic organizers in the form of pictures or diagrams (Alvermann, 1981), and diagrams illustrating the relationships among task components to central ideas (Mayer, 1975). Several conclusions can be drawn from the literature on the use of advance organizers.

1. Trainees should be given an indication of where they are going. They need to know in advance what topics will be discussed and why. They need to be able to relate what is to be learned to what they already know. In fact, trainees need a logical frame of reference to

which subsequent detailed learning can be related. With this in mind, it is suggested that lessons should always be preceeded by an advance organizer.

2. An advance organizer is a special form of introduction designed to place subsequent detailed learning into perspective. Although it may take various forms, its intended function is always to enhance the trainees ability to organize the new material and consequently to learn and remember it. It should be written in terms meaningful to the trainees and must take into account their existing knowledge. The advance organizer, by taking into account the trainees' existing knowledge, is designed to become a part of their cognitive structure. As such, it is designed to provide a clear, well organized framework under which new concepts can be subsumed.

KEY

	IS A COMPONENT OF
----	WILL BE COVERED BY
----	IS NOT MANDATORY

LESSON

REVIEW

TUTORIAL

LESSON SUMMARY

LESSON CHECK

TEACHING POINT 1
TEACHING POINT 2
...
TEACHING POINT n

CONFIRMATION 1
CONFIRMATION 2
...
CONFIRMATION n

INTRODUCTION

ADVANCE ORGANIZER

RATIONALE
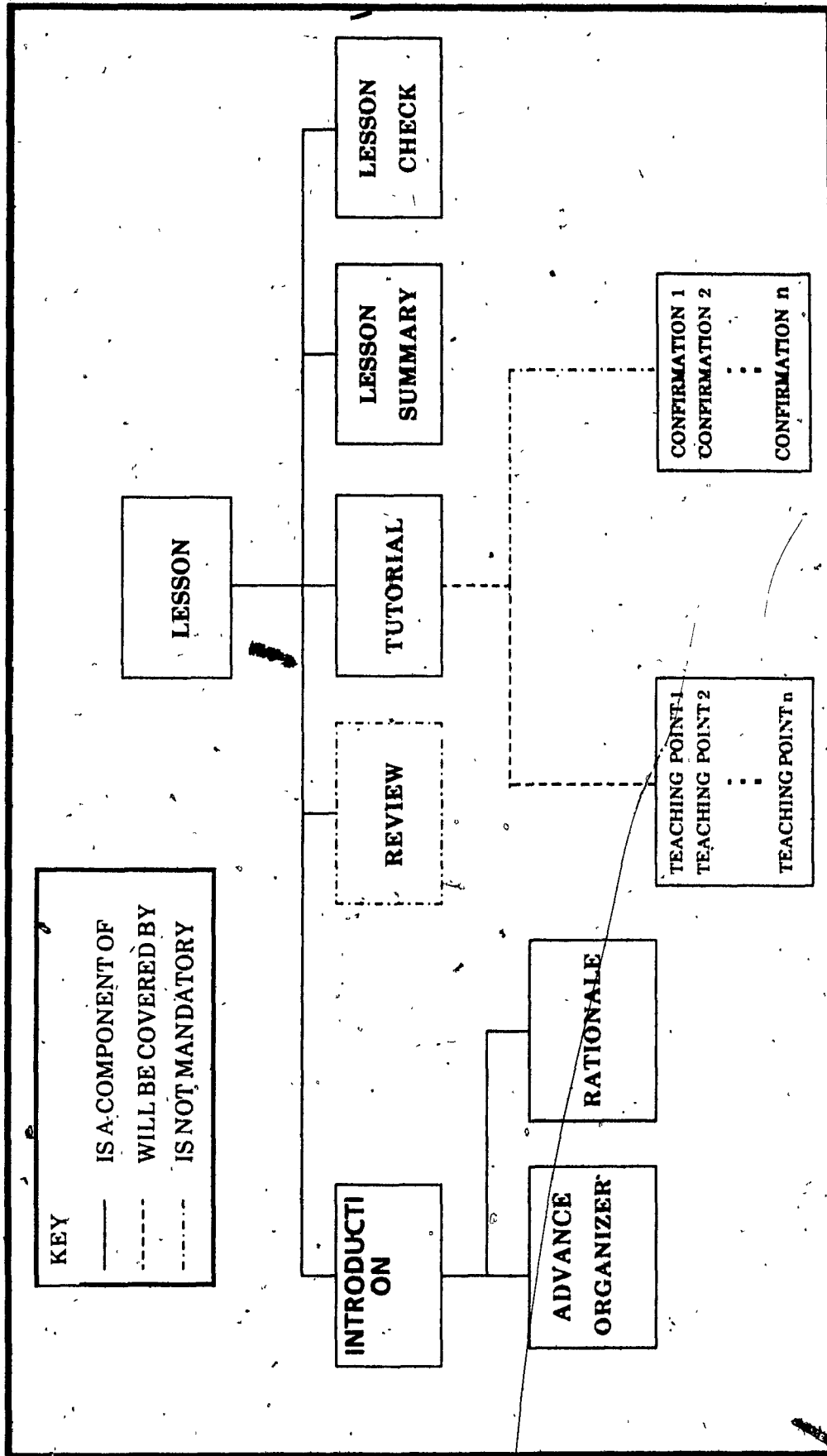
Figure 4: Components of a Tutorial Lesson

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3. Advance organizers are the concepts or ideas that are given to the trainee prior to the material actually to be learned. Similarities and differences between concepts to be acquired and old, familiar concepts may be identified, as well as similarities and differences between the new concepts themselves.

4. Chapter titles and section headings in a text book are examples of advance organizers. They serve to indicate to the reader what the succeeding content is and in some cases how it relates to other content. In the same way, introductory paragraphs frequently contain no new material but serve instead to remind the learner of certain ideas that are important in terms of their relationship to new material.

5. A Content Structure Diagram (CSD) may be included in an advance organizer. The Content Structure Diagram illustrates how the various parts of the subject matter are related. This illustration does not necessarily depict an order in which these parts will be dealt with in the lesson. If the lesson does not contain many parts to warrant the presentation of a global picture of the lesson content to the trainees at the beginning of the lesson, you may exclude this component. The following four types of Content Structure Diagrams may be used:

(i)   List - is used when the purpose of the lesson is to teach a series of facts. An example of a CSD in the form of a list is provided in Figure 5.

(ii)   Category - There are two types of **category** diagrams: *Parts* and *Kinds*. A *Parts* diagram (Figure 6) illustrates the relationship between an item and its parts. A *Kinds* diagram (Figure 7) shows the relationship between a major category and the different types of items within the category

(iii)   Procedure - There are two types of **procedure** diagrams: *No - Decision* (Figure 8) and *Decision* (Figure 9). A *No - Decision* Procedure CSD is used if the procedure to be taught contains only steps. On the other hand, if the procedure to be taught contains both steps and decision points, a *Decision* procedure CSD should be used.

COMMAND AND CONTROL SYSTEM

Serial Data Bus

CCS Processors

Operator Displays

Command Task Group Display And Slave Monitor

System Controller Group

Figure 5. List Content Structure Diagram

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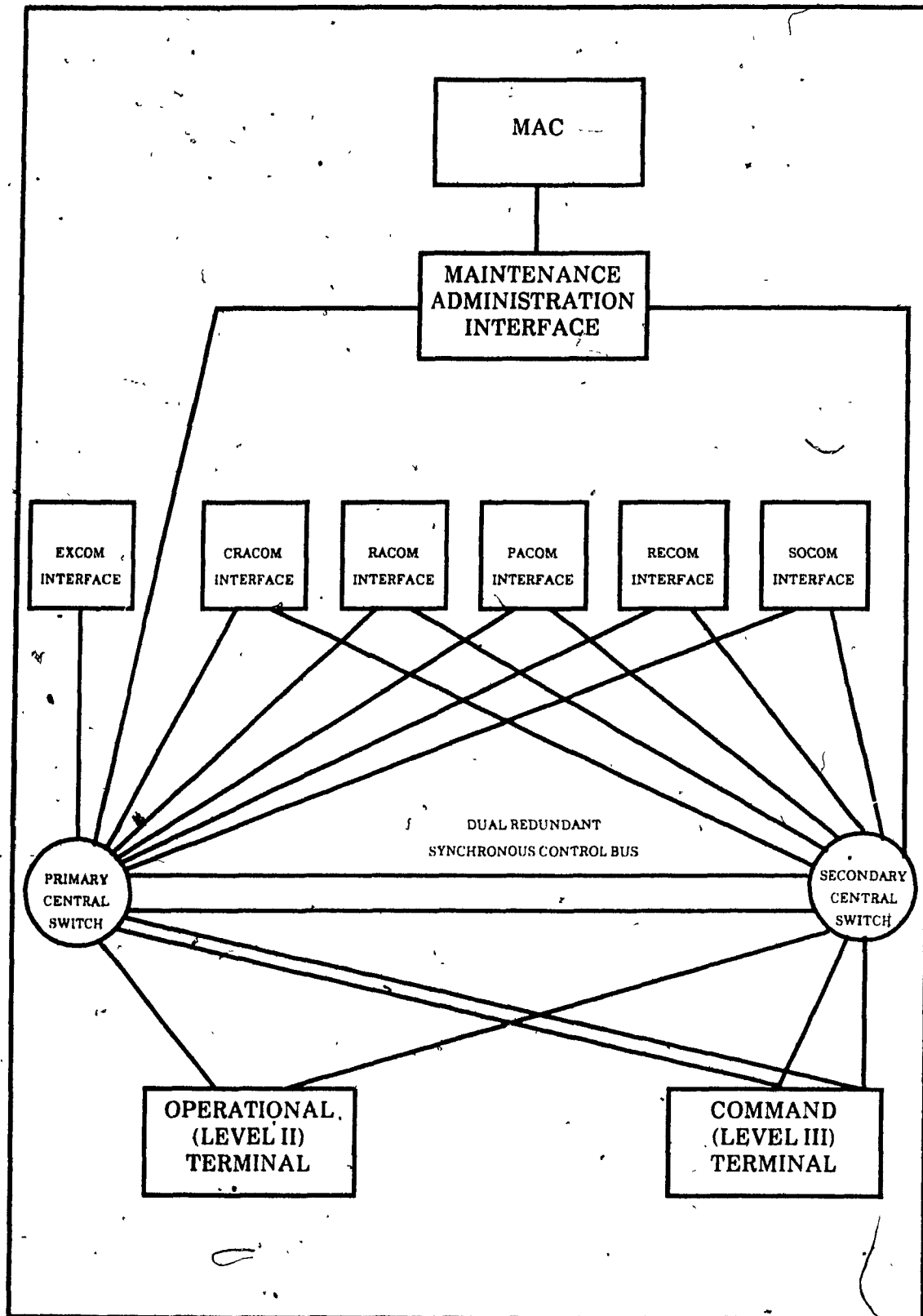
Figure 6. Parts Type Content Structure Diagram
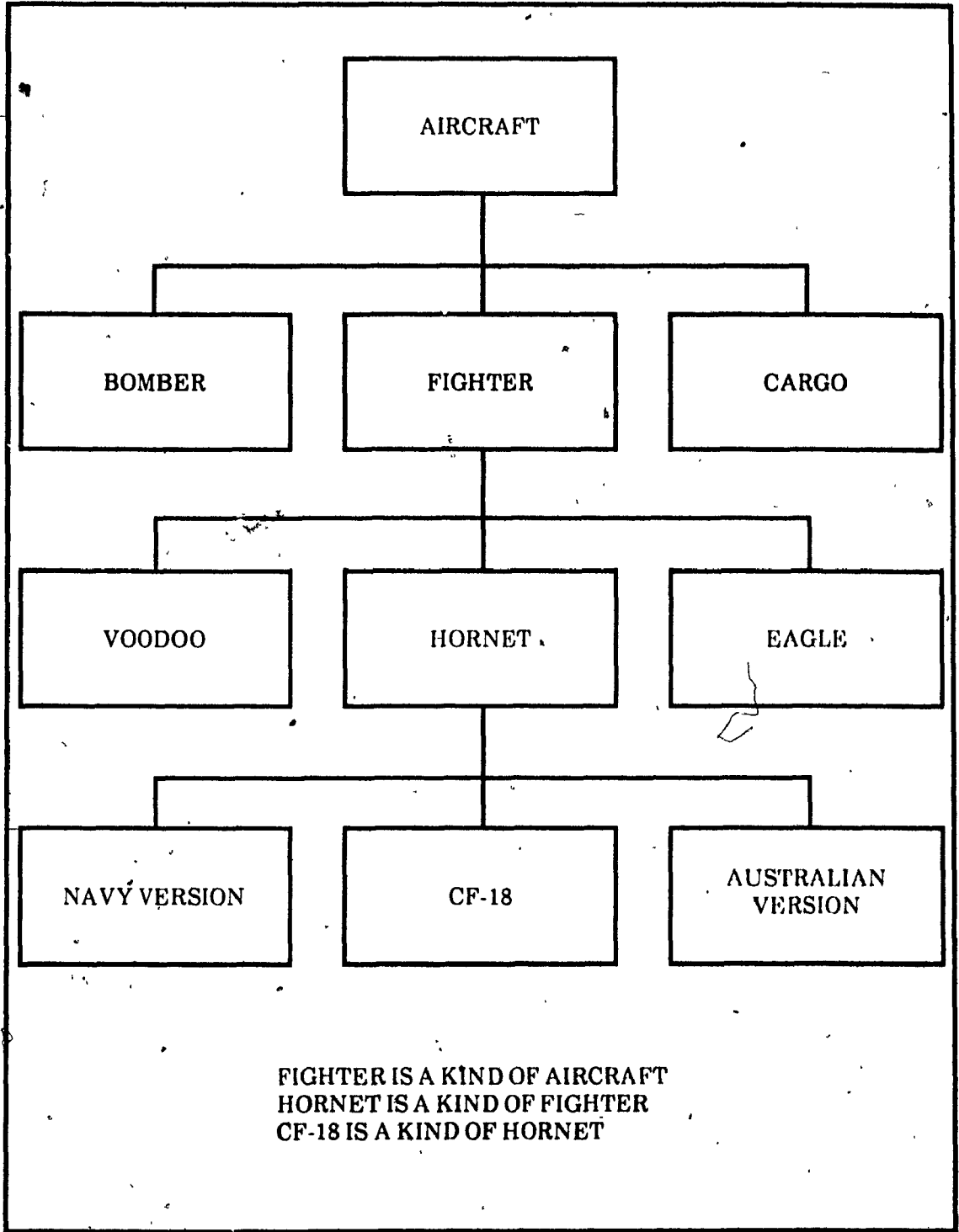
Figure 7. *Kinds* Type Content Structure Diagram

ACCESSING AN EXCOM TRUNK AND PLACING A SHORE LINE CALL

```
┌─────────────────────────────┐
│       PRESS CALL KEY        │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│     DIAL AN EXCOM TRUNK     │
│    ACCESS CODE NUMBER       │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│   DIAL A SHORE DESTINATION  │
│          NUMBER             │
└─────────────────────────────┘
```
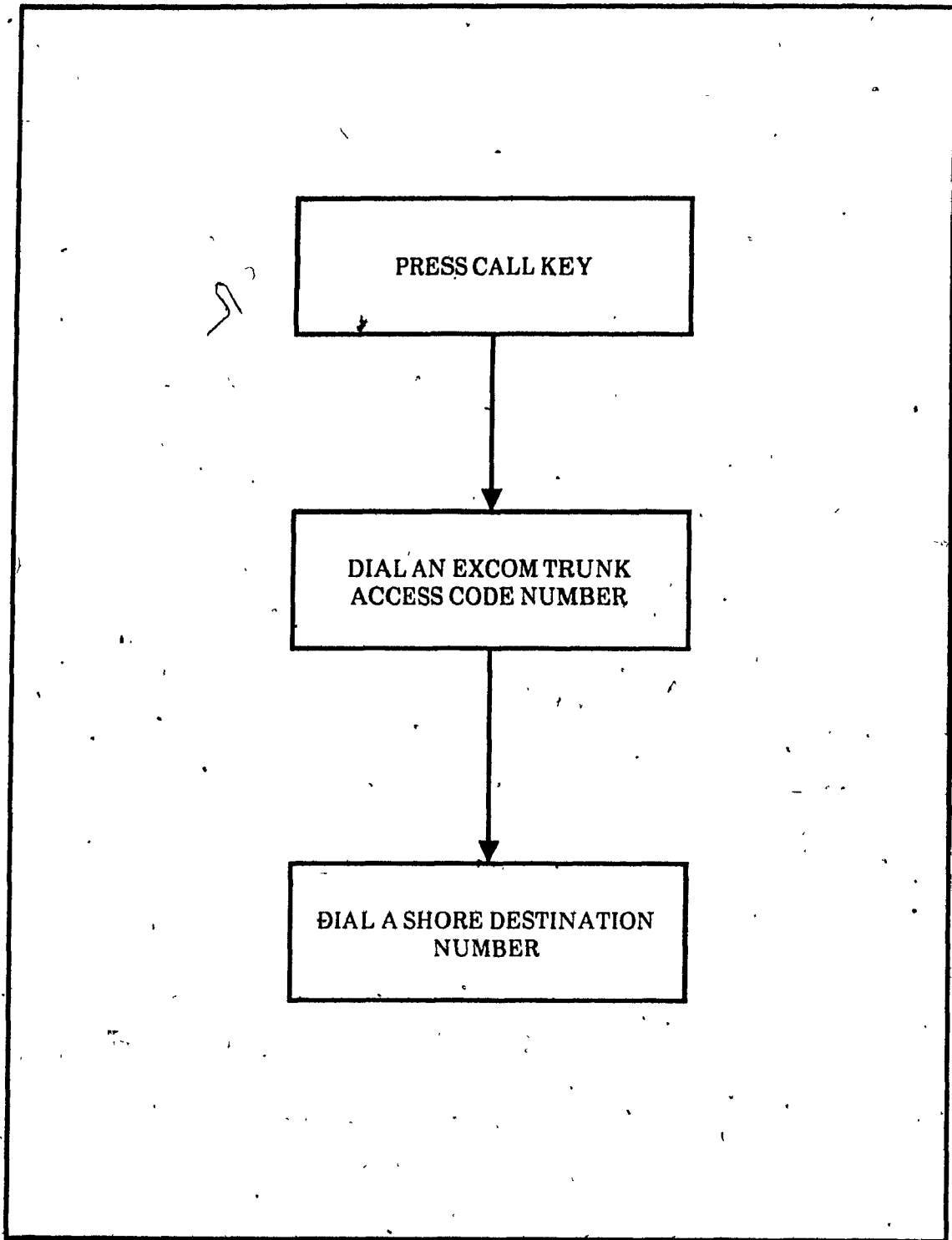
Figure 8. No-Decision Content Structure Diagram
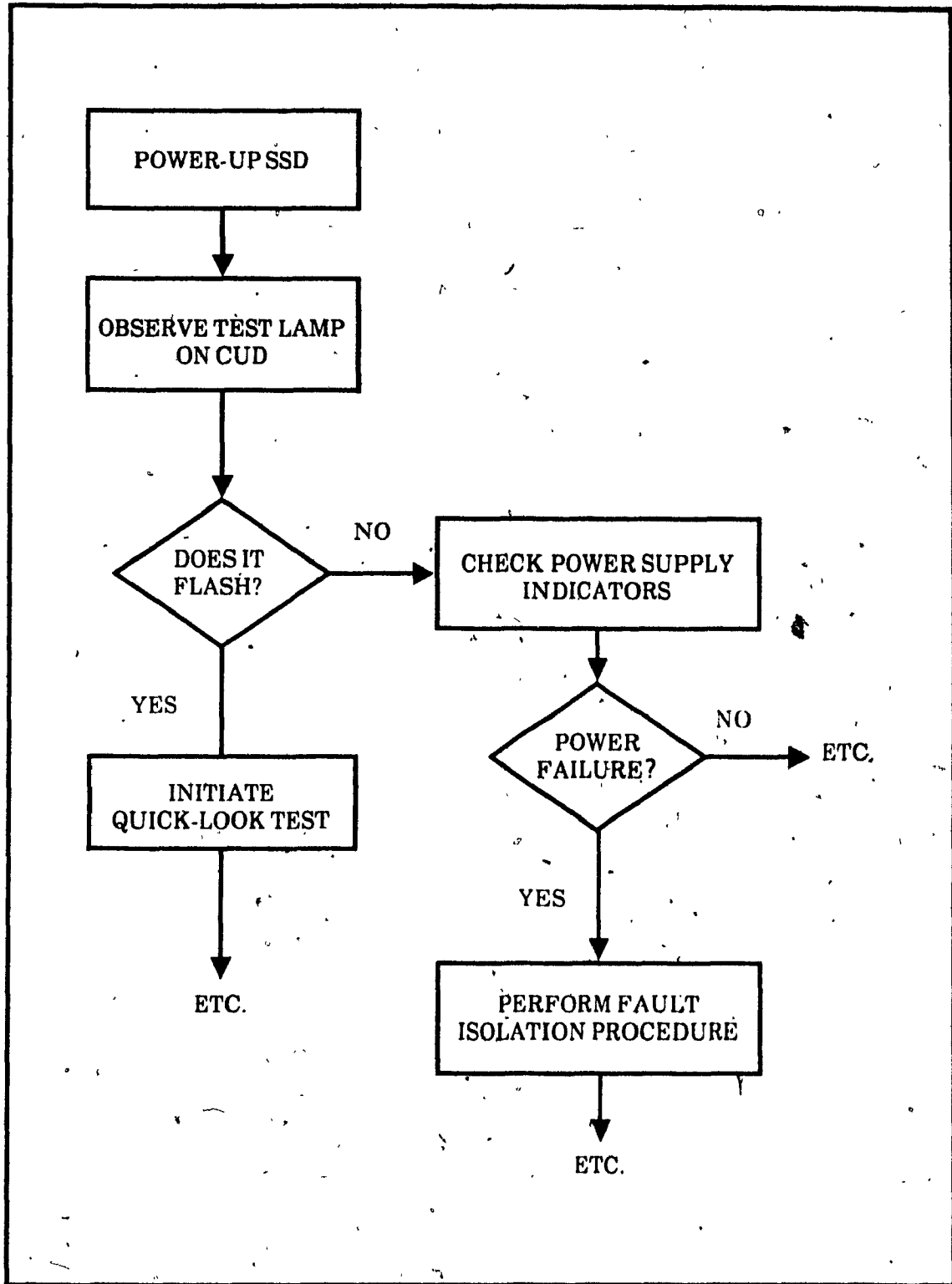
Figure 9. Decision Content Structure Diagram

(iv)   Cause and effect process - illustrates how a process occurs or what causes an action or activity to occur. This type of CSD is appropriate if the purpose of the lesson is to teach *principles of operation*. An example is provided in Figure 10.

(c) <u>Rationale</u>

In this part of the introduction, inform the trainees why it is important for them to know the material.

Review

This lesson component contains a review of facts, concepts, techniques, and skills needed to understand or maximize learning of the current lesson or in instances where a CBT lesson complements a segment of a lesson , part of which has been covered by conventional training methods. A review serves as a mechanism for stimulating recall of prior learning.

A review should be used whenever a lesson requires trainees to utilize specific information which they have learned in previous lessons or in a previous course. A review should not be included in lessons for which there are no prerequisite skills.

A review may be either a list or a series of questions covering the main points or critical information the trainees learned in previous training. The list or series of questions may address information in the lesson the trainee just completed or prerequisite information the trainee encountered earlier in training.

A review should be optional. The option to review should be preceded by a brief statement of what is conatined in the review. The inclusion of this statement provides the trainee with some basis with which to decide whether to select the review.

Following the completion of the review, the trainees should be informed that the instructor is available should they desire help with the information presented in the review. No remediation would be provided for trainees who have difficulty with lesson prerequisites.

Tutorial

A tutorial consists of one or more instructional segments which address a group of related teaching points. A teaching point is a component of a knowledge or skill element- a statement

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of a fact, a definition or a procedural step, etc., representing a very small amount of knowledge or skill that a trainee must master as a prerequisite to achieving a lesson objective. Since the advance organizer is intended to provide a clear framework under which new concepts can be subsumed, it is logical to present the new concepts within each segment in a way which relates most clearly to the framework of the advance organizer. It may contain confirmation items if the nature of the instruction dictates such a requirement. Confirmatory items are used to assess the degree to which trainees understand the information covered under teaching points.

Lesson Summary

The Lesson Summary is used to synthesize the knowledge taught in the instructional segments.
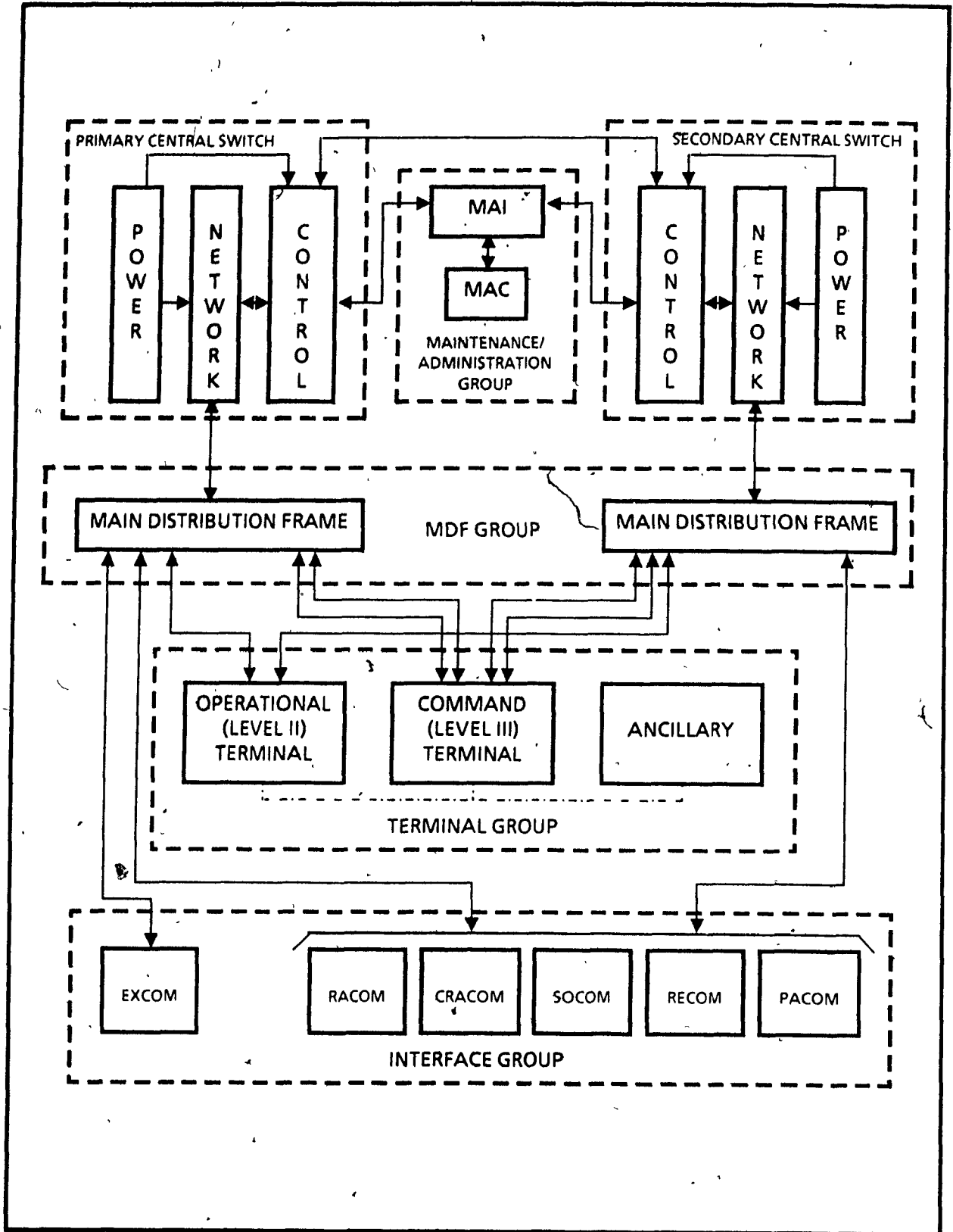
Figure 10. Cause-and-Effect Content Structure Diagram

Lesson Check

- The Lesson Check is designed to evaluate whether the trainees have achieved the lesson objective.

Components of a Tutorial and Part Task Simulation Lesson

The structure of a part-task simulation lesson (Figure 11) reflects the previously described instructor-oriented approach to operator and maintainer training: explanation followed by demonstration which in turn is followed by practice exercises. Lessons which contain a combination of tutorials and part task simulations contain the following components:

1. Introduction

2. Review

3. Tutorial

4. Guided Simulation

5. Open Simulation

6. Lesson Summary

7. Lesson Check

The first three components have already been described. Brief descriptions of the others follow.

Guided Simulations

This type of equipment simulation is very similar to open simulations except that cues and prompts will be provided to direct the trainee throught the desired events of the process or procedure (maintenance or operation). They are instruction-oriented rather than practice-oriented and are sequenced prior to open simulations. Guided simulations may also be invoked if trainee performance under the free play (open) mode is poor.

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Open Simulations

Open equipment simulations are designed to provide two-dimensional representations of equipment/systems with an emphasis on maintaining a high fidelity of functionality. These equipment simulations are used to provide the trainees with opportunities to master the desired procedures (maintenance or operation) along with the logical inferences required for equipment fault diagnosis and repair. Open simulations are performance oriented rather than instruction oriented.

Lesson Summary

The Lesson Summary is used to synthesize the knowledge and skills taught in the instructional segments. Debriefing information which describes the purpose, effects, and results of the simulation should be provided. Other key elements such as consequences of violating safety precautions, and common errors (pertaining to the operation/maintenance of the simulated equipment/system) should also be reviewed.

Lesson Check

The content domain of simulation(s) used as lesson checks matches that of those used during instruction.
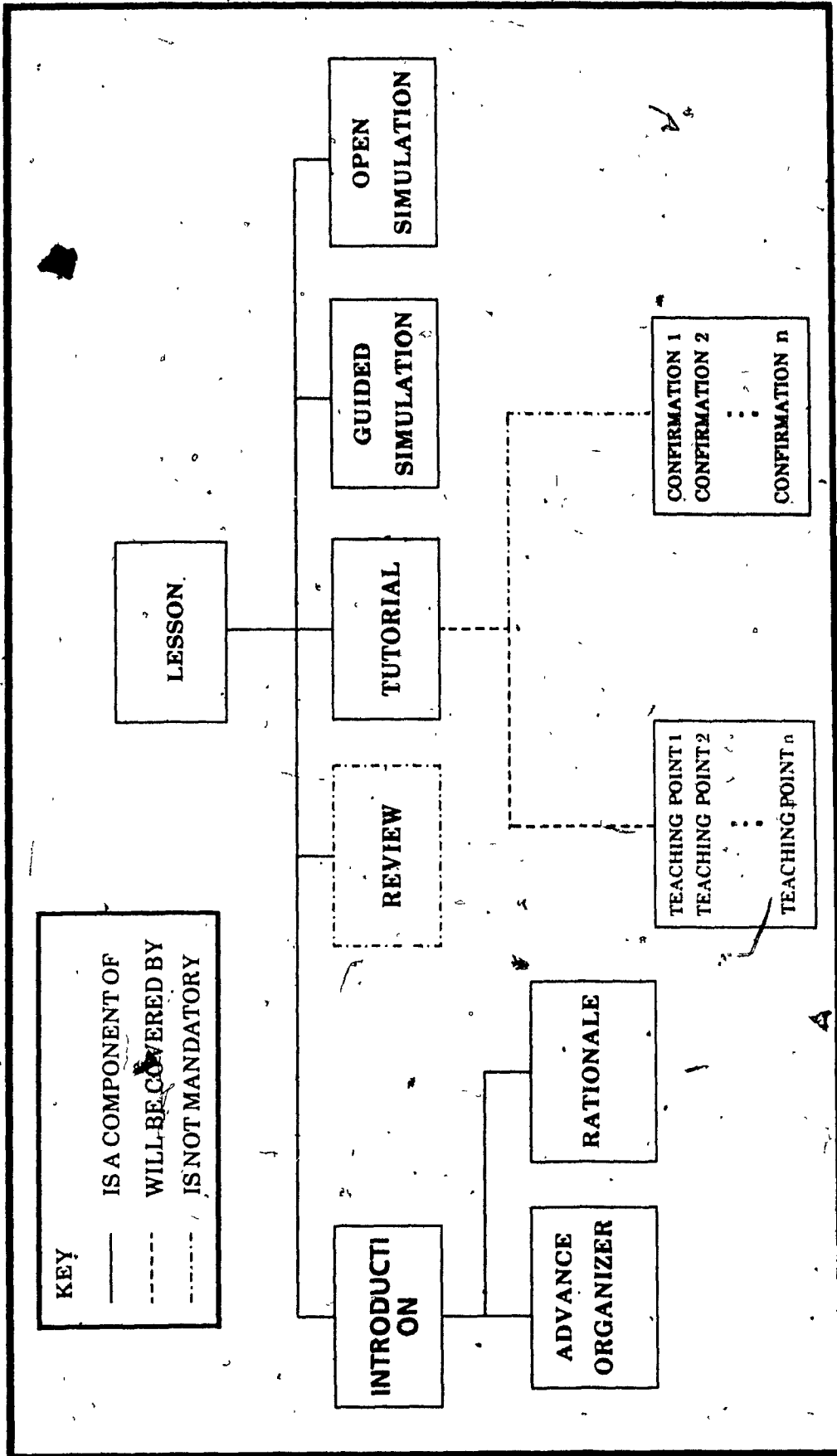
Figure 11. Components of a Part Task Simulation Lesson

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APPENDIX II

CONSISTENCY AND ADEQUACY OF INSTRUCTIONAL CONTENT

CONSISTENCY AND ADEQUACY OF INSTRUCTIONAL CONTENT

- Ensure that the presentation is consistent, that is, the right combination of instructional components ... present. Use Figure 12 as a guide. In addition to incorporating the appropriate components, a presentation must also meet the following criteria to be consistent:

  - Statements must be complete.
  - Examples must show application of complete content.
  - Examples must match or reflect the conditions and standards required of the objective and test as closely as possible.
  - Practice must include feedback
  - Practice must be of the same task/content level as the test item and objective.
  - Practice must match or reflect the conditions and standards required of the objective and the test as closely as possible, or be designed to help the student gradually learn to the final task,

- Ensure that the presentation is adequate by referring to the guidelines below.

  - Statements, Examples, and practice components must be separated.
  - Statements, Examples, and practice components must be labelled so that the trainees know what they are and can locate them.
  - The entire presentation must be clearly stated so that the trainees can understand statements, examples and practice.
  - Examples should range from easy to hard.
  - Examples should be representative of the job the trainee will do after training.
  - Examples should show clearly why common errors are wrong.
  - Practice items must be free of hints that would not be present in the test or on the job.
  - Practice items should have the same format as the format of the test items.
  - Practice items should range from easy to hard.
  - Practice items should be typical of the job to be performed after training.
  - Practice items should include the opportunity for common errors.

PRESENTATION COMPONENT	CONTENT TYPE OF THE				
	FACT	CATEGORY	PROCEDURE	RULE	PRINCIPLE
STATEMENT	complete fact presented	all critical characteristics and their combination are given	all steps are given in the correct order	all steps and branching decisions are given in the correct order	all causes, effects, and relationships are given
PRACTICE REMEMBERING	recall or recognition required	recall of concept definition required	recall of all steps in correct order required	recall of all steps and branch decisions in correct order required	recall of all causes, effects, relationships required
	For all content types.	Practice Remembering items must be the same as the test item practice items must include feedback		They must be the same format as the test item	All
EXAMPLES	not applicable	examples show all critical characteristics required for classification non-examples show absence or critical characteristics,	application of the procedure must be shown and steps must be shown in the correct order	application of each step or branching decision must be shown in the correct order	interpretation or prediction based on causes, effects, and relationships must be shown
PRACTICE USING	not applicable	classification of both examples and non-examples is required	all steps must be performed in the correct order	all steps and branching decisions must be performed in the correct order	explanation or prediction based on the principle is required

For all content types: Practice Using items must reflect what is to be done on the job or in later training. The task/content level, conditions, and standards must match the test item and objective. The practice item format must be the same as the test item format. All practice items must include feedback

For CONCEPT, RULES, and PRINCIPLES: Some practice items should be different than either the test items or the examples (Common error items might be the same.)

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Figure 12. Elements Required for a Presentation Component to be Complete.

(Adopted from Wallace, Wulfeck, Ellis and Richards, 1978)

APPENDIX III

TEXT PRESENTATION

TEXT PRESENTATION

Punctuation

- Consult the following references for standard rules and conventions governing punctuation.

    - Bell, J.B., & Corbett, E.P.J. (1982). *The Little English Handbook for Canadians.* Toronto: John Wiley and Sons.

    - Rosen, L.J. (1985). *The Everyday English Handbook.* New York: Doubleday & Company Inc.

    - *The Canadian Style: a guide to writing and editing.* Secretary of State Canada. Toronto: Dundurn Press, 1985.

Paragraph Indentation

- Use *block* style paragraphs.

- Leave one blank row between paragraphs.

Words

- *Do not* hyphenate a word at the end of a line; if there is insufficient space, spell out the complete word on the next line.

Lists

When subject matter within a paragraph can be made clearer by itemization, each item should be set off following these guidelines.

Vertical Spacing

- Leave one blank row between the heading or stem of the list and the items which constitute the list.

- *Do not* leave a blank row between items in the list.

- If an item occupies more than one line of text, *do not* leave a blank row between lines. Left justify each additional line with the first character of the first line.

Horizontal Spacing

- Balance textual display on screen.

Capitalization

- Capitalize only the first letter of the first word of each item in a list except when

    - the conventional spelling of the phrase requires that the first letter of each word be capitalized.

    - an abbreviation consists of all capitals.

Beginning Punctuation

- When there is only one level of detail, use a bullet followed by a space before each item in the list.

    Exception: When the information presented in a list describes a sequence or ordering process that dictates the use of numbers, *do not* use a bullet with a number.

- When there are several levels of detail, limit their number on the screen so the screen does not become cluttered.

End Punctuation

- *Do not* use a period unless necessitated by the length or grammatical construction of an item.
- If one item takes a period, each item in that list should also take a period.

<u>Sentence Break</u>

- More efficient learning occurs and higher retention levels are reached when text lines are broken between units of grammar. Therefore, you should try to end a line between units of grammar such as clauses, phrases, subject, verb, and object.   A quick way to determine whether you have broken lines at the correct places is to scan the right margin for the following parts of speech:

    - auxiliary verbs (is, should, may, will)

    - conjunctions (and, or, but, because, while)

    - relative pronouns (which, that, who)

    - articles (the, a, an)

    - possessive pronouns (your, its)

    - infinitive *to*

- preposition (at, about, on, above, below)

If you find some of these words, then it is most likely that you have broken lines within a unit of grammar.

Examples of correct and incorrect sentence breaks

- Auxiliary verb

  Incorrect   The control panel is
                                                          missing.

  Correct   The control panel
                                                          is missing.

- Conjunctions

  Incorrect   The computer and
                                                          the videodisc player ....

  Correct   The computer
                                                          and the videodisc player ....

- Relative pronoun

  Incorrect   The image that
                                                          you see ....

  Correct   The image
                                                          that you see ....

- Articles

  Incorrect

  You should replace <u>the</u> air filter.

  Correct

  You should replace <u>the</u> air filter.

- Possessive pronouns

  Incorrect

  You should check <u>its</u> temperature.

  Correct

  You should check <u>its</u> temperature.

- Infinitive

  Incorrect

  You will have <u>to</u> perform this procedure.

  Correct

  You will have to perform this procedure.

- Preposition

  Incorrect

  This section contains information <u>about</u> maintenance procedures.

  Correct

  This section contains information <u>about</u> maintenance procedure.

Pronoun Usage

- Avoid sexual stereotyping. Try to rewrite the sentence to eliminate the need for the pronoun.

    If you cannot rewrite the sentence effectively, use a plural.

    Example

    The trainees .... their.

Spelling

- Use Canadian spelling. Common differences between U.S. and Canadian spelling are:

U.S.	Canadian
analog	analogue
analyze	analyse
angle-of-attack	angle of attack
appendixes	appendices
armor	armour
bail out	bale out
behavior	behaviour
bomb bay	bomb-bay
caliber	calibre

catalog	catalogue
center	centre
color	colour
coordinate	co-ordinate
	coordinate (if referring to the position of a point, line, or plane)
counterclockwise	counter-clockwise
defense	defence
deice	de-ice
fiber	fibre
flight path	flightpath
formulas	formulae (more appropriate for formal and scientific writing)
	formulas (more appropriate for nontechnical or informal writing)
freefall	free fall
fuse (electrical)	fuse (electrical)
fuse (ordnance)	fuse (ordnance)

gage / gauge	gauge
gray	grey
harbor	harbour
infrared	infra-red
maneuver	manoeuvre
maneuvering	manoeuvring
odor	odour
play back	play back (if used as a verb)
	play-back (if used as a noun)
program	programme
	program (in computing)
practice (noun and verb)	practice (noun)
	practise (verb)
radio active	radioactive
servomechanism	servo-mechanism
servomotor	servo-motor
soundproof	sound-proof
tailwind	tail wind

troubleshooting	trouble-shooting
turboprop	turbo-prop
turnaround	turn round (move so as to face new direction, unload and reload ship, etc.)
	turn-round (process of loading and unloading)
ultrahigh	ultra-high
ultraviolet	ultra-violet
Xray(s)	X-ray(s)

Use the Concise Oxford Dictionary as a guide.

Abbreviations and Acronyms

The authorized reference for abbreviations and acronyms is Military Standard (MIL STD) 12C.

Refer to Table 1 for a list of frequently used acronyms.

Table 1: List of Abbreviations and Acronyms

A	Amperes	BPI	Bits per Inch
ABL	As Built Log	BPS	Bits per Second
ABM	Advance Bill of Material	BTS	Bench Test Set
AC	Alternating Current	C of C	Certificate of Compliance
ACCEL	Accelerometer	CCN	Contract Change Notification
A/D	Analog/Digital	CCR	Configuration Control Record
ADC	Air Data Computer, Analog-to-Digital Converter	CCS	Command and Control System
ADLIPS	Automatic Data Link Plotting System	CCW	Counterclockwise
AGE	Aerospace Ground Equipment	CD	Contract Demand, Change Directive, Canadian Document (Test Spec.)
AI	Assembly Instruction	CDR	Critical Design Review
AMECOM	Amecom Division of Litton	CDRL	Contractor Data Requirements List
ANSI	American National Standards Institute	CDU	Control Display Unit
A/R	As Required	CEI	Contract End Item
AR	Action Request	CF	Canadian Forces
ASCII	American Standard Code for Information Interchange	CFE	Customer Furnished Equipment
ASSY	Assembly	CFM	Cubic Feet per Minute
ATE	Automatic Test Equipment	CFTO	Canadian Forces Technical Order
ATP	Acceptance Test Procedure	CI	Control Issue, Configuration Item
ATR	Assembly, Test and Rework, Acceptance Test Results	CIN	Change Identification Number
AWACS	Advance Warning and Communication System	CM	Configuration Management
Az	Azimuth	CMO	Configuration Management Office
BITE	Built-In Test Equipment	CN	Change Notice
BM	Bill of Material	CP	Calibration Procedure, Company Procedure, Change Proposal, Central Processor
CPF	Canadian Patrol Frigate	DWG	Drawing

Table 1: List of Abbreviations and Acronyms (Cont'd)

CPU	Control Processing Unit	ECI	Engineering Change Instruction
CR	Change Request, Credit Cost Reduction, Current Regulator	ECN	Engineering Change Notice
CRT	Cathode Ray Tube	ECO	Engineering Change Order
CSA	Canadian Standards Association	ECR	Engineering Change Request
CTP	Calibration Test Procedure	EDP	Electronic Data Processing
CW	Clockwise	EIA	Electrical Institute of America
C/W	Complete with	EMI	Electro Magnetic Interference
CWBS	Contract Work Breakdown Structure	EO	Engineering Order
CY	Calendar Year	EPROM	Erasable Programmable Memory
D/A	Digital to Analog	ETP	Engineering Test Procedure
dB	Decibels	FDR.	Final Design Review
DC	Data Control /Direct Current	FET	Field Effect Transistor
DCN	Design Change Notice	FIS	Flight Inspection System
DCR	Design Change Request	FMEA	Failure Mode Error Analysis
DDL	Data Description Language	FPM	Feet per Minute
DED	Data Entry Display	FSC	Federal Stock Classification
DIAC	Data Interpretation and Analysis Centre	FSCM	Federal Supply Codes for Manufacturers
DID	Data Item Description	FSN	Federal Stock Number
DND	Department of National Defence	FTE	Factory Test Equipment
DRN	Data Release Notice	FY	Fiscal Year
D/S	Digital to Synchro	G&A	General Arrangement
DSD	Data Systems Division	GA	General & Administrative (overhead)
DSS	Department of Supply and Services	GAPL	Group Assembly Parts List
DT&E	Development, Text and Evaluation	GCI	Ground Control Intercept
DVM	Digital Voltmeter	GCSD	Guidance & Control Systems Division - USA

Table 1: List of Abbreviations and Acronyms (Cont'd)

GFE	Government Furnished Equipment	IRFIS	Inertial Reference Flight Inspection System
GFP	Government Furnished Parts - R&O	IRS	Inertial Reference System
GSM	Government Supplied Material	IRU	Inertial Reference Unit
GSE	Ground Support Equipment	JETDS	Joint Services Electronic Type Designation System
HCT	Hard Copy Terminal	LASER	Light Amplification by Simulated Emission of Radiation
HF	High Frequency	LASR	Litton Airborne Search Radar
HV	High Voltage	LATS	Litton Automatic Test Set
HVPS	High Voltage Power Supply	LCD	Liquid Crystal Display
HW	Hardware	LCP	Litton Company Proposal
Hz	Hertz	LED	Light Emitting Diode
IAW	In accordance with	LF	Low Frequency
IC	Integrated Circuit	LRU	Line Replacement Unit
ICCS	Integrated Command and Control System	LSL	Litton Systems Canada Limited
ID	Inside Diameter	LVPS	Low Voltage Power Supply
IDWA	Interdivisional Work Authorization	MAPL	Manufacturing Assembly Parts List
IF	Intermediate Frequency	MBO	Management by Objectives
ILS	Integrated Logistics Support Instrument Landing System	MCC	Manufacturing Configuration Control
IMF	Information Management Facility	MDI	Multi-Purpose Display Indicator
INE	Inertial Navigation Element	MDRI	Multi-Purpose Display Repeater Indicator
INS	Inertial Navigation System	MDT	Mean Down Time
INU	Inertial Navigation Unit	MIL	Military
I/O	Input/Output	MIL-STD	Military Standard
IPB	Illustrated Parts Breakdown	MMM	Multi Mode Matrix
IPS	Inches per Second	MOT	Ministry of Transport

Table 1: List of Abbreviations and Acronyms (Cont'd)

MRB	Material Review Board	P/N	Part Number
MSC	Milestone Chart	PMT	Photographic Mechanical Transfer
MTBF	Mean Time Between Failures	PL	Parts List
MTTR	Mean Time to Repair	PRF	Pulse Repetition Frequency
MUX	Multiplexer	PROM	Programmable Read Only Memory
N/A	Not Applicable, Not Available	QA	Quality Assurance
NATO	North Atlantic Treaty Organization	QE	Quality Engineering
NBS	National Bureau of Standards	QTP	Quality Test Procedure
N/C	No Change, No Charge	RAM	Random Access Memory
NEC	National Electrical Code	RAMP	Radar Modernization Program
NHA	Next Higher Assembly	R&D	Research and Development
NIU	Navigation Interface Unit	REF	Reference
NOTAM	Notice to Airmen	RF	Radio Frequency
OCC	Operator Control Console	RFI	Request for Information, Radio Frequency Interference
OD	Original Design, Outside Diameter	RFP	Request for Proposal Request for Price
OJT	On-Job Training	RFQ	Request for Quotation
P&A	Price and Availability	RH	Relative Humidity
PA	Project Authority	RLG	Ring Laser Gyro
PCB	Printed Circuit Board	R&M	Reliability and Maintainability
PDR	Preliminary Design Review	RMS	Root Mean Square
PERT	Program Evaluation and Review Technique	R&O	Repair and Overhaul
PHI	Position Homing Indicator	ROM	Read Only Memory
PIL	Parts Identification List	RSPL	Recommended Spare Parts List

Table 1: List of Abbreviations and Acronyms (Cont'd)

SCD	Specification Control Drawing	TES	Test Engineering Specification
SCN	Specification Control Number, Specification Change Notice	TI	Technical Instruction
SCR	Silicone Rectifier	TP	Test Procedure, Test Point, Test Package.
SK	Sketch	TTL	Transistor-Transistor Logic
S/N	Serial Number	U.K.	United Kingdom
SOW	Statement of Work	U.S.	United States
SPEC	Specification	USAF	United States Air Force
SRA	Shop Replacement Assembly	USN	United States Navy
SSR	Stock Sweep Request, Secondary Surveillance Radar	V	Volts
STD	Standard	VA	Volt-Amperes
SW	Software	Vac	Volts, ac
SYS	System	Vdc	Volts, dc
TATE	Tooling and Automatic Test Equipment	Vrms	Volts, rms
TBA	To be Announced/Advised	VCR	Video Cassette Recorder
TBD	To be Defined/Determined	VHF	Very High Frequency
TBL	Transportation, Board and Living	W	Watts
TD	Technical Directive, Test Data, Teardown, Tool Design	WL	Wire List
TEP	Test Engineering Procedure	WRT	With respect to

General rules governing the use of abbreviations are listed below.

- Abbreviate consistently. Do not indiscriminately mix abbreviated and unabbreviated forms of the same term or similar terms. For example, in similar applications, do not abbreviate *weight* (wt) and spell out *quantity* (qty).

- Spell out all acronym and abbreviations the first time they are used in a lesson. Follow spelled-out terms with their abbreviations in parentheses. If the term appears only once, do not use an acronym. General rules governing the use of abbreviations are listed below.

Examples:

The ICBM uses gaseous oxygen (GOX) for fuel.

The aircraft has been designed for Canadian Forces (CF).

- *Do not* define measurement abbreviations in text, figures or tables.

Examples:

10 psi   60 dB

5 in   120 mA

- Capitalize all letters in acronyms regardless of whether the words are capitalized when spelled out in text.

Examples:

air traffic control (ATC)

pulse repetition frequency (PRF)

Department of National Defence (DND) electronic warfare (EW) training aircraft

- Except in certain instances, use lower case for measurement abbreviations.

  Examples:

in.	Exceptions:	pF
ft		Hz
lb		GHz
psi		dB

- *dc* and *ac* should be lower case unless they appear in titles or at the beginning of a sentence.

- *ac* should not be used if there is another term in the expression to indicate that the electrical power is alternating.

  - 440V 400Hz (correct)
  - 440 Vac (correct)
  - 440 Vac 400Hz (*ac* is redundant)

- Generally, write abbreviations without terminating periods. Exceptions to this rule are often determined by general usage, and include abbreviations such as i.e., e.g., U.S., and U.K. Measurement abbreviations never take a period, with the exception of 'in.' (inch) to distinguish it from the preposition.

- Temperature measurements should be styled as follows:

  9°C   V ± 4

- When alongside a numeral, percentage is always represented by % symbol.

Examples:

85%

0.002%

<u>Exception</u>:

The percentages are as follows: ....

- Never abbreviate words such as *paragraph, figure, table*, and *section* (unless space requirements in graphics or tables demand it).

- Leave a space between the numbers and the units of measurement to which the numbers pertain, but *do not* leave a space between the unit modifier and the unit symbol.

Examples:

28 Vdc	45 in.
115 Vac	5.4 mV
25.5 ft	0.4 mA
3 g	12 lb

- *Do not* use measurement abbreviations in text when the words are not accompanied by numerals.

Examples:

The equipment measurements are specified in feet and inches.

The equipment measures 5 ft 2 in. by 18 ft 5 in.

- Express plural and singular measurement abbreviations the same.

Examples:

1 in.   20 lb

25 in.   6.9 kg

- Plurals of acronyms which are standing alone are generally formed by adding *s*.

Examples:

RCVRs (Receivers)

LSDs (Lesson Specification Documents)

- Avoid redundancy in abbreviations, such as IF *frequency*, AC *current* and so on.

- When abbreviating the prefix *micro* use Greek letter μ. *Do not* substitute *u* for μ unless no μ character is available.

Examples

μA (microampere)

μs (microseconds)

- *Do not* begin a sentence with an abbreviation.

Capitalization

- *Do not* use upper-case letters merely for emphasis.

- *Do not* use quotation marks in conjunction with capitalized words for emphasis

Initial Capitalization

- Initial-cap the following:

(a)   Proper nouns and other important words forming proper noun phrases, such as proper adjectives or proper nouns used as adjectives.

Examples:

Ohm's law

Zener diode

Phillips screwdriver

Doppler radar

Federal Communications Commission

the Government (when referring to the Canadian or U.S. Government)

U. S. Army

Canadian Forces

Exception:

The armed forces in Europe require strengthening.

(b)   Copyright trade names.   Avoid these when possible and use common noun equivalents.

Example:

Fiberglas, but use *fibreglass* when possible.

(c)   The names of specific pieces of equipment, generally identified by a number.

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Examples:

CCS - 280 Command and Control System

The LSL LASR - 2 Airborne Search Radar should be considered for any future replacement of the airborne radar system. (Note that 'airborne radar system' is in lower case.)

These are methods that could be incorporated within the Ship Electronics System Evaluation Facility.

LSL has the capabilities to undertake the Long-Range Patrol Aircraft Program.

<u>Exception</u>:

There is currently a great deal of interest in long-range patrol aircraft.

Incorrect - An Operator Console will be provided on the left side of the aircraft. This Console will provide Control Panels for remote operation of the equipment.

Correct - An operator console will be provided on the left side of the aircraft. This console will provide control panels for remote operation of the equipment.

(d)   Capitalize single letters used to describe objects.

   Examples:

   O - ring   C - clamp

   A - frame   T - square

   V - block   I - band

(e)   General geographical terms (North America), *but not* mere descriptive terms
          (Atlantic islands).

(f)   The letters X, Y, and Z used to designate axes.

(g)   Directions when used as proper nouns and referring to points on a compass, *but not* when used as adjectives such as 'west wind'.

Examples:

Vancouver is in the West.

The ship was heading southwest.

- When specific controls or indicators are mentioned in text, the panel designation of the control or indicator should be all in upper case.

Examples:

Set the POWER switch to the ON position

Rotate the VOL. control fully clockwise.

Set the MAIN / AUX. switch to AUX.

Numerals

- Spell out numbers from zero to nine. Numbers greater than nine should be expressed as numerals.

Exceptions:

Numbers should be written in words:

- at the beginning of a sentence.

- when two related words appear together, e.g., *Eight* or *nine* workstations will be required.

- when one numerical expression directly follows another, e.g., eight 6-inch bolts.

- when fractions stand alone or modify words that are not units of measurement, e.g., *one quarter* of a mile, *one quarter* full.

- in monetary expressions less than one dollar, e.g., *forty - eight* cents.

Numerals should be used for:

- weights, measures, distances, dimensions, clock times, percentages, degrees and age.

- mathematical expressions and statistical work

- dates, e.g., 8 February 1985, and calendar or fiscal years, e.g., 1914 to 1925

- decimals, e.g., 2.0176

- fractions when they occur in mixed numbers, e.g., 4-1/2

- monetary expressions over ninety-nine cents, e.g., $4.00 and $1.98. Monetary expressions in which cents are not involved should be written as $100 not $100.00.

Equal Sign

- *Do not* use the equal sign in text. Spell out the word *equal*.

Example:

An open latch equals (or is equivalent to) ON in a Fluids Check.

- In a formula, *do not* include any space on either side of the equal sign.

Example:

$V = D / T$

In lists/ headings, use one space on either side.

- Example:

- Latch = ON

WARNINGS AND CAUTIONS

Format

Warning

- Colour the word WARNING, DANGER or HAZARD in red.

- Place the word warning to the left and above the warning text.

- Use all caps for the word WARNING; use normal capitalization for the text.

Caution

- Colour the word CAUTION in yellow.

- Place the word CAUTION above and to the left of the information contained in the caution.

- Use all caps for the word CAUTION; use normal capitalization for the text contained in the caution.

Content

Warning

- Warnings must contain the following information in the order specified below.

  (a)   Specific nature of hazard

  (b)   Steps to take to avoid or minimize hazard

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(c)   Location / source of hazard

(d)   Consequences of ignoring warning or hazard

(e)   First-aid if hazard occurs

(f)   Critical time considerations

Caution

- Cautions should contain the same information specified in the same order as that for warning.

Presentation

- Tabular presentation is an effective way of presenting causes of malfunctions, lists, charts, checklists, inspection sheets, and statistical data.

Example:

There are several methods to warn the operator of malfunctions.	Warning Lights Horns / Buzzers Blinking Displays
These methods are effective because they stimulate more than one of the senses.	Sight Hearing

LESSON COMPONENTS ARRANGEMENT

Lesson Title Page

- Present the lesson title page on a separate screen.

- The title page should include the following items in the order specified:

    - Graphic logo for the equipment/system on which the lesson is based

    - Course name

    - Module name (optional)

    - Lesson title

- Center the graphic logo on the screen. Center text relative to the graphic logo.

Advance Organizer

Content Structure Diagram (CSD)

(a) Graphic / Text CSD

- The word INTRODUCTION should be placed near the top of the display.

- *Do not* use more than three vivid colours (excluding black and white) in the CSD.

- Use colour (to be determined) to highlight the main idea under discussion.

- Use grey to de-emphasize ideas already discussed.

- Retain the subheading INTRODUCTION throughout the screen sequence.

(b) Text - Only CSD

- Place the word INTRODUCTION near the top of the display.

- Use a bullet for each main idea.

- Use colour (to be determined) to highlight the main idea under discussion.

- Use grey to de-emphasize ideas already discussed.

- Retain the subheading INTRODUCTION throughout the screen sequence.

- Leave one blank row between each main idea.

- *Do not* leave blank rows between lines of text that comprise a main idea.

- Center the display vertically as well as horizontally.

Rationale

- Place the word INTRODUCTION near the top of the display.

- Leave two blank rows between the word INTRODUCTION and the first line of text.

- Keep the rationale brief.

- Retain the subheading INTRODUCTION throughout the screen sequence.

Tutorials

Headings

Headings are used to clarify the structure and organization of the lesson content. Each heading should summarize the essence of the information that follows it. If the information occupies more than one screen display, repeat the heading on each additional screen display. Refer to Figure 13 for examples of the following types of headings. Note that Figure 13 is not intended to constitute a single screen display. Headings should be in default text foreground.

Main headings

Main headings are the most general type. Main headings should be presented in all caps and centered horizontally.

Subheadings

Subheadings are more specific than main headings. Subheadings should be placed flush left. Capitalize only the first letter of each word.

Sub - subheadings

Sub-subheadings are the most specific type. Like subheadings, they should be placed flush left.
However, only the first letter of the first word should be capitalized unless other capitalization rules take precedence.

Example Arrangement

- The word EXAMPLE should be displayed in all caps flush left on line 3.

- Repeat the heading on each additional screen display.

- Leave two blank rows between the word EXAMPLE and the first line of text.

- *Do not* present more than one example on a screen. If you present several examples, number them as follows:

EXAMPLE 1 of 3

EXAMPLE 2 of 3

EXAMPLE 3 of 3

① SHINCOM SYSTEM

General:

The SHINCOM System is a militarized and fully integrated Internal Communications System capable of providing redundant / survivable operational and routine communications within a naval warship environment. The SHINCOM System is divided into seven different functional groups. These groups are:

(a)   Control Group
(b)   Network Group
(c)   Primary Power Group
(d)   Maintenance / Administration Group
(e)   Main Distribution Frame Group
(f)   Terminal Group with Ancillary Equipment
(g)   Interface Group.

② Control Group

The Control Group provides the facilities necessary to detect a communication requirement, assemble the switching resources necessary to satisfy the requirement, and re-allocate the switching resources as appropriate when the requirement is complete. The Control Group provides several functions:

(a)   System Processing
(b).   Memory
(c)   Miscellaneous functions.

③ System processing

The System Processing function provides the necessary control amd timing, logic, and hardware and software interfaces to the Network Group. In general, it allocates and re-allocates the appropriate switching requirements for the Network Group.

KEY:

①   Main Heading

②   Subheading

③   Sub-subheading

Figure 13. Types of Headings

Confirmation Items

- *Do not* use headings for confirmation items. Include a text transition into the confirmation items.

Guided Simulations

- Guided simulations should not be labelled as such. Headings that are representative of the maintenance / operator activities being simulated should be used; for example, *troubleshooting*.

Open Simulations

- Same as for Guided simulations.

Lesson Summary

- Place the word SUMMARY in default text foreground and in all caps in the upper left corner.

- Use a bullet to restate each main idea.

  Exception: use numbers if an order is implied.

- Leave two blank rows between this heading and the first line of text.

- Repeat the heading on each additional screen.

- Include a text transition into the Lesson Check.

Lesson Checks

- *Do not* use headings for lesson checks. The text transition in the summary announces their presentation.

Transitions

- Transitions help the trainee to move smoothly from one portion of a lesson to another. Transitions help the trainees maintain an overview on the lesson / module and keep them oriented on their progress through the material.

- Use transitions at the end of instructional segments / lesson or at the beginning of the forthcoming
  instructional segments / lesson.

Examples:

End of lesson

So far, you have been introduced to the subsystems which comprise the Command and Control System.

In the next lesson, you will learn how the subsystems relate to one another.

<u>Beginning of lesson</u>

In the previous lesson you were introduced to the subsystems which comprise the Command and Control System. Now you will be shown how those subsystems relate to one another.

Transitions may be supported by a Content Structure Diagram (CSD). If the lesson sequence dictates a change from one portion of the CSD to another, display the CSD again so that the trainees can realize that they are moving from one segment of the lesson to the next.

OUTLINE FORMAT

<u>Numeral punctuation</u>

- Use a period after:

-	Roman numerals	I.
-	Capital letters	A.
-	Arabic number	1.
-	Lower case letter	a.

- *Do not* use a period after:

-	An arabic number enclosed in parentheses	(1)
-	A lower case letter enclosed in parentheses	(a)
-	A lower case numeral enclosed in parentheses	(i)

<u>Numeral alignment</u>

- Arrange numerals so that the periods line up vertically.

Example of proper alignment:

    I.

    II..

    III.

    IV.

Outline Spacing

- Leave one blank row:

  - Between the end of one Roman numeral unit and the beginning of the next Roman numeral unit.

  - Between a capital letter subdivision and the first line of an Arabic numbered section which follows it.

- *Do not* leave a blank row between each subdivision in an Arabic numbered section.

- *Do not* leave a blank row between lines of text within a subdivision.

- Leave a single space between a period and the first letter of text when the period follows a number.

An example of vertical spacing in an outline is provided in Figure 14.

Outline Capitalization

- For numeral subdivisions, capitalize the first letter of each word.

- For all other subdivisions, capitalize only the first letter of the first word except when

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┌─────────────────────────────────────────────────────────────────────┐
│                                                                       │
│  I.   Shipboard Integrated Communication System                       │
│                                                                       │
│                                                                       │
│       A.  Terminal Auxilliary Equipments                              │
│                                                                       │
│            1.  Headset - the headset consists of a dynamic noise - cancelling microphone │
│                element, an earphone receiver, a handset shell and a retractable non-kinking │
│                cord.                                                   │
│                                                                       │
│            2.  Microphone -                                           │
│                                                                       │
│       B.  Interface Group                                             │
│                                                                       │
│                                                                       │
│  II.  Command and Control System                                      │
│                                                                       │
└─────────────────────────────────────────────────────────────────────┘
```

Figure 14. Vertical Spacing in an Outline

the conventional spelling of a phrase requires that the first letter of each word be capitalized.

abbreviation consists of all capitals.

Outline End- of-Line Punctuation

• Use a period only when the unit includes a full sentence.

APPENDIX IV

GRAPHICS/VIDEO PRESENTATION

GRAPHICS/VIDEO PRESENTATION

- Visuals should complement the instructional context. Graphics /video should not diminish the trainee's enthuasism to learn, detract from the sound track or other learning materials, or waste the learner's time.

- Show things that can be seen but are difficult to describe.

- Keep the sound (if sound is used) and the visuals on the same subject. The objective is to have the senses complement each other rather than have discontinuity. Similarly, there should be agreement between visualized text and visuals that appear on the same display (Braden & Walker, 1983; Braden, 1982).

- Restrict lists, sets, etc., to seven items or fewer per display (Miller, 1956).

- Show only one primary concept or idea per visual display. Several facts may be displayed so long as they all refer to a single, central subject.

- Repeat whole displays or major segments of displays to reinforce learning.

- Repeat visual themes from one display to another. Repetition should be carefully planned to serve as a continuity bond as well as a memory aid.

- Avoid abbreviations and acronyms that are not well known or defined in the lesson (Olson & Wilson, 1985).

- Avoid showing things symbolically unless the meaning of the symbol is clear.

- Avoid crowed screens (Olson & Wilson, 1985).

- Avoid too much detail in diagrams, drawings, and illustrations (Dwyer, 1983).

APPENDIX V

HIGHLIGHTING TECHNIQUES

HIGHLIGHTING TECHNIQUES

General Guidelines for Highlighting

- Minimize highlighting. The more you highlight, the less effective it becomes as a learning aid.

- Highlight only important points such as key terms, concepts, or relationships.

- *Do not* use capitalization or quotation marks for emphasis; use highlighting techniques such as coloured text or bold.

Specific Guidelines for Highlighting

Although there are many ways to highlight material, it is suggested that you use the following techniques:

(a) Bold

- Bold key words and brief phrases.

(b) Colour

- Use sparingly so that it remains effective. No more than 20 % of text on a screen should be in colours different from the default colour. Remember that colour loses its effectiveness when coloured units are too close together.

- Punctuation marks within coloured text should be displayed in the same colour chosen for the coloured text. All other punctuation marks should be displayed in default text foreground.

Exceptions:

- Use red to symbolize *warning, stop,* or *danger*; green to indicate *go* or *ok*; and yellow to denote *caution.*

- Display instructions to the trainee in a different colour/text size (TBD) from that of the lesson content.

- Highlight new terminology in a different colour/text size (TBD) from that of the text.

- Use italics for titles of books, films, etc., to indicate foreign words, and to emphasize a word or a phrase.

(b) Boxes

- Leave two blank rows / columns between unboxed text and box lines.

- Leave one blank row above and below text to be boxed and box lines.

- Within the box, leave two blank columns on the left and two on the right.

- If you use a bullet, leave one blank column to the left. Another blank column must be placed between the bullet and the first character of text.

(c) Background Colour

Do not use background colour to highlight sentences or blocks of text.

(d) Blinking

- Blinking causes selective attention to the point of exclusion of anything else on the screen.
  It should, therefore, be used only for urgent messages or when you simulate a piece of equipment that blinks as part of its function.

- Highly saturated, spectrally extreme colours should not be displayed simultaneously as they require refocusing. To avoid frequent refocusing and visual fatigue, extreme colour pairs such as red and blue or yellow and purple should be avoided. Reds, oranges, yellows, and greens can be viewed together without refocusing, but cyan and blues cannot be viewed simultaneously with red (Murch, 1985).

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- Our visual system is not set up for detailed, sharp, short-wavelength stimuli. While blue serves as a good background colour and is perceived clearly out into the periphery of our visual field, pure blue should not be used for text, thin lines, and small shapes (<u>Murch, 1985</u>).

- Adjacent colours which differ only in the amount of blue should be avoided because the edges created will appear indistinct (<u>Murch, 1985</u>).

- Our visual system depends on a brightness difference at an edge to effect clear focusing; therefore, multicoloured images should be differentiated on the basis of brightness as well as colours (<u>Murch, 1985</u>).

- The retinal periphery is insensitive to red and green. In the creation of large-scale displays, saturated red and green should not be used, especially for small shapes and symbols. Yellow and blue are good peripheral colours (<u>Murch, 1985</u>).

- Since opponent colours go well together, red and green or yellow and blue are good for simple displays. The opposite combinations red with yellow, or blue with green produce poor displays (<u>Murch, 1985</u>).

- Not all colours are equally readable or legible. Extreme care should be exercised with text colour relative to background colours. Besides a loss in hue with reduced size, inadequate contrast frequently results when the background and text colours are similar (<u>Murch, 1985</u>).

- Hues change with intensity and background colour; therefore, when grouping elements on the basis of colour, one should ensure that backgrounds and nearby colours do not change the hue of an element in the group. Limiting the number of colours and making sure that they are widely separated in the spectrum will reduce confusion (<u>Murch, 1985</u>).

- The need for colour discrimination in small areas should be avoided because hue information is lost for small areas. In general, two adjacent lines of a single-pixel width will merge to produce a mixture of the two. Also, the human visual system produces sharper images with achromatic colours. Thus for fine detail, it is best to use black, white, and grey while reserving chromatic colours for larger panels or for attracting attention (<u>Murch, 1985</u>).

- Colour should not be overused. If too many colours are used, the benefits of colour as an attention getter, information grouper, and value assigner are lost. Cognitive scientists have shown that the human experiences great difficulty in maintaining more than five elements simultaneously; so it is best to limit displays to about six clearly discriminable colours (Murch, 1985).

- A common backround colour should be used to group related elements. A common colour code prepares or sets the reader for related events. A successive set of images can be shown to be related by using the same background colour (Murch, 1985).

- The degree of similarity in hue can be used to convey the message that elements are related because similar colours connote similar meanings. The colour range from blue to green is experienced as more similar than the gamut from red to green. Along these same lines, saturation level can also be used to connote the strength of relationships (Murch, 1985).

- Brightness and saturation should be used to draw attention. The brightest and most highly saturated area of a colour display immediately draws the viewer's attention (Murch, 1985).

APPENDIX VI

INTERACTION TECHNIQUES

INTERACTION TECHNIQUES

General

You may use both dynamic and interactive sequences. In an interactive sequence, the trainee responds to a static or dynamic display. Dynamic sequences are characterized by change or movement.

Interactive Sequences

Interactive techniques

Any technique that requires the trainee to make a response adds to the instructional quality of the lesson. Here are some interactive techniques.

Press spacebar to continue.

The trainee presses the spacebar key to advance to the next display.

Point.

The trainee uses the mouse to point to a graphic, which causes the attributes of the graphic to change or results in the input of a set of coordinates.

Questions.

Trainees can enter their responses to a question by typing the answer on the keyboard or by pointing on the screen with the mouse. Here are some guidelines on which response mode to use.

(a) For constructed response questions, the trainee can enter the answer by using the keyboard.
    The keyboard as well as pointing devices may be used for selected response questions.

(b) Although simulations rely heavily on mouse and trackball input mode, trainees may also enter
    responses via the keyboard.

(c) Use pointing devices for questions which require the trainee to respond with more than one answer. Pointing devices would be applicable for a multiple choice answer in which three of the four alternatives are correct and you want the trainee to mark three responses.

(d) Group questions by response mode. For example, if you have three constructed response questions (keyboard input) followed by a multiple choice question, use keyboard input for the multiple choice question.

When you use questions to promote interaction, incorporate as many interactive graphics as possible into the questions. In addition, you should have the graphics change, depending on the trainee's response to the question. For example, you may cause dials to turn to a setting that the trainee chooses.

Help frames.

Help frames provide detail for trainee clarification. Include help frames whenever possible especially when presenting difficult material.

Menus.

Menus provide the trainee with choices. Menus should only be used when learning outcomes are not affected by the order in which the trainees study the topics listed in the menus.

Break Flags.

A lesson should not exceed 30 minutes. However, the content may occasionally require longer lessons.

In such instances, try to determine logical break points in the lesson and insert breaks at these junctures.

APPENDIX VII

WRITING STYLE

WRITING STYLE

Simplicity of Sentence Structure

- Use several clear and concise statements instead of one or two elaborate, complicated, and potentially confusing statements.
- Remove unnecessary verbiage.
- Avoid using modifiers which are redundant.
- Present information in small succinct units.

Tone

- Use conventional contractions instead of stilted or mechanical language.
- Use common words and expressions in the presentation.
- Avoid neologisms. If you must coin a word, place it in quotation marks.
- Avoid using jargon. Use legitimate technical terms. Legitimate technical terms provide a name for a function, process, or piece of equipment that would be very difficult to describe without the name. Jargon substitutes a faddish, difficult name for an existing, simpler name.
- Use conversational expressions.
- Avoid phrases which require the use of compound negatives to convey your meaning.
- Avoid subject-predicate inversion.
- Humour should be appropriate for the audience, applicable to the subject, and not offensive.
- Use the active voice. Use the present or future tense and aim directive statements to thee reader. As a rule-of-thumb, if the subject of the sentence *acts*, the statement is *active* voice; if the subject is *acted upon*, then it is *passive* voice.
- Modifiers should apply to nouns and verbs, not to other modifiers such as, adverbs or adjectives.
- Ensure that you maintain sequence of tenses.
- Use positive rather than negative expressions.
- Use motivational tactics to instill in the trainee a feeling of the importance of the learning activities. Point the value of the material that the trainee is learning. Communicate a feeling of responsibility through the explanation of the significance of the learning activities.

Integration of Material

Sequential Arrangement

- Unless the material deals with the development of a concept or universal principle, present materials with a progression form broad to narrow, general to specific.
- Develop fundamental skills and knowledge prior to presenting more difficult material.
- State safety precautions within procedures at the points where they are applicable.
- State the theme at the beginning of frames so that the trainee's attention is focused on the main point.

Development of Relationships

- Structure the material for the trainee.
- Tell the trainees what they will learn in the lesson.
- Inform the trainees what specific tasks they will be required to perform after completing the lesson, why those tasks must be completed, and why the materials represented by those tasks must be learned.
- Periodically reinforce organizational and motivational statements to help maintain a sense of direction and feeling of significance fresh in the trainees' minds.

Transitional Techniques

- Use consistent treatment when highlighting important words or phrases.
- Present a brief reiteration of previously covered material, and by way of introduction, an indication of how the next material to be presented ties in.
- Use connectives. Connectives such as *and, but, thus, however, also, while,* bind ideas in one part of a paragraph, frame, or sentence with ideas in another part.