# A TEXT DEVELOPMENT PROCESS TO IMPROVE
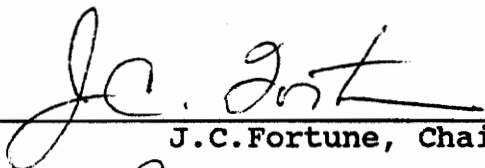# THE COMPREHENSIBILITY OF EDUCATIONAL TEXT

by

Penny Risdon

Dissertation submitted to the Graduate Faculty of the
Virginia Polytechnic Institute and State University
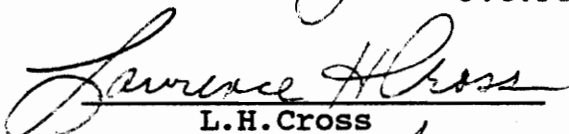in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

in

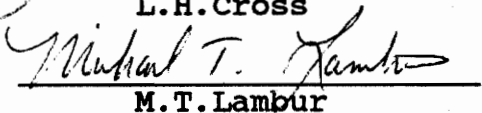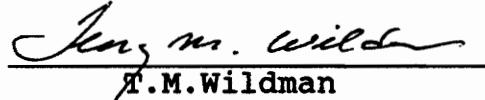Educational Research and Evaluation

APPROVED:

_____
J.C.Fortune, Chairman

_____          _____
L.H.Cross                        K.T.Hereford

_____          _____
M.T.Lambur                       T.M.Wildman

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A TEXT-DEVELOPMENT PROCESS TO IMPROVE
THE COMPREHENSIBILITY OF EDUCATIONAL TEXT
by
Penny Risdon
Committee Chairman: Jimmie C. Fortune
, Educational Research

(ABSTRACT)

Staff of the Cooperative Extension Service develops and
distributes educational publications to inform the public of
practical applications of research information. However, many
of these publications are written in a technical style that
makes them difficult for the average 4-H member and adult
leader to understand the subject matter presented. The
purpose of this study was to investigate a systematic process
for improving the understanding or comprehensibility of these
educational publications. A model of a publication
development process based on learning principles was created.
This study investigated the effectiveness of the model with
Extension subject-matter specialists developing publications
for 4-H youth. Specifically, this study was conducted in
three parts: the model of the text-development process was
taught to subject-matter specialists; the specialists in turn
used the model to develop educational texts for 4-H youth; and
finally comprehensibility testing of the text passages
produced by the specialists with 4-H youth members and adult
leaders was conducted. This study confirmed that the
utilization of learning principles within the text-development
process can improve the comprehensibility of subject matter
information presented in Extension educational publications.

# ACKNOWLEDGMENTS

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## INTRODUCTION

### Background

The Cooperative Extension Service was created to
disseminate to the public the practical application of the
latest scientific findings generated at land-grant
universities. To accomplish this mission, much of this new
knowledge is disseminated through 4-H educational
publications. In 1989, approximately 125,000 members of the
Virginia 4-H Program each received an average of two of these
educational publications. However, many of these publications
are written in a technical style which makes them difficult
for many 4-H youth members and adult leaders to understand the
subject matter presented; hence, substantially reducing their
utility. This study investigated the utilization of learning
principles in a text-development process to enhance the
understanding or comprehensibility of these educational
publications.

Most Extension publications are written by Extension
Specialists who have earned terminal degrees in their subject-
matter area. The level of their expertise inadvertently
creates a two-fold problem. First, part of the training for
earning a terminal degree is in the comprehension of technical
concepts in a specialized field. Most of the specialists have
become so comfortable with these technical concepts that they
are not aware of the gap in knowledge that exists between them

and novice learners. Secondly, in earning a terminal degree a scholar must demonstrate the necessary skills to conduct research. This places an emphasis on developing skills to conduct research, but not necessarily on the skills to teach the research findings or subject matter to novice learners. Teaching is a subject-matter specialty itself. Consequently, subject-matter specialists often lack an appreciation of how people learn and of teaching principles. In short, educational publications are developed to aid in the understanding of subject-matter concepts; unfortunately, information about how learning occurs may be overlooked by specialists who develop these materials. Due to these and related factors, many of Extension's publications are inappropriate for disseminating the practical application of research information to the general public (Nehiley, & William, 1980; Reyburn, 1979). This situation creates a need for a publication development process based on learning principles, that specialists could use to revise or create effective educational publications.

The Cooperative Extension Service is the educational division of the United States Department of Agriculture. As a federal agency, Extension serves citizens from diverse socio-economic levels. Many programs, such as the Expanded Food and Nutrition Education Program, are targeted for low-income participants. There is a linear relationship between reading ability and socio-economic status (Wingfield, & Asher,

1984). Therefore, a model of a publication development process that would facilitate reading comprehension for less skilled readers would be beneficial for the Extension program, as well as the broader educational profession.

Proponents of Extension programs emphasize that its subject matter is research-based. Accordingly, Extension's educational materials should be developed in alignment with learning and/or teaching principles that are also research-based. Considerable knowledge about the learning and/or teaching process relevant to instructional materials has been generated through research in the field of educational psychology. A review of the research suggests that instructional materials or educational text can be developed to complement the learning process, thereby facilitating the understanding of new information. In the field of curriculum development, systems have been utilized that integrate learning principles into a developmental process for creating educationally effective materials (Dick, & Carey, 1985; Gagne, & Briggs, 1974; Wildman, & Burton, 1981). The same concept that is used for the systematic application of psychological principles in the formation of instructional materials could be used for the development of Extension's educational publications. This study proposes a systematic text-development process based on psychological principles to assist subject-matter specialists in creating more educationally effective publications.

## Purpose of the Study

The purpose of an educational text passage is to encourage the learning of subject-matter concepts. The purpose of this study was to encourage Extension subject-matter specialists to use learning principles to develop more comprehensible educational text. This study proposes a model of a text-development process based on fundamental learning principles, as an educational aid to assist subject-matter specialists in developing more comprehensible educational publications. The proposed text-development process could be used to assist subject-matter specialists in revising an existing text or in creating an original text. This study investigated the effectiveness of text-development process on both revised and original text conditions.

## Research Questions

The use of learning principles in a text-development process for the expressed purpose of improving the comprehensibility of Extension's educational publications raised questions which were the object of this investigation. These are:

1.  Does the application of learning principles in a text-development process aid Extension subject-matter specialists in improving comprehensibility of Extension educational text passages?

2.  Does the application of learning principles in a text-development process aid comprehension for most of

Extension's clients?  In particular, will less skilled readers benefit from text which has been produced with the aid of the text-development process?

## Research Hypotheses

The purpose of the study was to test the influence of the application of learning principles in the text-development process on the comprehensibility of Extension's educational text.  The research hypotheses are directly related to the two research questions.  These are:

$H_1$. The application of the learning principles in text-development does result in more comprehensible text.

$H_{1a}$. The application of the learning principles in text-development does aid Extension subject-matter specialists in **revising** text to improve comprehensibility.

$H_{1b}$. The use of the learning principles in text-development does aid Extension subject-matter specialists in creating more comprehensible **original** text.

$H_2$. The application of the learning principles in text-development does aid comprehension of text for less skilled readers.

$H_{2a}$. The application of the learning principles in text-development does aid comprehension of **revised** text by less skilled readers.

$H_{2b}$. The application of the learning principles in text-development does aid comprehension of **original** text for less skilled readers.

The primary research hypothesis for each text condition (revised and original) was tested indirectly by comprehensibility ranking, testing, and rating of text written by Extension subject-matter specialists. The secondary hypothesis was tested directly with reading comprehension testing with skilled and less skilled readers.

**Scope of the Study**

Based on prior studies, experimental research is subject to limitations. Therefore, the scope of this study was based on the following conditions.

1. Several types of text exist. This study investigated the impact of the use of learning principles in text-development on the comprehensibility of educational text developed by Extension subject-matter specialists.

2. Three Extension subject-matter specialists were taught learning principles with a proposed text-development process.

3. The study tested comprehension of educational texts written by Extension specialists by children enrolled in the sixth-grade 4-H program and by 4-H adult leaders.

4. Given that reading comprehension is a covert mental process, there is no exact observable method of measurement. A written test of comprehension was composed of questions focusing on main ideas presented in the texts or requested in the text specifications. In addition, the texts were ranked and rated on reading

quality by the youth and adult readers.

5. Given that reading comprehension skill improves as a result of practice, it was assumed that children are less skilled readers than literate adults. It was further assumed that it is more difficult to develop text comprehensible to children, rather than adults.

## Overview of the Study

The purpose of this study arose from a need to improve the educational quality of Extension's publications. A text-development model was created to aid subject-matter specialists in utilizing learning principles to revise and create more effective and comprehensible educational publications. In Chapter 2 the text-development model is described and supported with related research efforts. This is followed by a presentation of preliminary studies conducted with the model. A description of teaching the model to subject-matter specialists, and, the research methods used in the study are presented in Chapter 3. The research results and discussion of the findings are given in Chapter 4. Conclusions and recommendations are in Chapter 5.

# Chapter 2

## REVIEW OF RELATED RESEARCH

### The Need For A Text-Development Model

There is a need for a text-development model that focuses on comprehensibility, because the concern with the poor instructional quality of educational text permeates the educational profession (Britton, Van Dusen, Gulgoz, and Glynn, 1989). However, it is not a new concern. The concept of improving text quality in an effort to improve comprehensibility was proposed by Edmond Huey in 1909. Since then, hundreds of studies have been conducted on individual text factors or text construction strategies, that have been shown to influence comprehension. Lacking in this research area is a model that incorporates multiple text construction strategies related to basic learning principles within a systematic process for creating comprehensible text.

Within the past two years Walter Kintsch (1987) and Isabel Beck (1989) have proclaimed a need for a text-development model based on information gained from cognitive processing research. The concept of using knowledge on how the mind processes information to develop educational materials was suggested 25 years ago by cognitive psychologists Jerome Bruner (1959) and David Ausubel (1963). Since that time, research efforts have focused on individual factors that enhance the comprehension or learning of subject-matter concepts. Many of the successful research efforts with

text construction strategies can be shown to be in alignment with two learning principles essential to comprehension. The two fundamental principles concerning how people learn or acquire new information were proposed by Ausubel in 1963, and were extensively investigated in the 1970s and 1980s in relation to text processing.

The first learning principle, progressive differentiation, indicates that knowledge is processed and stored within an organized hierarchical system, i.e. ranked from general to specific information. Ausubel proposed that effective learning occurs when information is presented in an organized manner that is consistent with the way the mind processes and stores information. Research over the past twenty years has verified and clarified the importance of the progressive differentiation principle in relation to comprehension or learning. Over time this principle has been identified by different terms. For this study a term descriptive of its function will be used; it will be called the principle of structure and organization. Relevant text construction strategies associated with the structure and organization principle serve on the global or overall text level to organize the main concepts to be presented in the passage. The same principle facilitates learning when used on the local or sentence-paragraph level to organize individual or supporting concepts.

Ausubel's second learning principle, integrative

reconciliation, proposed that new knowledge is learned by connecting or anchoring the new knowledge to an existing knowledge structure, i.e. what the learner already knows. Whereby, the reader's prior knowledge of a subject must be activated and in working memory to serve as a foundation for understanding or retaining new knowledge. This principle also has been empirically verified and identified by different terms. For this study a term descriptive of its function will be used; it will be called the relevance principle. Several text construction strategies consistent with the relevance principle function on the global level to relate the central topic to the anticipated reader's common knowledge base. The same principle serves on the local level to assist readers in gaining an understanding of technical terms, essential for comprehending a subject-matter concept.

For this study, a model of a text-development process was created based on learning principles related to text processing. The model of the text-development process is theory-driven from the cognitive processing perspective, and supported by empirical studies focusing on the specific application of text construction strategies shown to enhance comprehension. The text construction strategies used in each stage of the text-development process are directly related to the two broad educational principles. The combination of these two basic principles is used on the global or overall text level, as well as the local or sentence/paragraph level

as shown in Figure 1.

## The Model of the Text-Development Process

The model of the text-development process has six stages: clarifying the purpose, creating relevance, developing coherent structure, explaining terminology, composing cohesive passages, and evaluating the text. The stages serve as a time frame for the balanced and practical application of the two learning principles. Decision-making questions and developmental guidelines were generated for each stage, to assist use of these learning principles. It is proposed that a writer could implement the two learning principles in the development of a writing project by thinking through each of the stages before beginning production, and projecting how the learning principles could be used to facilitate the understanding of subject-matter concepts. A matrix displaying the stages, decision-making questions and developmental guidelines is shown in Figure 2. The model is explained through its relationship to basic learning principles and supporting theoretical and empirical research. Each stage of the model is summarized by the text construction strategies writers could use to implement the learning principles while creating educational text.

The number of text construction strategies which have been shown to increase comprehension of text is extensive. To attempt to use all strategies would overwhelm even the most ambitious writer. The proposed text-development process uses

### Relationship of Learning Principles
### In The Text-Development Process

Text
Comprehensibility

Structure &
Organization
Arrangement
of concepts

Relevance
Relationship to
reader's prior
knowledge

Stage One:
Clarifying
the
Purpose

Stage Two:
Creating
Relevance

Stage Three:
Developing
Coherent
Structure

Stage Four:
Explaining
Terminology

Stage Five:
Composing
Cohesive
Passages

Stage Six:
Evaluating
the
Text
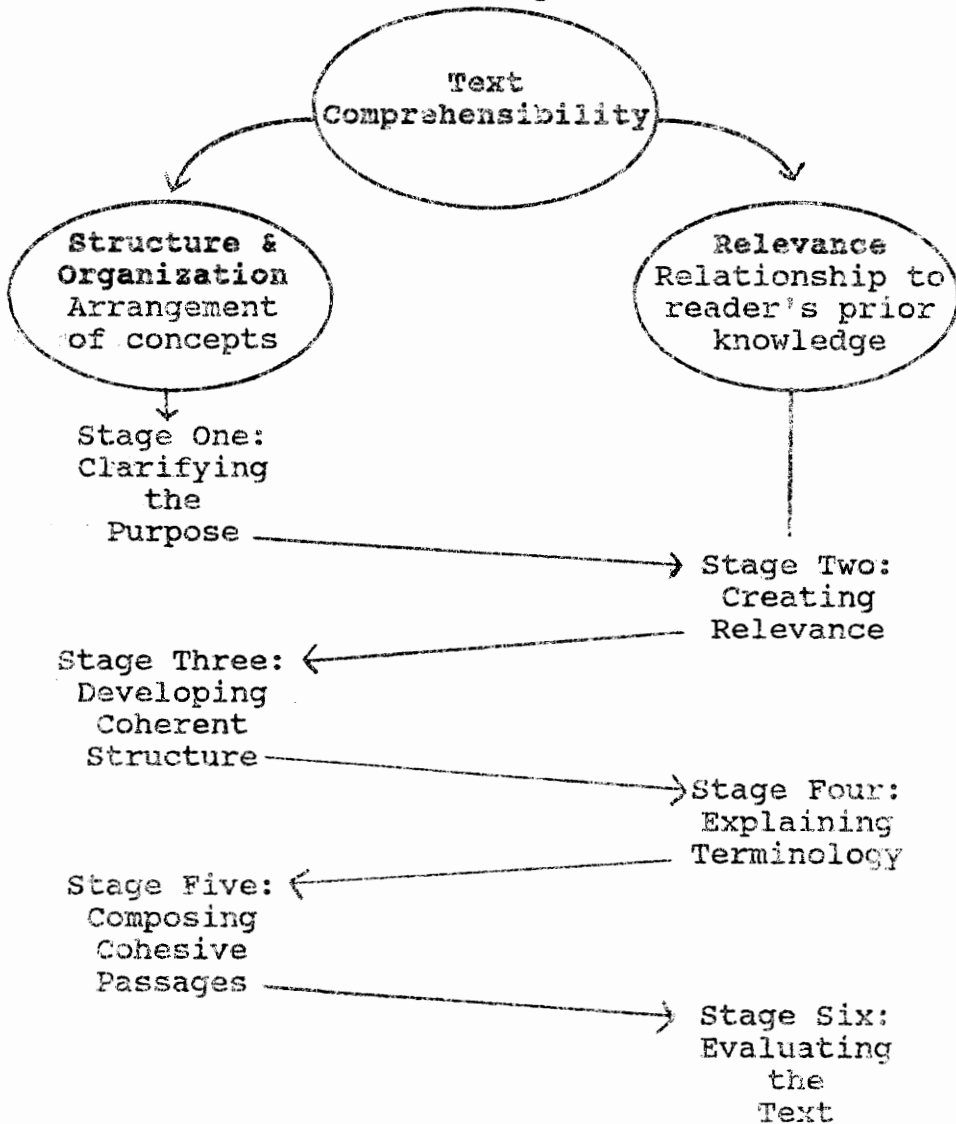
Figure 1 represents the practical application of the two
learning principles in an effort to enhance comprehension.
Use of the structure and organization principle aids
arrangement of concepts on the global and local level within
a text passage. Whereas, the relevance principle is used on
the global and local level to relate concepts to the
anticipated reader's prior knowledge.

Figure 2

## Model of the
## Text-Development Process

| Stage | Decision-making Questions | Developmental Guidelines |
|---|---|---|
| **Stage One:** Clarifying The Purpose | What is the purpose of the text? What is the central topic to be conveyed? What are the main and supporting ideas? | Designate the purpose. Develop a semantic map. Delineate major and minor points. |
| **Stage Two:** Creating Relevance | How much do the intended readers know? How can the new information relate to them? What's important about this new information? | Estimate readers' knowledge of this area. Anticipate readers' interests. Develop an opening statement. |
| **Stage Three:** Developing Coherent Structure | Are the concepts in a consistent order? Has a conceptual flow been created? Has non-relevant information been deleted? | Develop a conceptual outline. Articulate relationships. Eliminate non-essential material. |
| **Stage Four:** Explaining Terminology | Have technical terms been identified? Which terms must reader's comprehend? Which technical terms should be explained? | Identify technical terms. Decide which words to substitute. Decide which words to explain. |
| **Stage Five:** Composing Cohesive Passages | Does each paragraph have a topic sentence? Does each sentence connect with the next? Have all major concepts been presented? | Develop topic sentences. Confirm connections between sentences. Prepare a summary statement. |
| **Stage Six:** Evaluating The Text | How will comprehension be measured? Are the main ideas comprehensible? Did the reader gain important information? | Evaluate text for adherence to principles. Have colleague evaluate the text. Have intended reader evaluate the text. |

the most promising text construction strategies within developmental stages to assist the creation of more comprehensible educational text. The merit of the text-development process is that it allows the writer to focus on one beneficial text construction strategy at a time. The application of each strategy in the development of text should enhance the opportunity for learning.

**Stage One: Clarifying the Purpose.**

The first stage of the text-development process assists the writer in clarifying the educational purpose or objective of the proposed text. The theoretical underpinning of objectives was advocated by Ralph Tyler in 1949. He indicated that the educational objective serves as a compass to guide the planning of a lesson. By analyzing the expected outcome of instruction the writer can work backwards to plan the text to facilitate achieving the purpose. This is analogous to knowing the destination of a trip, then planning the route to reach the destination. Gagne (1962) promoted the importance of conveying the objective to the learner, as encouragement for the learner to activate existing semantic knowledge.

At the beginning of a writing project the writer may only have a vague idea of the educational objective. It is suggested that the writer develop a semantic map which shows the relationship of main and supporting ideas of the text in an hierarchical, structured network. Jotting down ideas in a semantic map has been shown to be an effective method for

generating ideas and concept delineation (Glynn, & DiVesta, 1977; Moore, & Readence, 1984). From this activity the writer can analyze ideas and conceptualize how each point relates to the central topic. A semantic map or network can take many forms depending on how the writer perceives the relationships, but it should show the relationships between concepts with lines and arrows. The semantic map in Figure 1 gives a visual representation of the relationship of learning principles in the text-development process.

Writers revising existing texts should read through the entire publication, then summarize the main purpose. It is suggested that the main idea of each paragraph be circled and key words of the supporting concepts be underlined. The identified concepts should then be ordered within a semantic map. If a major re-organization of an extensive text is anticipated, the writer could develop a series of semantic maps.

Practical Application of the Learning Principle:

To implement the global use of the structure and organization principle, the writer should develop a semantic map. The semantic map establishes and clarifies the overall purpose and affirms the relationships between major and minor concepts to be presented in the overall text passage.

**Stage Two: Creating Relevance**

The second stage of the text design model is concerned with analyzing the knowledge level of the intended reader, and

reflecting on how new information can be connected to what the reader already knows. The relevance principle is used on the global level to relate the central topic to the learner's existing knowledge. The text construction strategies in this stage focus on activating the reader's existing knowledge of the topic they are to read about so that the new information can be more readily understood and retained.

The underlying theoretical base supporting the importance of prior knowledge activation was first proposed by David Ausubel in 1963. Since then the importance of this principle has been discussed by Alba and Hasher (1983), Adams and Bruce (1982), Ausubel, Novak, & Hanesian (1978), Bransford (1979), Langer (1982), Spiro (1977), and Wilson and Anderson (1986) as enhancing the learning process. This concept stems from the constructive educational orientation which contends that learning occurs by incorporating new knowledge on an established knowledge foundation. The new knowledge is retained by associative structures which serve as bridges between knowledge bases and the formation of new knowledge structures. As Adams and Bruce (1982) suggest, a major determinant of comprehensibility is the goodness of the match between the knowledge the author has presumed of the reader and that actually possessed by the reader. When writers begin by introducing concepts familiar to the reader and go on to explain how these familiar ideas are connected to novel ideas, the new information is better recalled than when writers fail

to make these connections. Numerous studies (Anderson, Spiro, & Anderson, 1978; Beck, Omanson, & McKeown, 1982; Bransford, & Johnson, 1972; Johnson, & Kieras, 1983; Langer, & Nicolich, 1981; Pearson, Hansen, & Gordon, 1979; and Thorndyke, & Hayes-Roth, 1979), have confirmed the importance of prior knowledge activation in the learning and remembering of new information.

Interest and motivation also have a substantial influence on comprehension. Samuels and Eisenberg (1981) proposed that comprehension can be influenced by the reader's reasons for reading the material. In general, readers understand more when they are interested and motivated in a topic. Samuels and Eisenberg contend that by altering a reader's state of interest and motivation, positively or negatively, the degree of comprehension can be altered. When comprehension is viewed in this light, the writer works to stimulate knowledge and interests expected of the reader (Anderson, & Armbruster, 1986).

One way to introduce familiar knowledge and stimulate interest is to begin a passage using a device known as an advance organizer. An advance organizer is a statement or short paragraph in which the writer provides an overview of the information to be presented in the passage. Within the overview the writer conveys how the information is organized and how it relates to what the reader already knows. The strategy concerning advance organizers is that readers will learn more from text when they are given advance notice of

how the information to be presented is organized and relates to existing knowledge (Ausubel, & Fitzgerald, 1962; Ausubel, 1963; Townsend, & Clarihew, 1989). Such notice can relate a student's prior knowledge base with the new concepts that are going to be presented.

Practical Application of the Learning Principle:

An advance organizer implements the global application of the relevance principle. To develop an advance organizer or opening statement, the writer must decide what reader knowledge might serve as a framework for the new information and what reader concerns might be intrigued with the new information. This gives the learner cause to pay attention to the information that will be presented. To design an advance organizer the writer can refer to the organizational pattern established with the semantic map, and then decide how to relate the major points within the map to general concepts, with which the reader is familiar. This will activate the reader's existing knowledge of the central topic and facilitate the assimilation of new knowledge.

**Stage Three: Developing Coherent Structure**

The purpose of the third stage of the process is to create an organizing structure for the text, which depicts the relationships between individual concepts. The semantic map identified the major and minor concepts and suggested their relationship to each other and perhaps their relative position in the conceptual hierarchy. Next the writer must

align the concepts into a conceptual outline which clarifies the order of presentation as well as the relationships of the concepts. The developmental guidelines used in this stage build on the reader's knowledge base by moving from the most general common knowledge concepts to specific subject-matter concepts to facilitate reader's comprehension.

Organization and structure help the reader understand the relationships between concepts which support the main idea of the text. Jerome Bruner (1959) suggested that good organization improves learning and thinking; further, that the organization and categorization of ideas reduces cognitive demands and facilitates concept attainment. Ausubel (1963) proposed that the hierarchical organizations of concepts aids learner's comprehension of subject-matter concepts. Ausubel further proposed that there should be a parallel between the organization of the subject-matter information and the way the mind has information organized. Goetz and Armbruster (1980) advised that the better structured the text and the more apparent the structure to the reader, the more likely the reader is to be able to understand the writer's meaning. Anderson and Armbruster (1986), Bruner, Goodnow, and Austin (1968), Clewell and Cliffton (1985), Mayer (1979), Pearson and Camperell (1981), Spiro (1977), and Tierney and Mosenthal (1982) have advocated that more new information will be learned if it is organized by categorization of supporting concepts. Empirical studies conducted by Aulls, (1975);

Britton, Glynn, Meyer, and Penland, (1982); Bruner and Olver, (1963); Kieras, (1978); Kintsch, Mandel, and Koziminsky (1977); Meyer, Brandt, and Bluth, (1980); and Taylor and Samuels (1983) have demonstrated the positive influence of organized or structured text on comprehension and learning. Practical Application of the Learning Principle:

In a well organized text, main ideas are presented first followed by supporting detailed information to compose a conceptual flow of information. Accordingly, during this stage in the writing process, the major and supporting concepts from the semantic map should be developed into a conceptual outline. Information unrelated to main ideas will only serve to confuse the reader; consequently, it should be deleted. To guide global application of the structure and organization principle, the writer should develop a conceptual outline which articulates the relationship between individual ideas.

**Stage Four: Explaining Terminology**

In the fourth stage of the text-development process the writer focuses attention on the technical terms which support the central topic. Many subject-matter concepts are more precisely conveyed through the use of technical terms; hence, it is important for the reader to learn the meaning of the technical term. The writer can assist the learner in gaining this understanding by introducing the term and explaining its meaning in words with which the intended reader will be

familiar. This text construction strategy is a local application of the relevance principle of connecting new information with existing knowledge.

There is a limit to the facilitating effects of using technical terms. While they offer the learner precision of meaning, their use makes comprehension more difficult. This is because, relative to reading more common words, when learners read an unfamiliar term they spend more mental effort understanding the word. Therefore, less attention is available for understanding the concept being conveyed. Because of this, writers are wise to limit the number of unfamiliar terms they introduce in a selection. To decide which terms to introduce and develop, the writer should consider the relationship of the technical words to the concept being conveyed. When the technical term conveys a major idea it should probably be introduced and explained. However, when the term relates to a lower order idea, a more familiar synonym may be substituted (Just & Carpenter, 1987).

When a technical term is introduced it should be elaborated or used in a context-rich way so the reader can understand the word. This guideline supports the concept of automatic encoding; whereby, learning is facilitated by the writer explaining the word's meaning in such a way that the comprehension of the new word is almost effortless (Hasher, & Zacks, 1979; McDaniel, Dunay, Lyman, & Kerwin, 1988). An elaborative presentation of a word explains the meaning with

familiar words, which enables the reader to anchor the new word to existing knowledge. New or technical terms should be introduced to the reader slowly and used several times to aid the comprehension of the word and the concept the word represents. This text construction strategy was empirically tested and verified as effective in relationship to comprehensibility in studies conducted by Herman, Anderson, Pearson and Nagy (1987) and McKeown (1985).

Practical Application of the Learning Principle:

At this stage in the process, the writer should identify all complex or unfamiliar words in the conceptual outline. Then a decision should be made as to which of these should be retained and explained in the text, and which should be replaced by more familiar synonyms. Underlining the technical terms will flag the need for elaboration in the composing stage. The application of the relevance principle serves to relate essential technical terms to the readers' knowledge base.

## Stage Five:  Composing Cohesive Passages

The fifth stage of the model is concerned with weaving together individual, but related, concepts into a cohesive passage. In the third stage the writer focused on the coherence of the overall writing project; whereas, in the fifth stage the focus is on connecting individual concepts presented within paragraphs. For both stages the principle of structure and organization is used, but on different

levels. The text construction strategies that may be used to connect individual concepts are topic sentences, conceptual linkage and summaries. These guidelines assist the writer with the organization of concepts by linking or showing the relationship between sub-concepts, presented in individual sentences and paragraphs.

An explicit topic sentence can be used to provide a connection between individual, but related, concepts and the central topic. Information near the beginning of a paragraph often has been reported to be recalled better than information appearing later in the paragraph (Kieras, 1978). This suggests that there is a linguistic convention that important information should appear in the initial position. Empirical research has shown that when main ideas are presented in an explicit topic sentence at the beginning of a paragraph, then supported by detailed information, comprehension of discourse is increased (Aulls, 1975; Baumann, 1986; Britton, Glynn, Meyer, & Penland, 1982; Kieras, 1978; and Kintsch, Mandel, & Kozminsky, 1977).

Another text construction strategy that enhances comprehension involves the concept of cohesion. Cohesion is defined by Irwin (1986), as "the psychologically significant semantic links that tie individual sentences to adjacent sentences". Cohesive linkages smooth the transition between idea units and establish a clear relationship between component elements. Cohesion can be created by using devices

which organize and introduce individual but related concepts. These devices can take the form of transitional words and phases, such as: therefore, however, on the other hand. Even when a text passage is relatively well-organized and cohesive, readers still can profit from cues about the organization of ideas in the text; especially, when the content is relatively unfamiliar to the reader or technically difficult.

Empirical research with prose passages has shown that adding a causal connection improves comprehension. Three studies found that sentences which coherently integrate the underlying semantic relations are assimilated more easily than those that do not make the connections (Beck, McKeown, Omanson, & Pople, 1984; Irwin, 1986; Pearson, 1974). Irwin's (1986) experimental results support the importance of coherent links in the comprehension process, indicating a positive relationship between cohesion of concepts and comprehensibility.

A summary statement is another text developmental guideline that enhances comprehension. This textual device briefly restates the major points supporting a concept and brings closure to a passage. Summaries influence learning by putting special emphasis on concepts which the writer feels are essential to understanding the most important ideas in the passage (Reder, & Anderson, 1980).

Practical Application of the Learning Principle:

The structure and organization principle can be

implemented on the local level by composing the supporting concepts listed in the conceptual outline into complete and connecting sentences. The main idea should be presented in an explicit topic sentence at the beginning of a paragraph, then supported by detailed information. The underlined words from the outline should be defined and used several times. If the outline has been followed, the concepts should be arranged in an hierarchical ordered and structured manner. Attention should be paid at this point to cohesion or the connection of individual concepts and individual sentences. A summary statement can be developed to draw together major points which support and bring closure to the topic. These text construction strategies assist in organizing and connecting individual concepts on the local or paragraph level.

## Stage Six: Evaluating The Text

The final stage of the text-development process involves the writer in evaluating the comprehensibility of the written material. The assessment should be conducted at two points: formative (while the text is being developed) and summative (the readers' assessment). At each point the writer must determine exactly what information to assess, how to measure the information, and text changes that will result from the information gained. In the formative evaluation, the writer will be assessing whether the learning principles (structure - organization and relevance) have been utilized to increase

text comprehensibility. In the summative evaluation the writer will be determining if readers were able to gain an understanding of the purpose of the text. Text is a communication device; therefore, the writer is assessing whether the reader understood the intended meaning.

For the formative assessment the decision making questions from the model can serve as evaluators of each stage of the text-development process. For example, in the first stage of the process, did the writer identify the central topic to be conveyed? Did the writer identify the related concepts and sub-concepts?

The stages have an interactive nature, with the questions from one stage promoting thought that helps guide formation of the other stages. For instance, in the second stage (relevance) the writer might think of an additional concept that would help the reader understand the central topic, then add this concept to the semantic map created in the first stage.

In the final steps of the text-development process a summative evaluation of the text should be conducted with the type of readers for which the text was developed. The writer will be assessing the knowledge gained from reading the text; that is, if the reader was able to incorporate the new knowledge. Johnston (1983), suggests using two or three types of measurement strategies to assess reading comprehension, depending on the type of information to be gained from the

assessment tool. The writer not only wants to know if the reader understood the central concept; but also, if developmental guidelines used in each of the stages went far enough to enhance the readers' understanding of the main ideas presented. For example, did the writer elaborate enough on the meaning of a critical technical term for the reader to understand the related concept. Evaluation of the text should be developed in relation to the purpose of the text. If the text conveys procedural knowledge, was the reader able to fully understand the directions? By field testing with members of the intended audience the writer can assess whether the purpose of the text has been met.

Tests can measure comprehension by either recall (unprompted eg: written response) or recognition (prompted eg: multiple choice questions) of main idea concepts. Recall of text meaning is mentally more demanding than recognition. Tests can be developed to correspond with the conceptual outline; whereby, the readers' responses can be mapped back to the concepts in the outline. In this manner, the source of a communication breakdown can be located and adjusted to improve comprehension. Testing can be conducted informally (one-on-one, verbal discussion) or formally in groups (pencil and paper tests) depending on the information required and the proposed use of the information.

Practical Application of the Learning Principle:

The evaluation stage serves to establish the educational

worth or effectiveness of a learning tool, and alerts the writer to portions of the text that may need revision. This stage can be used to ascertain whether the subject-matter concepts were presented in an understandable manner.

**Preliminary Studies With The Text-Development Process**

The text-development process investigated in this study has been refined through six pilot tests over a two-year period. During this time experiments were conducted to assess the influence of the learning principles within the text-development process on the comprehensibility of Extension publications. In six experimental studies with different text passages, tests and subjects (adults and children), it has been demonstrated that the application of the two learning principles through text construction strategies can increase comprehensibility of some Extension publications.

<u>General Method</u>

Materials

The materials that were tested were original Virginia Cooperative Extension (VCE) educational text passages and revised versions of the same text passage. In all the studies the subject matter of the original educational publication was typical of the materials presented at Extension educational meetings. Educational publications were selected from three major Extension program areas (agriculture, home economics, and 4-H). The five most popular publications (by frequency of use) from each program area were identified; then one

publication from each program area was selected for the experiments. A passage approximately 500 words was extracted from each publication. Experiments were conducted using an original text as a control and a revised text for the experimental treatment. The text passages were revised according to text construction strategies suggested in the text-development process.

Subjects and Design

Text comprehensibility was assessed by reader preference, cloze, written recall, probe questions, and/or multiple choice questions. In each test administration a standard procedure guide with directions was read aloud. In all six experiments the testing site was selected and then random sampled. All subjects were familiar with VCE educational publications. The subjects were informed that the purpose of the study was to gather information in an effort to improve the quality of the organization's educational publications.

**Experiments I and II**

The first two experiments involved adult members of Extension farm management and homemakers groups. The subjects were asked to read both versions of a one page text passage and place a mark on the version they felt was easier to understand. The two versions were presented on opposite sides of a single sheet of paper. The text versions were randomly ordered, whereby, the subjects had an equal change of reading either the original or the revised text version first. The

subjects were not aware of which text was the revised version.

In Experiment I, thirty-six adult males attending an Extension farm management meeting were asked to read both versions of an Extension publication concerning land leases. Twenty-eight of the thirty-six (78%) farm management members indicated that the revised version was easier to understand than the original version.

In Experiment II, twenty adult females attending an Extension homemakers County Council meeting were asked their preference of text versions of a publication concerning anorexia nervosa and bulimia. Nineteen of the twenty (95%) Extension homemakers indicated that the revised text version was easier to understand than the original version.

**Experiments III and IV**

Materials, Subjects and Design

4-H members (fifth grade students) were tested with either a multiple choice or cloze test after reading an original or revised text passage concerning the formation of the oceans. For Experiment III, a multiple choice test was used as a test of reading comprehension product. Reading comprehension product is what the reader is able to remember about the text after the text passage has been read. The multiple choice test for this experiment was constructed with fifteen questions on main idea and detail information contained in both text versions. The content validity of the multiple choice test was established through administration

to twenty graduate students without the text passage; whereby, the respondents chose the correct option less than twenty-five percent of the time -- the percentage that could have been selected with chance probability by the students.

For Experiment IV a cloze test was used as a test of reading comprehension process. Reading comprehension process determines text comprehensibility as the text is being read. Reading comprehension construct validity is inherent with the cloze type test. For the cloze test, the first two sentences of each text were left intact with every eighth word thereafter deleted. The two texts were randomly ordered before being distributed. The subjects were asked to fill in the blanks. Only exact replications of the author's words were counted as acceptable for scoring.

Experiments III and IV were conducted simultaneously. Presentation of the two tests types were counter-balanced across class periods to control for time of day and/or fatigue effects. The content validity was established by the fact that the answers were directly passage dependent to both text versions, as judged by two reading specialists.

Results and Discussion

In Experiments III (n = 61) and IV (n = 52) the test scores for the multiple choice and cloze tests were tabulated and an independent t-test was used to determine if there was a statistically significant difference between the performance of the subjects reading the original text and revised text.

The subjects who read the original text had a mean of 5.9 (SD = 1.9) on the multiple choice test; while, the subjects who read the revised text had a mean of 7.06 (SD = 1.61). The test results for the subjects administered the multiple choice test were: df = 59, t = 2.58, p <.01. The subjects who filled in the cloze responses on the original text had a mean of 13.46 (SD = 9.32), whereas, the subjects responding to the revised text had a mean of 20.46 (SD = 8.56). The test results for the subjects who filled in the cloze test were: df = 50, t = 2.82, p <.01. The subjects reading the revised text version with the multiple choice test showed a significant increase in comprehension with an effect size of .66; while subjects with the cloze test showed an effect size of .78. Test scores were low for both test types, but consideration must be given to the lack of motivation students might have in taking a test for which they did not receive a grade.

**Experiment V**

Materials, Subjects and Design

The purpose of experiment five was to determine whether comprehension scores from original and revised text versions would correlate on different test formats. Fifth and sixth-grade subjects were asked to read either the original or revised text on soil erosion and write a recall of the main idea of the text, followed by twenty probe questions. A week later the same probe questions with multiple choice options

were administered.

The two text versions and corresponding tests were random ordered in sets of ten and distributed to the subjects in the classroom. The subjects were asked not to refer to the text while taking the test.

Dependent Measures and Scoring

The dependent measures used in this study were a written recall, twenty probe questions focusing on either main idea or supporting detail information, and the same questions with multiple choice answers. The subjects were given one point credit for each of the idea units they listed in the written recall and in answering the probe questions. To test for the influence of text version on retention of subject matter, a follow-up test was given a week later. The follow-up test had the same twenty questions with multiple choice answers. There was one correct answer, three foils, and an "I don't know" option to discourage guessing. The data obtained from the test scores was analyzed by separate t-tests for each type of test to determine whether there was a difference in the level of comprehension between the subjects reading the original and revised text versions.

Content validity was established by the fact that all questions on the test were directly passage dependent to both text versions, as assessed by two reading specialists. Test reliability for the multiple choice format was established at 0.58 with the Kuder Richardson 21 formula. Seven students

that were absent the day the other students read the texts took the multiple choice test. The results, mean of 3.8, were less than could have resulted by chance probability. The correlation coefficient of stability and equivalence was .58 between probe questions and written recall, .52 between probe and multiple choice questions, and .37 between written recall and multiple choice questions.

Results and Discussion

In Experiment V the test scores for the comprehension tests were tabulated and an independent t-test was used to determine if there was a statistically significant difference between the performance of the subjects reading the original text and revised text. The subjects who read the original text had a mean of 1.96 (SD = 1.28) on the written recall test; while, the subjects who read the revised text had a mean of 3.04 (SD = 1.5). The quantitative analysis of the data from the written recall indicated a significant difference between the groups: df = 98, t = 3.88, p <.001. More revealing was the substance of the written recalls; 6 percent of the original group recalled the main idea of the text, as opposed to 82 percent recalling the main idea in the revised group. The subjects who read the original text had a mean of 3.39 (SD = 2.29) on the probe test; whereas, the subjects who read the revised text had a mean of 5.1 (SD = 3.58). The responses given by the subjects on the probe test showed a significant difference between the groups: df = 98, t = 4.53,

p <.001. The subjects who read the original text had a mean of 5.73 (SD = 3.39) on the multiple choice test; while, the subjects who read the revised text had a mean of 9.24 (SD = 4.18). The t-test results for the multiple choice questions indicated a significant difference between the groups: df = 95, t = 4.53, p <.001. The subjects reading the revised version showed a significant increase in comprehension with effect size on written recall of .77, probe questions .90, and multiple choice questions .92.

A secondary analysis was conducted to assess comprehension of main idea and detail information. The subjects who read the original text version answered correctly 29 percent of the main idea questions and 28 percent correct responses to the detail information questions. The subjects reading the revised version answered correctly 48 percent of the main idea questions and 42 percent of the detail information questions. The influence of the learning principles in the text-development process seemed to improve comprehension of both main idea and detail information.

**Experiment VI**

Materials, Subjects and Design

The purpose of the sixth study was to determine the influence of the learning principles on text comprehensibility by gender and skill level. The subjects were divided into four groups according to gender and stanine scores on the Science Research Associates (SRA) reading comprehension sub-

test.  Those with sub-test scores 1 to 4 represented less skilled readers.  Whereas, those with reading comprehension sub-test scores 5 to 9 were considered skilled readers.  The research design required the sixth-grade subjects to read an original or revised text passage on soil erosion, followed by twenty short response questions.  The two text versions and test were random ordered in sets of ten and distributed to the subjects in the classroom.  The subjects were asked not to refer to the text while taking the test.  The test was administered immediately after reading the text passage and a week later.

Dependent Measures and Scoring

The dependent measures used in this experiment were twenty short response questions.  The subjects were given one point credit for each of the idea units they listed in their responses.  The same test was administered a week later, without the subjects rereading the text to determine whether there would be a difference in the retention of information by those reading the original or revised text.

Reading comprehension content validity for the short response test questions was established by two reading specialists.  Prior to testing, an answer key was created by generating appropriate responses to each question.  A distractor text (a text of equal length, but on an entirely different subject) was administered to ten students with the same test.  The results, mean of 4.3 were less than could have

resulted by chance probability. The tests were graded by the primary researcher and two research assistants. Inter-rater reliability was established by having the two assistants grade a sample of tests graded first by the primary researcher. The inter-rater correlation coefficients calculated from test scores were between .89 and .93. To establish test reliability, the Kuder-Richardson formula 21 was computed for both the original and revised groups; the results were .76 for the original and .84 for revised version. A test-retest correlation coefficient of .85 was established.

Results and Discussion

For Experiment VI the test scores for the short response questions were tabulated and two 2x2x2 ANOVA were utilized to determine if there was a statistically significant difference between the performance of the subjects reading the original and revised text, gender and reading skill level for the post and delayed test. An analysis of variance of post test scores for main effects showed: $F(3,170) = 14.89$, $p<.001$, and on delayed test scores for main effects showed: $F(3,155) = 11.54$, $p<.001$. An analysis of variance of post test scores for two-way interaction showed: $F(3,170) = 6.14$, $p<.001$, and on delayed test scores for two-way interaction was $F(3,155) = 4.74$, $p<.003$. The significant interaction for both tests occurred between skill level and gender. Less-skilled males reading the revised text version exceeded skilled female subjects reading the original text version. To ascertain a

difference in retention, a dependent t-test was conducted between matched test scores on the post and delayed test for all eight groups.  Only one group, less-skilled males reading the original text version, showed significant results of df = 40, t = -2.24, < .037.

## Summary

Research in educational psychology has shown that text can be developed to aid the processing of information or acquisition of knowledge.  The results from all six experimental studies indicate that text revisions with respect to learning principles can be made which will enhance comprehensibility of some Extension publications.  The revision seemed to have a stronger influence on males and less skilled readers, and therefore merits further research.  There is a need for research which examines how effective and practical a systematic text-development model is for subject-matter specialists.  Information from this research should guide the development of the model.

# Chapter 3

## METHODS OF THE STUDY

### Research Design

The intent of this study was to encourage Extension subject-matter specialists to use a text-development process based on the application of learning principles to enhance the comprehensibility of new or revised educational text. If one creates text in compliance with this model process, it is hypothesized that subject-matter concepts would be easier for Extension's clients to comprehend. This study was conducted in three parts. First, Extension specialists were taught the learning principles within the text-development process. Second, the specialists developed two texts using the learning principles within the text-development process. Third, text comprehensibility was tested with adults and 4-H members.

The study began with the researcher asking for six Extension subject-matter specialists to volunteer for the study. The specialists were randomly assigned (by flip of a coin) to either develop textual material on their own or to be taught the text-development process. Three specialists were taught the learning principles within the text-development process to revise an existing text (titled "What caused the muddy water?") and develop an original text for comprehension testing. The other three specialists were asked to revise the existing text and write an original text from specifications without the benefit of the text-development

process. This research plan resulted in twelve texts being generated, two by each of the six specialists. Texts A, B, and C were revised without the process, texts D, E, and F were revised with the text-development process, original texts G, H, and I were developed without the process, and texts J, K, and L were created with the text-development process (Appendix B).

## Original Text Specifications

The specifications for the original text were the same for all six specialists; they were as follows:

Develop a 1-2 page promotional article for junior 4-H members (age 9-11) concerning the life skills they can learn through your 4-H subject matter. The life skills are:

Acquiring, Analyzing and Using Information -- Developing an inquiring mind, knowing how to acquire, analyze, and use knowledge.

Problem Solving and Resource Management -- Involves the ability to examine a situation, generate alternatives, and plan the allocation of resources to solve the problem.

Communicating and Relating to Others -- Giving, receiving, and exchanging information to accomplish group goals.

## Teaching the Process

Before the teaching session the three specialists were asked to read "Developing More Effective Extension Educational Publications" (Appendix A). At the teaching session, the researcher modeled the text-development process with an existing text ("What is an ocean?" Appendix B), explaining the logic and learning principle within each stage. By using an existing text, the specialists had an experiential learning opportunity with the text-development process before being asked to generate an original text.

At the beginning of the teaching session, the researcher asked the specialists if they had read "Developing More Effective Extension Publications" and if they had any questions or concerns. Each specialist made comments about a different stage in the process. These comments will be presented while describing the instruction of the text-development stages. One of the specialists mentioned that he was already familiar with all of the concepts, but that it was difficult to remember to use them when developing publications. He indicated that the concepts were almost common sense, but not common practice. He mentioned that in his monthly newsletter he included a section on helpful hints based on common sense principles. And that this section of the newsletter elicited positive comments because people forget or overlook the basics. He indicated that he became preoccupied with conveying details of the subject matter and

completely overlooked basic composition factors. He further stated that the model could be used to "remind" specialists to use the concepts while developing publications.

The researcher explained the model by the use of the two learning principles in the text-development process. It was pointed out that the principle of structure and organization concerned the arrangement and association of information and that this principle is used in the first and third stage to assist in organizing concepts to be presented in the global or overall structure of the text. The principle is again used in the fifth stage to organize and connect individual ideas. The other principle, relevance, is used in the second and fourth stage to assist in relating concepts to the learner's existing knowledge. The principle is used in the second stage to relate the central topic to knowledge assumed known to the reader. The principle is used again, in the fourth stage, to relate subject-matter terminology to words assumed to be known to the novice. It was explained to the specialists that they would be revising the "Muddy" text in order to gain an understanding of the text-development process. Then, they would be asked to generate an original text with the process. As the researcher modeled each of the stages in the text-development process, the specialists were instructed to take the same actions with the "Muddy" text.

Teaching Stage One

The researcher began teaching the process by modeling

the text analysis procedure: first reading through the text and summarizing the main topic; then identifying the main idea of each paragraph. The central topic was written on the bottom of the passage and the main ideas were written to the side of each paragraph. It was shown how the identified ideas from the "Oceans" text were placed in a semantic map. The researcher briefly mentioned the importance of a title in conveying the central topic of a passage.

Then the specialists were instructed to read through the "Muddy" text and summarize the central topic. The specialists were requested to analyze each paragraph, circle the main idea(s), and underline the supporting ideas. They were asked to form the identified concepts into a semantic map. The researcher explained how a semantic map could be used at the conception of a writing project, such as, when they begin working on the original text.

Teaching Stage Two

The researcher used the semantic map of the "Oceans" text to develop an opening statement or advance organizer for the passage. By brain-storming with the specialists, opening statements were prepared for the revised texts. All the specialists commented on how confusing the opening quote was in the "Muddy" text. Questions about how to anticipate an audience's base knowledge of the subject matter were raised. A discussion occurred concerning 9 - 11 year old children and what they might know about the colonists or dirty water.

Ideas were generated to connect the concepts to be presented with what the children already knew or their interests. The researcher discussed the need to motivate or catch the reader's interest in the subject matter as an aid to learning or understanding the central topic. The importance of the relevance principle was explained in relation to presenting the central topic in the light of 4-H members' interests.

Teaching Stage Three

The researcher explained the purpose of stage three as an aid in organizing the main concepts to be presented in the text. The specialists were shown how the ideas in the semantic map for the "Oceans" text were numbered and lettered to form a rough outline. One of the specialists indicated that she had difficultly making outlines for her written materials. She said the semantic map was a good way to initially organize ideas for an outline. Working from the semantic map the specialists developed outlines for the revised text version. The researcher suggested that if they became "stuck" at any point in the writing process, they would review the questions in the model as a thought stimulus, and, that it might be helpful to come back to the semantic map anew to develop an outline.

Teaching Stage Four

The researcher discussed the importance of specialized terms to convey concepts in a specific subject-matter area, and the importance of having readers gain a rich understanding

of a given term in order to understand the subject-matter concept. It was explained that the educational purpose of many publications is to have clients understand the technical words that represent subject-matter concepts. Therefore, the technical terms cannot be deleted or substituted, but must be thoroughly explained to achieve their educational purpose. The specialists underlined the words in their outline that they thought the children would need to learn.

Teaching Stage Five

The researcher explained how less-skilled readers process each sentence as an independent thought, and how difficult it is for them to relate the idea in one sentence to a related idea in another sentence. It was explained how comprehension can be facilitated by cohesive linkage and that this is another application of the structuring and organization principle. By connecting individual parts, the less-skilled reader is able to understand the whole picture. One specialist said he was criticized for using so many "connecting words", but he felt that practice made it easier for the clients to understand his meaning.

The specialists studied their outlines and decided the order in which to present concepts to make cohesive ties. They developed connecting sentences from the ideas in their outline. The specialists were asked to finish the revised text on their own. They were asked to create the original text according to the specifications, and return it to the

researcher.

Teaching Stage Six

The idea of field-testing their 4-H publications on actual members was novel to all the specialists. It was pointed out that a single 4-H publication could be read by 25,000 young Virginians a year, at an average cost of 2 dollars for each publication. The total number of publications distributed to 4-H members in Virginia yearly averages 250,000. Also, that the University is responsible for the accuracy of the information presented in their publication. The researcher said that given this substantial investment of resources, the information should be accurate and comprehensible to 4-H members.

The researcher explained the two forms of evaluation that should be used on publications. The specialists were asked to conduct a formative evaluation by using the Decision-making Questions from the model to assess their text.

The specialists were informed that their texts (revised and original) would be field-tested with junior 4-H members and adult leaders. The two types of comprehension testing (recall and recognition) were discussed. The specialists were each asked to develop five multiple choice questions for the revised text, and five short-response questions and responses appropriate for the questions on the original text.

## Data Collection Procedures

The intent of this study was to ascertain if a process of text revision and development based on learning principles could be utilized by subject-matter specialists to improve the comprehensibility of materials they were developing for Extension publications. The materials tested were the 12 text passages generated by the specialists (6 texts developed without the process and 6 texts developed with the process, Appendix B). Each passage was approximately 250-500 words long. The comprehensibility of the texts was judged by three methods: reader preference, comprehension questions based on content of the text, and reader appraisal on qualitative factors.

For the quantitative analysis of reading comprehension, subjects (sixth-grade students) were asked to read two of the twelve text passages, and then answer the comprehension questions. Questions for both tests were developed jointly by the researcher and the specialists (Appendix B). There were fifteen multiple choice questions for the revised text. The correct answer for each multiple choice question was traced back to all six text versions, to verify that the answer could be gained by reading any of the six revised text versions. For the test on the original text, fifteen short response questions were developed from the text specifications. There were three questions focusing on main idea, and four questions for each of the three sub-sections.

Prior to testing, a list of acceptable responses was developed by the researcher and the specialists. The original-text test was scored by awarding one point for each acceptable response. Each test also had a section where the 4-H member was asked to judge the text on brevity, confusion, clarity, organization, and learnability. Inter-rater reliability was established by having two research assistants grade a sample of the tests. Inter-rater reliability ranged from 93.4 to 96.7 on short response questions and 99.9 on multiple choice questions. Test internal consistency reliability was calculated with Kuder-Richardson formula 20 (Crocker & Algina, 1986) for both tests.

## Subjects and Test Administration

The Virginia 4-H Program is targeted to children between the ages of 5 and 19. This experiment tested passage comprehensibility by sixth-grade students enrolled in the 4-H school program. Each subject read two texts, an original and a revised text. The texts were random ordered by the roll of a die in sets of six before being distributed to the subjects. The subjects were informed that the State 4-H Program was conducting a research project to determine how much children could learn from reading. They were asked to read the text they were given and then answer the questions. The test was attached to the text, but the subjects were asked not to refer to the text while taking the test.

The sample size for this experiment was determined by

using an effect size of interest (gamma equal to 0.50) with power set at .90 (delta of 2.75) which required 30 subjects per group (Levin, 1974; Cohen, 1969). The sample needed for this nested design required 180 subjects. To increase generalizability, subjects were random sampled from two different schools.

Skill was used as a blocking factor; because previous research studies have found that particular text factors benefit the less skilled reader more than the skilled reader. The subjects in one group (skilled and less skilled readers) read text passages developed without the process. Whereas, the other group (skilled and less skilled readers) read text versions of the same passage developed with the process. After testing, the subjects were divided into ability levels on the basis of their stanine scores on the SRA reading comprehension sub-test. Post assignment blocking was completed using stanine scores. The subjects with sub-test scores 1 to 4 represented less skilled readers, while those with scores 5 to 9 were considered skilled readers.

## Data Analysis

The primary experimental hypothesis for both text conditions (revised and original versions) was that there would be a difference in reading comprehension scores between the group reading the texts developed without the learning principles and the group reading the texts developed with the learning principles within the text-development process. In

the hypothesis testing, an alpha of .05 level was used as the criterion for rejection of the null hypothesis. Each hypothesis was addressed with an analysis of variance (ANOVA) procedure, with gender and SRA reading skill levels used as factors (Howell, 1982). Separate ANOVAs were used with reading comprehension test scores from the revised and original text versions to ascertain if there was a difference in using the learning principles to revise an existing text or develop an original text. To assess the overall influence of the application of learning principles within the text-development process on comprehensibility, effect size was calculated using the results of t-tests (Fitz-Gibbon & Morris, 1987).

The results from the 4-H members rating the texts according to organization, clarity, comprehension, brevity, and learnability were addressed with separate Chi-square tests of independent proportions (Herzberg, 1983) for each qualitative statement with the revised and original text versions. The test responses for the two dependent measures (comprehension scores and ratings) were organized into a four-fold classification for data analysis, as follows: by treatment (with process and without process) and text condition (revised and original).

The third form of comprehension testing was conducted with six 4-H adult leaders. Three adults were given all six revised versions of the text and asked to ranked them in

descending order for comprehensibility. Three other 4-H adult leaders were asked to rank all six versions of the original texts on comprehensibility. The strength of the judges agreement was measured with the Kendall coefficient of concordance statistical procedure (Siegel, 1956).

# Chapter 4

## RESULTS

The primary hypothesis tested by this study was that the application of learning principles in the development of educational text would enhance comprehensibility as assessed by three measures. The findings for the reading comprehension test are presented in Part I. The outcomes for the readers' rating of text quality are presented in Part II. The results from the comprehension ranking by adult readers are presented in Part III.

## Part I Analyses of Comprehension Testing

The test scores on the dependent variable, that is, the reading comprehension test questions for the twelve texts were organized into a four-fold classification, as follows: by treatment (with process and without process) and text condition (revised and original). Then each division of data were divided by gender and reading skill level.

## Revised-Text Testing Results

The descriptive statistics on the dependent variable for mean performance by gender and skill level with revised text versions are presented in Table 1. The positive influence of the learning principles on the comprehensibility of revised texts versions is graphically illustrated in Figure 3. Test reliability estimates for those texts revised without the process was .78 and .76 for those reading the text versions revised with the process, as established by the Kuder-

Table 1.  Descriptive statistics on mean performance with
reading comprehension test scores by gender and reading
skill level for **revised** text versions  N = 202

| | Text Versions | | | | | | |
| | Text Developed Without Process | | | Text Developed With Process | | | |
| | Males | Females | Combined | Males | Females | Combined | Overall |
|---|---|---|---|---|---|---|---|
| **Skilled** | | | | | | | |
| M | 7.87 | 7.32 | 7.56 | 10.04 | 9.64 | 9.84 | 8.64 |
| SD | 3.57 | 3.57 | 3.55 | 3.30 | 3.30 | 3.28 | 3.59 |
| n | 23 | 31 | 54 | 24 | 25 | 49 | 103 |
| **Less Skilled** | | | | | | | |
| M | 5.15 | 5.38 | 5.25 | 8.42 | 9.92 | 9.16 | 7.26 |
| SD | 3.58 | 3.17 | 3.37 | 3.15 | 3.67 | 3.47 | 3.93 |
| n | 27 | 21 | 48 | 26 | 25 | 51 | 99 |
| **Combined** | | | | | | | |
| M | 6.40 | 6.73 | 6.47 | 9.20 | 9.78 | 9.49 | 7.97 |
| SD | 3.80 | 3.48 | 3.64 | 3.30 | 3.46 | 3.37 | 3.82 |
| n | 50 | 52 | 102 | 50 | 50 | 100 | 202 |
| **Overall** | | | | | | | |
| M | 7.80 | 8.13 | 7.97 | | | | |
| SD | 3.81 | 3.84 | 3.82 | | | | |
| n | 100 | 102 | 202 | | | | |

Means
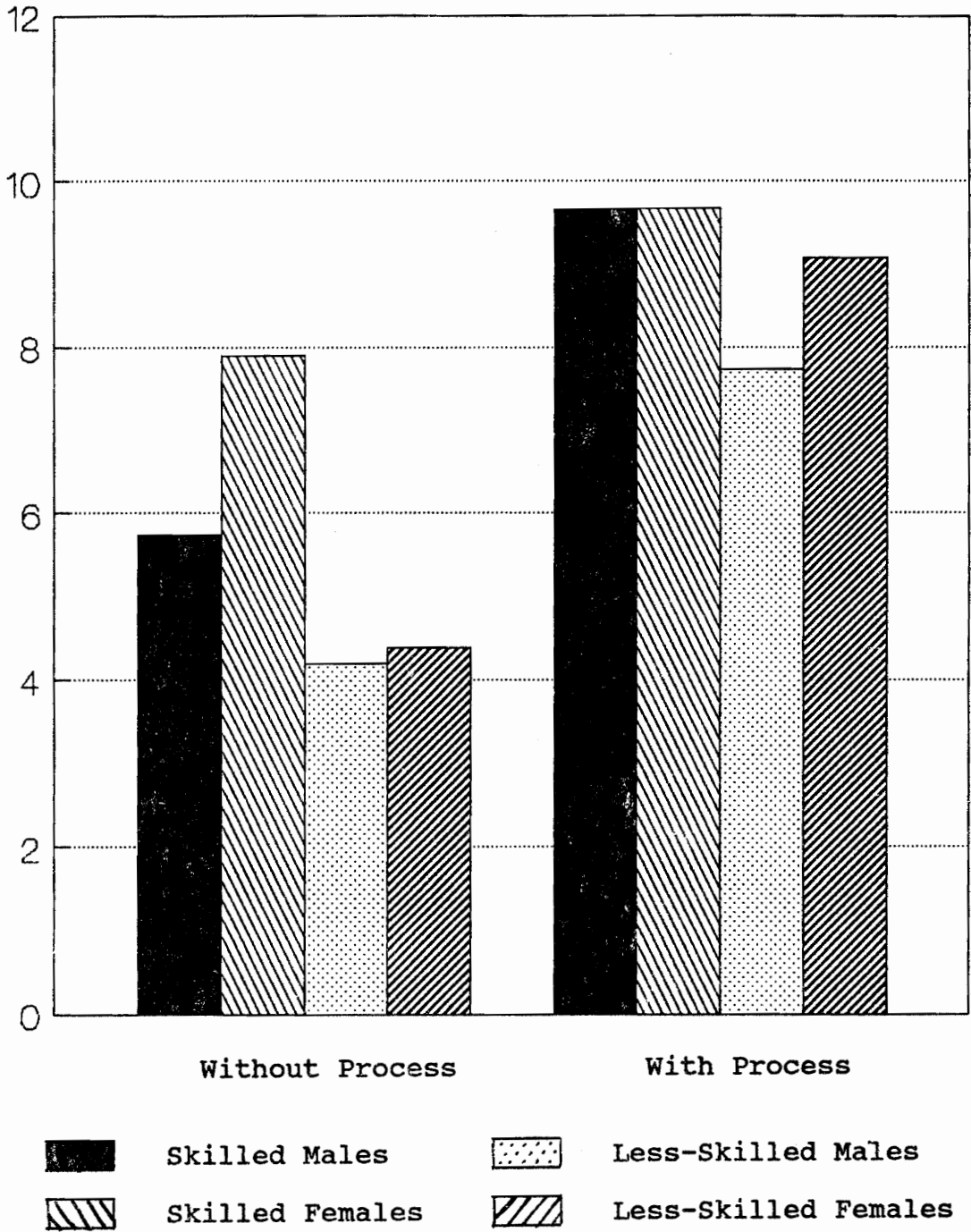


Figure 3   Plot of means for gender-skill level on revised
text versions   N = 202

Richardson reliability formula 20.

To address the first research question concerning the influence of the learning principles on the comprehensibility of revised text, an analysis of variance (ANOVA) was used with reading comprehension test scores as the dependent variable. A summary ANOVA for the revised text test scores displayed in Table 2 shows no two or three way interactions. A three-factor ANOVA indicated that significant differences could be attributed to treatment, and to skill level, but not to gender. Skilled and less-skilled readers reading the text versions revised with the text-development process performed significantly better than the children reading the texts revised without the process. For this method of measurement, the gender variable was not of statistical significance.

Original-Text Test Results

The descriptive statistics on mean performance by gender and skill level for original text versions are presented in Table 3. The positive influence of the text-development process on the comprehensibility of original text is graphically illustrated in Figure 4. Test reliability estimates for those texts developed without the process was .90 and .84 for those reading the text versions developed with the process, as established by the Kuder-Richardson reliability formula 20.

To address the first research question, concerning the influence of the learning principles on the comprehensibility

Table 2.  ANOVA summary for main effects and interactions on **revised** text comprehension test scores  N = 202

| Source | SS | df | MS | F | F prob |
|---|---|---|---|---|---|
| Treatment (T) | 478.29 | 1 | 478.29 | 40.65 | 0.01 |
| Skill (S) | 109.80 | 1 | 109.80 | 9.33 | 0.01 |
| Gender (G) | 2.91 | 1 | 2.91 | .25 | 0.62 |
| T x S | 34.54 | 1 | 34.54 | 2.94 | 0.09 |
| T x G | 6.03 | 1 | 6.03 | .51 | 0.48 |
| S x G | 22.40 | 1 | 22.40 | 1.90 | 0.17 |
| T x S x G | 3.91 | 1 | 3.91 | .33 | 0.57 |
| Error | 2282.65 | 194 | 11.76 | | |
| Total | 2940.53 | 201 | | | |

Table 3.  Descriptive statistics on mean performance with reading comprehension test scores by gender and reading skill level for **original** text versions   N = 202

| | Text Versions | | | | | | |
| | Text Developed Without Process | | | Text Developed With Process | | | |
| | Males | Females | Combined | Males | Females | Combined | Overall |
|---|---|---|---|---|---|---|---|
| **Skilled** | | | | | | | |
| M | 5.74 | 7.90 | 6.98 | 9.67 | 9.68 | 9.67 | 8.26 |
| SD | 4.27 | 4.66 | 4.58 | 3.94 | 4.19 | 4.03 | 4.51 |
| n | 23 | 31 | 54 | 24 | 25 | 49 | 103 |
| **Less Skilled** | | | | | | | |
| M | 4.19 | 4.38 | 4.27 | 7.73 | 9.08 | 8.39 | 6.39 |
| SD | 3.20 | 4.09 | 3.58 | 4.29 | 3.67 | 4.02 | 4.32 |
| n | 27 | 21 | 48 | 26 | 25 | 51 | 99 |
| **Combined** | | | | | | | |
| M | 4.90 | 6.48 | 5.71 | 8.66 | 9.38 | 9.02 | 7.35 |
| SD | 3.77 | 4.73 | 4.34 | 4.20 | 3.91 | 4.05 | 4.51 |
| n | 50 | 52 | 102 | 50 | 50 | 100 | 202 |
| **Overall** | | | | | | | |
| M | 6.78 | 7.90 | 7.35 | | | | |
| SD | 4.4 | 4.57 | 4.51 | | | | |
| n | 100 | 102 | 202 | | | | |

Means
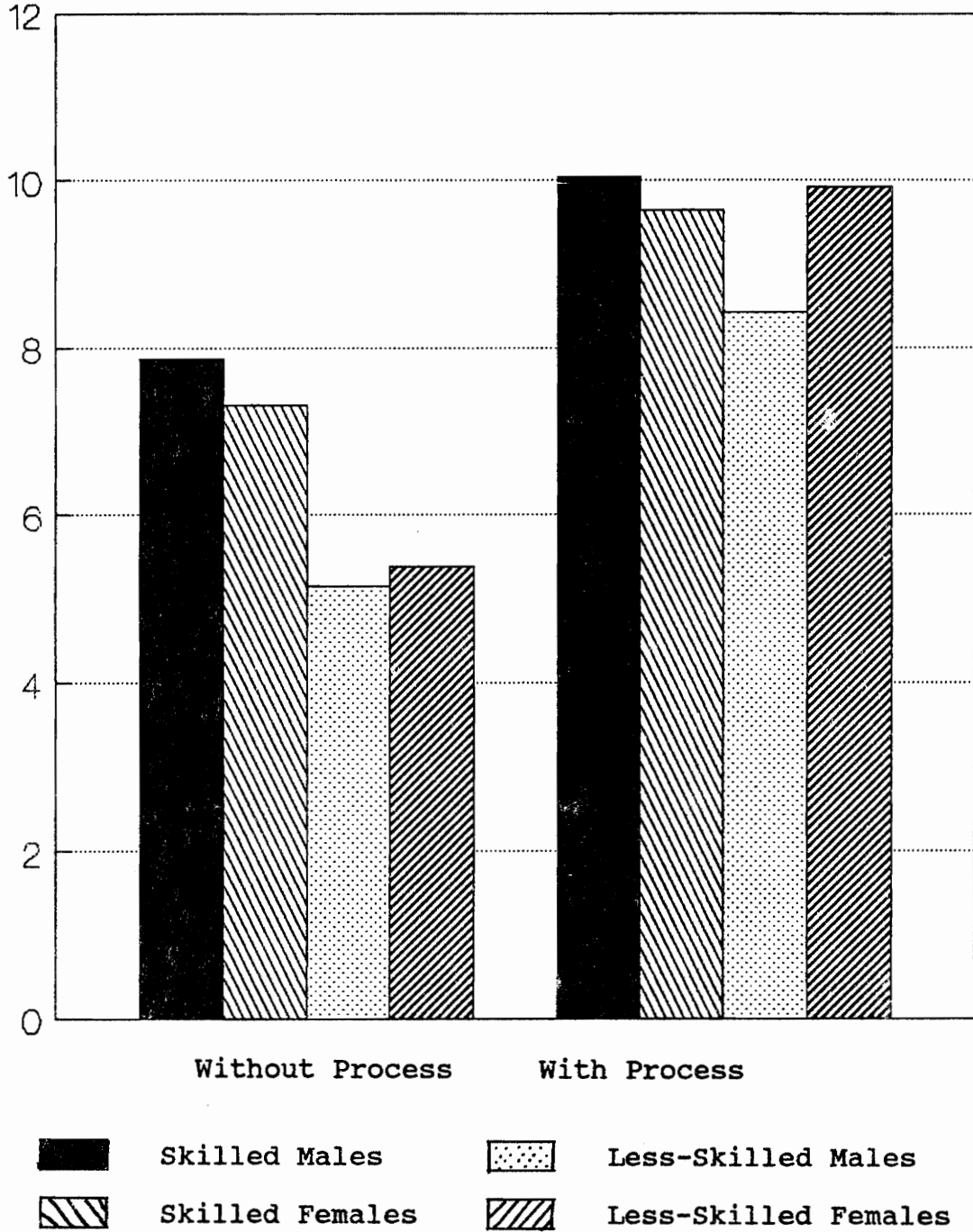


Figure 4   Plot of means for gender-skill level on original
text versions   N = 202

of original text, an analysis of variance was used with reading comprehension test scores as the dependent variable. A summary ANOVA for the original-text test scores displayed in Table 4 shows no two or three way interactions. A three factor ANOVA indicated that significant differences could be attributed to treatment, and to skill level, but not to gender. Skilled and less-skilled readers reading the original-text versions written with the text-development process performed significantly better than the children reading the original texts developed without the process.

Based on the results of the ANOVA statistical procedures, the treatment was stronger with the revised-text versions than with the original-text versions.

**Part II Analyses of Reader's Ratings**

The second test of the primary research hypothesis occurred when the children rated the text passage they read by answering five true-false statements. The results of the readers' rating or opinion of the texts were tested with the Chi-square test of two independent proportions to determine if there was a statistically significant difference in ratings between the groups (with the process and without the process) at the $p < .05$ level of significance.

Revised-Text Ratings

The first statement was, "This lesson was well organized". As shown in Table 5, the children who read the texts written with the process, 85 percent answered true;

Table 4. ANOVA summary for main effects and interactions with **original** text comprehension test scores  N = 202

| Source | SS | df | MS | F | F prob |
|---|---|---|---|---|---|
| Treatment (T) | 582.70 | 1 | 582.70 | 35.17 | 0.01 |
| Skill (S) | 185.21 | 1 | 185.21 | 11.18 | 0.01 |
| Gender (G) | 50.51 | 1 | 50.51 | 3.05 | 0.08 |
| T x S | 20.26 | 1 | 20.26 | 1.22 | 0.27 |
| T x G | 3.48 | 1 | 3.48 | .21 | 0.65 |
| S x G | 1.24 | 1 | 1.24 | .08 | 0.79 |
| T x S x G | 34.06 | 1 | 34.06 | 2.06 | 0.15 |
| Error | 3213.90 | 194 | 16.56 | | |
| Total | 4091.36 | 201 | | | |

Table 5.  Readers ratings and Chi-square values on five questions pertaining to text quality.  Figures indicate the number (%) of respondents who marked "true" as an answer.

|  | Without Process (n = 102) | With Process (n = 100) | Chi Square (df = 1) |
|---|---|---|---|
| Revised Text |  |  |  |
| Organization | 86 (84) | 85 (85) | 0.02 |
| Clarity | 75 (74) | 82 (82) | 2.09 |
| Confusion | 48 (47) | 31 (31) | 5.47* |
| Brevity | 48 (47) | 54 (54) | 0.97 |
| Learnability | 79 (78) | 80 (80) | 0.20 |
| Original Text |  |  |  |
| Organization | 78 (77) | 77 (77) | 0.01 |
| Clarity | 70 (69) | 66 (66) | 0.16 |
| Confusion | 53 (52) | 57 (57) | 0.52 |
| Brevity | 55 (54) | 56 (56) | 0.09 |
| Learnability | 71 (70) | 63 (63) | 0.99 |

* Significant at the p <.05 level.

whereas, of the children who read the texts written without the process 84.3 percent answered true. The difference was not statistically significant at the p < .05 level of significance.

The second statement was, "This lesson was written clearly". Of the children reading the texts developed without the process, 73.5 percent thought this was a true statement, while 82 percent of those that read the texts written without the process thought it was written clearly. The difference was not statistically significant at the p < .05 level of significance.

The third statement was, "This lesson was confusing". Of the children that read the texts written with the process, 31 percent answered true; whereas, of the children that read the texts written without the process, 47.1 percent answered true. In this case, analyses based on the Chi-square procedure indicated a statistically significant difference between the groups at the p < .05 level of significance.

The forth statement was. "This lesson was short and to the point". Of the children who read the texts written with the process, 54 percent answered true; whereas, of the children that read the texts written without the process 47.1 percent answered true. The difference was not statistically significant, using to the Chi-square statistic at the p < .05 level of significance.

The fifth statement was, "I learned something new from this lesson". Of the children reading the texts developed without the process, 77.5 percent thought this was true, while 80 percent of those that read the texts written without the process thought they learned something new from the lesson. The difference was not statistically significant at the p < .05 level of significance (refer to Table 5).

Original-Text Ratings

The Chi-square procedure indicated no statistically significant difference at the p < .05 level of significance in the ratings of the original texts developed with or without the process, as shown in Table 5. On three of the statements: organization (76.5%, 77.0%), confusion (52.0%, 57.0%), and brevity (53.9%, 56.0%); the group reading the passages developed with the process rated the texts higher. On the other two statements, clarity (68.6%, 66.0%) and learnability (69.6%, 63.0%), the children reading the text prepared without the process, rated the passages higher.

This form of measurement was not as sensitive as the comprehension questions. The readers rated the revised texts higher than the original texts, except on brevity. As displayed in Table 5, the children noticed that the original texts were shorter than the revised texts.

Skill Level

There were higher ratings from skilled readers except

on the question involving learning, where the less-skilled readers reading the texts developed with the process, rated the text higher. Overall the subjects who read the revised texts developed with the process rated the texts higher, as can be seen in Table 6. There was only one statistically significant difference of the twenty different groupings for each text condition, statement, and skill level. The difference occurred among less-skilled readers' opinions on whether the revised text was confusing. Of the less-skilled readers reading the passage developed without the process, 52 percent thought the lesson was confusing; as opposed to 29 percent of the less-skilled readers reading the passages developed with the process.

Gender

There were higher ratings from female readers except on the question involving brevity, the male readers reading the texts developed with the process, rated the text higher. Overall, the subjects who read the revised texts developed with the process rated the texts higher. The results of the readers ratings by gender as displayed in Table 7, shows that there were only three statistically significant differences among the twenty groupings (text condition, statement, and gender). The differences occurred between male readers' opinions on whether the revised text was confusing and whether they learned something new. Of the male readers, reading the passage developed without the

Table 6. Descriptive statistics and Chi-square values on **skilled and less skilled readers** rating of five questions pertaining to text quality. Figures indicate the number (%) of respondents who marked "true" as an answer.

|  | Without Process | With Process | Chi Square (df = 1) |
|---|---|---|---|
| Skilled | n = 54 | n = 49 | |
| Less-Skilled | n = 48 | n = 51 | |

Revised Text
Organization
| Skilled | 49 (91) | 45 (92) | 0.04 |
| Less-Skilled | 37 (77) | 40 (78) | 0.03 |

Clarity
| Skilled | 42 (78) | 42 (86) | 1.08 |
| Less-Skilled | 33 (69) | 40 (78) | 1.20 |

Confusion
| Skilled | 23 (43) | 16 (33) | 1.08 |
| Less-Skilled | 25 (52) | 15 (29) | 5.28* |

Brevity
| Skilled | 29 (54) | 28 (57) | 0.13 |
| Less-Skilled | 19 (40) | 26 (51) | 1.30 |

Learnability
| Skilled | 45 (83) | 39 (80) | 0.24 |
| Less-Skilled | 34 (71) | 41 (80) | 1.23 |

Original Text
Organization
| Skilled | 43 (80) | 35 (71) | 0.94 |
| Less-Skilled | 35 (73) | 42 (82) | 1.27 |

Clarity
| Skilled | 40 (74) | 32 (65) | 0.94 |
| Less-Skilled | 30 (63) | 34 (67) | 0.19 |

Confusion
| Skilled | 29 (54) | 32 (65) | 1.43 |
| Less-Skilled | 24 (50) | 25 (49) | 0.01 |

Brevity
| Skilled | 29 (54) | 31 (63) | 0.97 |
| Less-Skilled | 26 (54) | 25 (49) | 0.26 |

Learnability
| Skilled | 38 (70) | 30 (61) | 0.96 |
| Less-Skilled | 33 (69) | 33 (65) | 0.18 |

* Significant at the $p < .05$ level.

Table 7. Descriptive statistics and Chi-square values on **male and female readers** rating of five questions pertaining to text quality. Figures indicate the number (%) of respondents who marked "true" as an answer.

|  |  | Without Process | With Process | Chi Square |
|---|---|---|---|---|
|  | Males | n = 50 | n = 50 | (df = 1) |
|  | Females | n = 52 | n = 50 |  |
| **Revised Text** |  |  |  |  |
| Organization |  |  |  |  |
| Male |  | 39 (78) | 42 (84) | 0.59 |
| Female |  | 47 (90) | 43 (86) | 0.47 |
| Clarity |  |  |  |  |
| Male |  | 33 (66) | 39 (78) | 1.79 |
| Female |  | 42 (81) | 43 (86) | 0.50 |
| Confusion |  |  |  |  |
| Male |  | 25 (50) | 14 (28) | 5.09* |
| Female |  | 23 (44) | 17 (34) | 1.12 |
| Brevity |  |  |  |  |
| Male |  | 27 (54) | 23 (46) | 0.64 |
| Female |  | 21 (40) | 31 (62) | 4.77* |
| Learnability |  |  |  |  |
| Male |  | 34 (68) | 45 (90) | 4.57* |
| Female |  | 45 (87) | 37 (74) | 2.54 |
| **Original Text** |  |  |  |  |
| Organization |  |  |  |  |
| Male |  | 36 (72) | 38 (76) | 0.21 |
| Female |  | 42 (81) | 39 (78) | 0.12 |
| Clarity |  |  |  |  |
| Male |  | 29 (58) | 33 (66) | 0.68 |
| Female |  | 41 (79) | 33 (66) | 2.11 |
| Confusion |  |  |  |  |
| Male |  | 23 (56) | 26 (52) | 0.36 |
| Female |  | 30 (58) | 31 (62) | 0.20 |
| Brevity |  |  |  |  |
| Male |  | 24 (48) | 28 (56) | 0.64 |
| Female |  | 31 (60) | 28 (56) | 0.14 |
| Learnability |  |  |  |  |
| Male |  | 31 (62) | 32 (64) | 0.04 |
| Female |  | 40 (77) | 31 (62) | 2.68 |

* Significant at the p <.05 level.

process, 50 percent thought the lesson was confusing; as opposed to 28 percent of the male readers reading the passages developed with the process. Of the male readers reading the passage developed without the process, 68 percent thought they learned something new; as opposed to 90 percent of the male readers reading the passages developed with the process. Females differed on the statement concerning brevity, 40 percent of the females reading the passages revised without the process thought the passage was short and to the point; as opposed to 62 percent of the females reading the versions revised with the process. There were no statistically significant differences with the original text passages at the $p < .05$ level of significance.

**Part III Analyses of Readers' Rankings.**

The texts were evaluated and ranked for comprehensibility by six adult 4-H leaders. The adults were given all six versions of the revised texts or all six versions of the original texts and asked to rank the texts according to their preference in descending order of comprehensibility. The results of the judges' decisions strongly supported the texts revised by the process, but not as strong agreement on the original texts. The texts revised or developed with the text-development process are underlined in Table 8. All six adult leaders reported difficulty in judging the texts. They said it was easy to judge the best and the worst, but the texts that were in-

Table 8. Summary of rankings of comprehensibility of texts developed by Extension subject-matter specialists, as judged by adult leaders.

|  | Most Comprehensible ---->---->---->----> Least Comprehensible | | | | | |
|  | Ranked First | Ranked Second | Ranked Third | Ranked Fourth | Ranked Fifth | Ranked Sixth |
| <u>Revised Texts</u> | | | | | | |
| Judge 1 | E | F | B | D | A | C |
| Judge 2 | E | D | F | B | C | A |
| Judge 3 | E | F | D | B | C | A |
| <u>Original Texts</u> | | | | | | |
| Judge 4 | L | G | H | K | I | J |
| Judge 5 | K | J | L | G | H | I |
| Judge 6 | K | L | G | J | H | I |

-between were difficult to rank.

Of the judges ranking the revised texts, one placed two of the texts written with the process in the top three, and two written without the process in the bottom three. The other two judges placed all three of the texts written with the process in the top three, and the texts written with out the process in the bottom three. Of the texts written with the process 8 of the 9 were placed in the top half. The strength of the judges' mutual agreement was established at 92 percent by the Kendall coefficient of concordance statistical procedure.

The judges ranking the original texts were not as decisive. One judge placed only one text written with the process in the top three, another placed two in the top three. Only one judge ranked all three texts that were written with the process in the top three. Only 6 of the 9 texts written with the process were ranked in the top half. According to the Kendall coefficient of concordance statistical procedure, the judges shared 60 percent agreement in ranking texts.

This measurement technique was not as sensitive as the reading comprehension test scores, especially in relation to a decision on accepting or rejecting a research hypothesis. Based on the judges' decision, the primary research hypothesis for revised texts would be accepted, but there would be a borderline decision involving the original texts.

By this form of measurement, the text-development process was not as effective on the original texts as it was on the revised texts.

## Summary of Comprehensibility Analyses

The test of comprehensibility with the responses the children gave to the multiple choice questions, provides substantial evidence that the utilization of learning principles in a text revision process improves comprehension. The scores from the short response questions would indicate that the learning principles used in the text-development process can influence the creation of more comprehensible text. For both text conditions less-skilled readers appeared to have benefited more than skilled readers.

The test of comprehensibility with readers' ratings did not provide as convincing evidence. In the overall analysis there was only one area (Confusion) in which there was a statistically significant difference between text treatments at the p < .05 level of significance.

For the test of comprehensibility with adult readers' rankings, the results from the evaluation of the revised texts would provide substantial evidence. But the evaluation of the original texts would not be strong enough evidence to advise organizational adoption of the text-development process.

Overall there appears a preponderance of evidence to

support the validity of the process. This evidence appears to be more conclusive with regard to revision, but also convincing with original text development.

# Chapter 5

## CONCLUSIONS

The concern that prompted this study arose from a need to improve the educational quality of Extension's publications. A model of a text-development process was created to aid subject-matter specialists in using learning principles to revise and create more effective and comprehensible educational publications. The primary research hypothesis of this study was that the text-development process would assist subject-matter specialists in applying learning principles to revise and create more comprehensible text. The secondary research hypothesis of this study was that the texts the specialists either revised or created with the text-development process would benefit less-skilled readers, as well as skilled readers. These hypotheses were tested using three forms of measurement. The primary hypothesis concerning revised texts was supported by all three methods of evaluation. The hypothesis concerning the development of original texts was only supported by the children's reading comprehension test scores.

The secondary hypothesis concerning less-skilled readers was supported by the reading comprehension scores from both the revised and original test results. It must be pointed out that there were children who read texts developed with the process who scored few points on the

comprehension test. The effects of the use of learning principles in text-development will not help every reader. But it does appear to help both skilled and less-skilled readers. Since the process does benefit less-skilled readers it will be particularly advantageous for developing publications targeted to the low-income audience.

Based on the empirical findings on this study, four conclusions can be drawn:

1. The model of the text-development process can assist subject-matter specialists in revising and creating more comprehensible educational text.

2. Use of the learning principles within the text-development model may improve comprehension for adults, as well as children.

3. Use of the learning principles within the text-development model facilitates comprehension more for less-skilled than for skilled readers.

4. The model of the text-development process is more effective in revising an existing text than developing an original text.

## Discussion

Various text construction strategies can be identified in any of the texts written by the specialists who used the text-development process. But, none of the specialists used all the strategies. Since the use of any one of the text construction strategies results in improved comprehension,

it may not be necessary for (or realistic to expect) a writer to use all the text construction strategies suggested in the model. Perhaps, a writer would reach a level of diminishing returns after two or three text strategies were used. This is one area that deserves further research. The decision of which strategies a writer will use to improve comprehension could be a matter of personal preference or natural ability. The writing process is still more an art than a science. It relies upon natural ability and talent. The strategies a writer would be motivated by the model to use might be dependent upon which ones the writer is accustomed to using.

The results from all three methods of measurement showed that the influence of the text-development process was stronger for revising texts than for creating original texts. This could be attributed to the short period of instruction the specialist had before being asked to develop an original text. It was a mentally demanding task for a specialist to develop an original text. It required original ideas, at the same time the specialist was becoming familiar with the model. Perhaps, with practice, subject-matter specialists would become more proficient in use of the model. The extent that the model would help subject-matter specialists would be dependent in part on their natural talent and their interest in improving the comprehensibility of a text passage. Relating to the

specialist's comments (p. 42) concerning common sense not being common practice, the model may serve to remind specialists of the composition basics, which are consistent with learning principles. As the specialist mentioned, sometimes the writer's mind is so preoccupied with conveying details of the subject matter that the style in which information is presented is forgotten.

Consideration must be given to the fact that the specialists volunteered to participate in the study. This would indicate that they had an interest or concern in improving the materials for the 4-H audience. This may not be true of other subject-matter specialists. This fact may influence the acceptance of the model.

**Recommendations for Extension.**

Since the process has been shown to be effective, it could be taught by the Educational Communications Specialist to other subject-matter specialists during an educational in-service workshop. An eight-page publication similar to the one in Appendix A (Developing More Effective Extension Educational Publication) could be used as an educational aid for this type of workshop. In addition, a hard copy or plastic template of the Publication Development Process matrix could be given to the workshop participants to keep on their desks, as a reminder when creating materials. Also, a publication proposal form, such as shown in Figure 5, might prompt specialists to use the model, or at least

## V.C.E. Publication Proposal Form

Specialist:_____ Department:_____

VCE Objective Number:_____

Proposed Title:

Related Publications:

Major concept(s) to be conveyed:


Anticipated audience:


How much does the audience already knows about this subject?

Why is this concept important for the audience to know?


**Please attach an outline of the proposed publication.**

Anticipated publication length:_____

Quantity anticipated:_____


_____
(Specialist's Signature)

_____
(Program Leader's Signature)

_____
(Publication Manager's Signature)




Figure 5.  Suggestion for a publication proposal form

contemplate important concerns relative to developing an educationally effective publication.

Use of the model could heighten subject-matter specialists' awareness of learning principles. The model demonstrates how the application of these learning principles could enhance comprehension of subject-matter concepts. Since the text-development process was modeled from other curriculum development systems, it might influence the way specialists develop other educational presentations.

**Future Research**

Research in this area will continue because textbooks are important in the educational process. Specific areas for related research would be to apply this type of text-development model to different educational fields, such as mathematics and foreign language; different writers, i.e. which text construction strategies would writers favor; different lengths of text passages; different topics and the influence of topic on gender. The list of future research studies would only be limited by monetary resources and interests of educational researchers. There may not be an ultimate answer, exact method, or solution for the text comprehensibility problem. However, this study has produced an educational aid that has been shown to be effective in the development of more comprehensible Extension educational materials.

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Appendix A

Developing More Effective Extension Publications

# Developing More Effective Extension Educational Publications

Extension publications serve as a critical educational tool to help clients learn about the practical application of new research information in everyday living. A problem that has continually plagued Extension is that many clients avoid using Extension publications because they are hard to read and understand[1]. Publications can be developed using information concerning how comprehension occurs to complement the learning process; thereby, facilitating clients' understanding of new subject matter concepts. This article presents a model of a publication development process which uses learning principles to help clients understand the new research information you want to communicate.

The publication development model is composed of six stages, based on knowledge of how clients learn or acquire new information. Two basic learning principles are used throughout the model. The first principle is that clients learn by adding on new knowledge to knowledge which they are already familiar. This principle is call prior knowledge. You can use this principle to relate the subject matter concepts you want your clients to learn to what they already know. The second principle concerns the organization of the subject matter information you are presenting. Information presented in an organized network, explaining the relationships between concepts, helps extension clients understand the overall topic. These two basic learning principles are used in the stages of the publication development model.

The model is composed of six developmental stages: clarifying the purpose; creating relevance; developing coherent structure; explaining terminology; composing cohesive passages; and evaluating the publication. Within each stage the relevant learning principle will be explained in relation to helping the client understand the concepts you want to communicate. Decision making questions and developmental guidelines were created to stimulate your thinking concerning actions you can take to capitalize on the learning principle. The stages serve as a time frame for the practical application of the learning principles; while, the questions serve to focus your writing efforts. A matrix displaying the publication development stages, decision making questions and developmental guidelines is shown in Figure 1. The stages have an interactive nature, with the questions from one stage promoting thought that helps guide formation of another stage. You could think through each of the stages before you begin to write, contemplating how each stage could be used to help extension clients understand the subject matter concepts you want to communicate.

**Figure 1**
**Publication Development Model**

| Stage | Decision-making Questions | Developmental Guidelines |
|---|---|---|
| **Stage One:** Clarifying The Purpose | What is the purpose of the publication? What is the central topic to be conveyed? What are the major concepts? | Designate the purpose. Develop a semantic map. Delineate major and minor points. |
| **Stage Two:** Creating Relevance | How much do the intended clients know? How can the new information relate to them? What's important about this new information? | Estimate clients' knowledge base. Anticipate clients' interests. Develop an opening statement. |
| **Stage Three:** Developing Coherent Structure | Are the concepts in a consistent order? Has a conceptual flow been created? Has non-relevant information been deleted? | Develop conceptual outline. Articulate relationships. Eliminate non-essential material. |
| **Stage Four:** Explaining Terminology | Have technical terms been identified? Which terms are critical to comprehend? Which technical terms should be explained? | Identify technical terms. Decide which words to substitute. Decide which words to explain. |
| **Stage Five:** Composing Cohesive Passages | Does each paragraph have topic sentence? Does each sentence connect with the next? Have all major concepts been presented? | Develop topic sentences. Confirm connections between sentences. Prepare a summary statement. |
| **Stage Six:** Evaluating The Publication | How will comprehension be measured? Are the main ideas comprehensible? Did the client gain important information? | Evaluate text for adherence to principles. Have colleague evaluate the publication. Have intended client evaluate publication. |

## Stage One: Clarifying the Purpose.

The first stage of the model assists you with clarifying the purpose of your proposed publication. The purpose of the publication can serve as a compass to guide the planning of the lesson. By analyzing the expected outcome of the lesson you can work backwards to plan the educational lesson to facilitate reaching the overall purpose of the publication. This is analogous to knowing the destination of a trip, then planning the route to reach the destination.

At the beginning of the writing project you may only have a vague idea of the purpose of the publication. It might be helpful to develop a semantic map which shows the relationship of concepts and sub-concepts in an organized or structured network. Jotting down ideas in a semantic map can be considered an idea generation or brain storming activity. That is, with this activity you can analyze your ideas and conceptualize how each concept relates to the central topic.

A semantic map or network can take many forms depending on your creativity, but it should show relationships between concepts with lines and arrows. The semantic map in Figure 2 gives a visual representation of the ideas presented in this publication.

If the specialist is revising an existing publication s/he should read through the entire text, then summarize the purpose of the text. It is suggested that the major concepts of each paragraph be circled and key words of the supporting concepts be underlined. The identified concepts should then be arranged in a semantic map.

To implement the learning principles while developing your publication, you can contemplate the following decision making questions and reflect on the concepts you wish to present. What is the purpose of the publication? What is the main idea to be conveyed? What are the major and minor related concepts?

Figure 2

Relationship of Learning Principles
In the Publication Development Process

Comprehensible Publications

Using Structure & Organization

Using Prior Knowledge

Stage One: Clarifying The Purpose

Stage Two: Creating Relevance

Stage Three: Developing Coherent Structure

Stage Four: Explaining Terminology

Stage Five: Composing Cohesive Passages
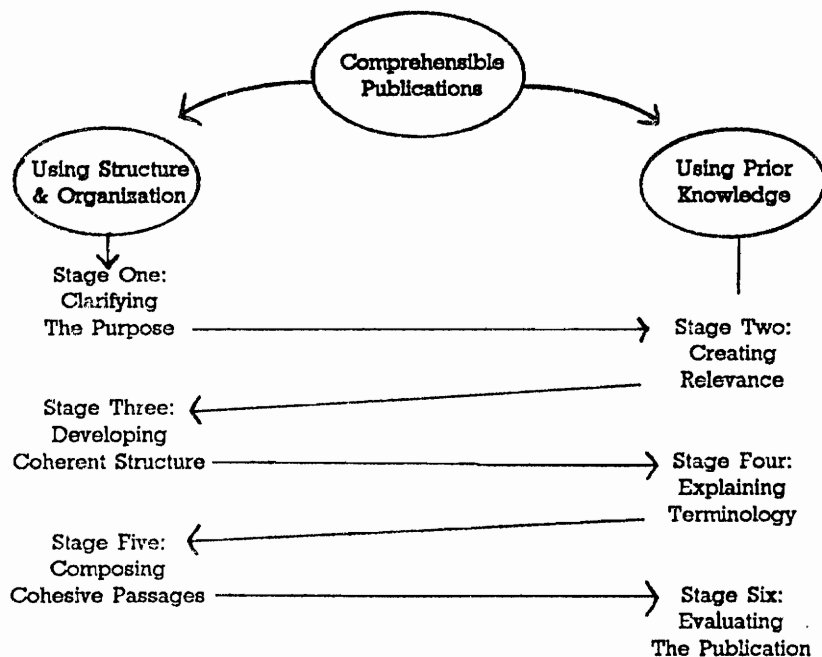
Stage Six: Evaluating The Publication

Figure 2   represents the practical application of the two learning principles in an effort to enhance comprehension.

## Stage Two: Creating Relevance.

The second stage of the publication development model is concerned with analyzing the existing knowledge of your intended clients; and, reflecting on how new information can be more easily connected to what the clients already know. Prior knowledge is the general knowledge your readers possesses about your subject matter area. New information which is presented in relation to existing or prior knowledge will be easier for the clients to understand and remember. Once you have conceptualized the purpose of your publication you will assist your readers' understanding of the overall topic by emphasizing related concepts and sub-concepts with which you expect extension clients to be familiar. You will be creating relevance by building bridges between the clients' prior knowledge of the material to the new knowledge you will be presenting.

Interest and motivation have a substantial influence on comprehension, because it is directly related to the amount of prior knowledge extension's clients possesses. To create relevance you can design the publication to relate knowledge you expect readers to possess and to stimulate interests you expect are important to extension's clients. One way to simultaneously introduce familiar knowledge and stimulate interest is to develop an opening paragraph which informs the clients as to what information is going to be conveyed and why it should be of interest or importance to them. This gives your clients cause to pay attention to the information that you will be presenting.

To implement this principle when developing a publication you should decide to what common knowledge base you can attach the new knowledge you want your clients to understand. Then to decide and explain why the new information should be important to the client. It might be helpful to visualize the type of clients for which you are writing your publication. The decision making questions concerning prior knowledge assessment are: How much do the intended clients know about the subject? How can the new information relate to what is already known? and What's important about this new information?

## Stage Three: Developing Coherent Structure.

The purpose of the third stage is to form an organizing structure which connects the ideas generated in the semantic map to the main idea you want your readers to understand. This can be accomplished with a conceptual outline which helps you clarify the relationships of the major and minor concepts to the central topic. New subject matter concepts are easier for the client to understand if they are presented in an organized network. An organized network that progresses from common knowledge concepts to specific subject matter concepts facilitates the readers' comprehension.

Organization and structure help extension's clients understand the relationships between concepts which support the main idea of the publication. In a well organized publication, main ideas are presented first, followed by supporting detailed information to compose a conceptual flow of information. Non-relevant information will only serve to confuse the reader; therefore, it should be deleted. At this stage in the model you should develop a conceptual outline of the major and minor ideas generated in the semantic map. The decision making questions for this stage of the model are concerned with structure and organization, they are: Are the concepts arranged in a consistent order? Has a conceptual flow been created? Has non-relevant information been deleted?

## Stage Four: Explaining Terminology.

The fourth stage should focus your attention on the technical terms you'll be presenting to your clients. Many subject matter concepts are conveyed by a single technical term, it is therefore important for extension's clients to gain a rich understanding of the technical term. You can assist the clients in gaining this understand by explaining the meaning of the word with enough elaboration to ensure an understanding of the related concept. Your readers will remember the new term or concept by the connections you make to concepts with which they are already familiar.

New words, technical terms, or jargon can cause comprehension problems because the reader has to spend more mental effort decoding the word; therefore, less attention is spend in understanding the concept being conveyed. Vocabulary can be manipulated in the development of a publication in two ways, by substitution or explanation. The decision of which words to substitute or explain depends on the relationship of the word to the concept being conveyed. Just and Carpenter[2] suggest using synonyms of a lower order in place of complex or difficult words. This concept would be helpful if the word was not necessary to the comprehension of technical material.

If the word conveys a technical or subject matter concept then the word should be elaborated or used in a context rich way so extension's clients can gain an understanding of the word. In this way, the clients are aided by you explaining the word's meaning in such a way that the

comprehension of the new word is almost effortless. By explaining the word's meaning with familiar words your clients will be able to connect the new word to existing knowledge. New or technical terms should be introduced to extension's readers slowly and used several times to aid the comprehension of the word and the concept which the word represents. By repeating the word several times and in different contexts the clients will be able to gain a richer understanding of the concept.

At this stage in the model, you should underline key technical terms in the conceptual outline, flagging the need for substitution or explanation in the composing stage. The decision making questions concerned with explaining individual concepts are: Have technical terms been identified? Which terms are critical for understanding the main idea? Which technical terms should be explained?

## Stage Five: Composing Cohesive Passages.

In the third stage you focused your attention on the overall structure of the publication, in this stage you focus on structuring and organizing individual concepts within sentences and paragraphs to create a meaningful flow of information. You can help your readers comprehend your meaning by using explicit topic sentences which explain the relationships of upcoming concepts. In addition, the use of cohesive ties and summary statements explicitly organize and connect individual concepts to each other, making the passage more meaningful.

The placement of new information in a publication has an important influence on how much and what readers will remember. Information near the beginning of a passage has often been reported to be recalled better than information appearing later in the passage[3]. The explanation has been that the most important information in a passage is recalled best, and this information usually appears early in a passage. An explicit topic sentence can be used to provide connections between concepts in a passage in terms of the relationship of an individual concept to the main topic.

Another structuring device that enhances comprehension is cohesion. Cohesive linkage smoothes the transition between ideas and establishes a clear relationship between concepts. Cohesion can be created by using transitional words and phases which serve to organize and introduce individual but related concepts.

Words or phases such as; therefore, however, because of, on the other hand, etc. explicitly connect concepts within sentences and paragraphs. Even when your publication is well organized and structured your clients will benefit from information providing cues to relationships between concepts, especially when the content is relatively unfamiliar or technically difficult.

The last structuring device to enhance comprehension is a summary statement. This device briefly restates the major points supporting the central topic and brings closure to a passage. A summary will help your readers understand the major points you think are salient to the central topic.

The learning principle can be implemented by developing explicit topic sentences to introduce the main point to the clients. Then the related ideas in the conceptual outline should be composed into complete sentences. The underlined words from the outline should be defined and used several times. If the outline has been followed the concepts should be arranged in an organized and structured manner. At this point you should pay special attention to the connection (cohesion) of individual ideas. Summaries can be developed to draw together major points which support and bring closure to your central topic. The decision making questions for the fifth stage are: Does each paragraph begin with an explicit topic sentence? Does each sentence relate to the preceding and succeeding one? Have all major concepts been presented?

## Stage Six: Evaluating The Publication.

The final stage of the model assists you with evaluating the comprehensibility of your publication. The assessment should be conducted at two points in time, formative (while you are developing the publication) and summative (your readers' assessment). At each point you must determine exactly what information you want to assess, and changes you will make as a result of the information gained. In the formative evaluation, you will be assessing whether the learning principles (prior knowledge and structure-organization) have been utilized to increase the understanding of your publication. In the summative evaluation you will be determining if clients were able to gain an understanding of your intended meaning. An Extension publication is a communication device; therefore, you will be assessing whether your clients understood the intended meaning you wanted to communicate.

For the formative assessment the decision making questions can serve as evaluators of each stage of the development process. For example: in the first stage of the process, did you identify the central topic to be conveyed? Did you identify the related concepts and sub-concepts? The stages have an interactive nature, with the questions from one stage promoting thought that helps guide formation of the other stages. For instance: in the second stage (relevance) you might think of an additional concept that would help extension's clients understand the central concept, you would then add this concept to the semantic map created in the first stage.

In the final steps of the writing project a summative evaluation of the publication should be conducted with the type of clients for which the publication was developed. You'll be assessing the knowledge the reader gained from reading the publication. A field test with clients will indicate whether the publication has the ability to communicate an understanding of this new knowledge. Also, you can assess whether the purpose of the publication has been met. If the publication conveys procedural knowledge, were your clients able to fully understand the directions? Evaluation of the publication should be developed in relation to the purpose of the publication.

Tests can be developed to measure comprehension by either recall (unprompted eg: written response) or recognition (prompted eg: multiple choice questions) of main idea concepts. Recall of subject matter concepts is mentally more demanding than recognition. Tests can be developed to correspond with the conceptual outline; whereby, the readers' responses can be mapped back to the concepts in the outline. In this manner, the source of a communication break down can be located and adjusted to improve comprehension. Testing can be conducted informally (one-on-one, verbal discussion) or formally in groups (pencil and paper tests) depending on the information that needs to be gained and the proposed use of the information.

The evaluation stage serves to establish the educational worth or effectiveness of a learning tool and alerts you as to portions of the publication that may need to be revised. The decision making questions pertaining to publication evaluation are: How will comprehension be measured? Is the central topic comprehensible? Did the readers gain important information?

In a recent work Kintsch[4] suggested that a process be created that integrates learning principles into a text design model. The preceding model of a publication development process with the underlying learning principles could serve as a guide in creating more effective educational publications. By using the publication development model you could be increasing the learning potential of your educational publications; thereby, increasing their value as learning tools.

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Written by Penny Risdon,
Extension Agent, 4-H Youth, VCES.

Appendix B

Texts and Tests Used In The Study

## What Is An Ocean?

The oceans are tremendous, containing nearly 330 million cubic miles of water. A single cubic mile of water contains about 9.5 trillion gallons of water. There is enough water in the oceans to fill a cylinder 75 miles in diameter and 70,000 miles high. If the earth were smooth both above and below the water, the ocean would completely cover the earth to a depth of 12,000 feet.

The oceans were formed during the early history of the earth, probably three to four billion years ago. It is believed that the earth was formed from cooling, condensing gases. From a hot, molten state, the earth eventually cooled to the point where water vapor condensed and the water cycle began. Water trapped in molten rock was released as the rock cooled, increasing the amount of atmospheric water. Once the earth's surface cooled enough to allow standing water to remain, the filling of the oceans began. It may have taken more than a billion years for the oceans to fill to their present volume.

The oceans occupy large depressions in the earth's surface called basins. How these were formed is not known; however, scientists agree that it was a very slow process. The oceans have been undergoing constant change throughout their entire history. Mountains that are now thousands of feet above sea level were once part of the ocean floor. The Ice Ages, movement of the continents (continental drift), and other dramatic processes have reshaped the oceans during their long history. Picture a canyon larger than ten Grand Canyons, a 40,000 mile long mountain chain, or a 3000 mile long cliff over one mile high. These are some of the awesome features hidden on the ocean floor.

The oceans show several general features. A shallow rim, called the continental shelf, surrounds the continents. This area is usually less than 600 feet in depth and may extend from a few hundred feet to hundreds of miles from the shore. It is the most productive part of the ocean and most susceptible to human activity.

Moving seaward, the continental shelf slopes downward, forming the continental slope. It may plunge uninterrupted for two to three miles to the ocean floor and is one of the most impressive features of the ocean basin. The face of the continental slope is cut by deep gorges and canyons, probably created by undersea land slides.

The deep ocean floor, called the abyssal plain, averages two miles in depth and occupies five sevenths of the total sea area. In many areas it is completely flat, covered by sediments that have accumulated over millions of years. This vast, flat plain is often interrupted by towering mountains and mountains ranges called oceanic ridges.

A continuous, undersea mountain range runs along the Atlantic, Indian, Antarctic, and Pacific Oceans, stretching nearly 40,000 miles. It is the longest mountain range in the world, averaging more than one mile high. Another interesting feature of the ocean floor is the deep openings called oceanic trenches. They are all V-shaped and very deep, reaching more than 30,000 feet below the surface.

### What Caused The Muddy Water?

A Virginia river known for "sweetness of tastes"...and "so stored with sturgeon and other sweet fish as no man's fortune has ever possessed the like. We got good store of mussels and oysters which lay on the ground as thick as stones. We opened some and found in many of them pearls."

Although the language sounds a bit odd, this is the writing of a Virginia colonist, the date -- April, 1607. The place -- Lynnhaven Bay or what is now Virginia Beach. Visit the same area today and the description hardly fits. Long gone are the sturgeon (a fish), now an endangered species, facing extinction. There are few oysters or mussels along the shore and eating them would be risky because of the polluted water. The water is anything but sweet now. Drink a cup full and you may end up in bed with an upset stomach.

The early colonists discovered a rich, unpolluted land upon arriving in the "New World". Native Indians had lived in harmony with nature for thousands of years prior to the colonists arrival, taking only what they needed and not abusing the resources. It is well documented that the major reason for European colonization of the America's was exploitation of natural resources, primarily gold and other valuable minerals. When these were not discovered, the colonists turned their attention to other resources of export value.

In order to make the colonies profitable for European backers, the colonists needed to find a valuable export item. That came with John Rolfe, a 1611 immigrant, and a simple plant - tobacco. Tobacco became the rage of fashionable Europeans and a booming market for the dried leaves was established. By 1640 much of the land along the lower James River had been taken up for tobacco farming; while further inland, wheat and other grains became important crops. Forests were cleared; the soil tilled; and crops planted and harvested with little thought to soil conservation. River shores were the best place for farms with easy access to shipping docks for getting crops to European markets.

So began the slow but steady destruction of forests along rivers feeding the Chesapeake Bay. The bare, cultivated fields allowed wind and rain to erode topsoil. Colonists noted extensive erosion and muddy waters as early as the late 1600's; and by 1800, sediments had filled in waterways (once 8-15 feet deep) around towns like Marlboro and Joppatown in Maryland. These and other shipping towns became isolated from the shipping channels that were once their very livelihood.

Since the colonists had no concept of soil conservation, the vastness of the new lands led to a "use and move on" attitude: "You can't tell me how to farm, I've already worn out two farms."

Soil erosion has become a major problem of the Chesapeake Bay area. Water quality has steadily declined, land has been lost and waterways filled, farmlands have become unproductive, and plants and animals living in the water have been affected. The problem has steadily worsened and now threatens the health of the greatest estuary in the United States -- the Chesapeake Bay.

## What Caused The Muddy Water?

A Virginia river known for "sweetness of tastes"...and "so stored with sturgeon and other sweet fish as no man's fortune has ever possessed the like. We got good store of mussels and oysters which lay on the ground as thick as stones. We opened some and found in many of them pearls."

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The early colonists discovered a rich, pure land upon arriving in the "New World". Native Indians had lived in harmony with nature for thousands of years prior to the colonists arrival, taking only what they needed and not abusing the resources. It is well documented that the major reason for European colonization of the America's was exploitation of natural resources. They wanted to find gold and other valuable minerals. When these were not found, the colonists turned their attention to other resources of export value.

In order to make the colonies profitable for European backers, the colonists needed to find a valuable export item. That came with John Rolfe, a 1611 immigrant, and a simple plant - tobacco. Tobacco became the rage of fashionable Europeans. There was a booming market for the dried leaves. By 1640 much of the land along the lower James River had been taken up for tobacco farming. Further inland, wheat and other grains became important crops. The forests were cleared; the soil tilled; and crops planted and harvested with little thought to saving the soil. River shores were the best place for farms. The farms on the rivers had easy access to shipping docks for getting crops to European markets.

So began the slow but steady destruction of forests along rivers feeding the Chesapeake Bay. The bare, cultivated fields allowed wind and rain to erode topsoil. Colonists noted extensive erosion and muddy waters as early as the late 1600's. By 1800, sediments had filled in waterways (once 8-15 feet deep) around towns like Marlboro and Joppatown in Maryland. These and other shipping towns became isolated from the shipping channels that were once their very livelihood.

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In order to make the colonies profitable for European backers, the colonists needed to find a valuable export item. That came with John Rolfe, a 1611 immigrant, and a simple plant - tobacco. Tobacco became the rage of fashionable Europeans and a booming market for the dried leaves was established. By 1640 much of the land along the lower James River had been taken up for tobacco farming; while further inland, wheat and other grains became important crops. Forests were cleared; the soil tilled; and crops planted and harvested with little thought to soil conservation. River shores were the best place for farms with easy access to shipping docks for getting crops to European markets.

So began the slow but steady destruction of forests along rivers feeding the Chesapeake Bay. The bare, cultivated fields allowed wind and rain to erode topsoil. Colonists noted extensive erosion and muddy waters as early as the late 1600's; and by 1800, sediments had filled in waterways (once 8-15 feet deep) around towns like Marlboro and Joppatown in Maryland. These and other shipping towns became isolated from the shipping channels that were once their very livelihood.

Since the colonists had no concept of soil conservation, the vastness of the new lands led to a "use and move on" attitude: "You can't tell me how to farm, I've already worn out two farms." The problem continues to threaten the health of the Chesapeake Bay.

### The Effect of Soil Erosion Upon the Chesapeake Bay

When the early colonists arrived in the "New World" they discovered a rich, unpolluted land. Native Indians had lived in harmony with nature for thousands of years prior to the colonists arrival, taking only what they needed and not abusing the resources.

The Chesapeake Bay at the time of the colonists arrival was pure and unpolluted. A Virginia colonist wrote in April, 1607, of a Virginia River known for "Sweetness of tastes"... and "so stored with sturgeon and other sweet fish as no man's fortune has ever possessed the like. We got good store of mussels and oysters which lay on the ground as thick as stones. We opened some and found in many of them pearls."

Visit the same area today and the description hardly fits. Long gone are the sturgeon, which is a species of fish that is endangered and facing extinction. There are few oysters and mussels along the shore and eating them would be risky because of the polluted water. The water itself is anything but sweet today. To drink it would be running the risk of getting an upset stomach.

What has caused these drastic changes in the Chesapeake Bay? Perhaps the reasons can best be explained by looking at why the colonists came to the "New World" and the attitudes that have evolved through the years in respect to use of natural resources.

It is well documented that the major reason for European colonization of the America's was the search for gold and other valuable minerals. When these were not discovered, the colonists looked for other resources that would be valuable to export.

Farming was soon discovered as a way of producing valuable products to be used for exportation. The simple plant, tobacco, discovered by John Rolfe in 1611, soon became the rage of fashionable Europeans. A booming market for the dried tobacco leaves was established. By 1640 much of the land along the lower James River was taken up for tobacco farming; while further inland, wheat and other grains became important crops to European markets.

Since the colonists had no concept of soil conservation, the vastness of the new lands led to a "use and move on" attitude. So began the slow but steady destruction of forests along rivers feeding the Chesapeake Bay. The bare, cultivated fields allowed wind and rain to erode topsoil. Colonists noted extensive erosion and muddy waters as early as the late 1600's. By 1800, sediments had filled in waterways (once 8-15 feet deep) around towns like Marlboro and Joppatown in Maryland. These and other shipping towns became isolated from the shipping channels that were once their way of making a living.

Soil erosion has become a major problem of the Chesapeake Bay area. Water quality has steadily declined, land has been lost and waterways filled-in. Farmlands have become unproductive and plants and animals living in the water have been affected. The problem has gotten worse through the years and now threatens the health of the greatest estuary in the United States -- the Chesapeake Bay.

## What Is Causing The Muddy Water?

Have you been very hot and thirsty for a nice cold glass of ice water? What if you could not get that glass of water because the water was unfit to drink? Here's a bit of history to help you understand how this has happened.

In the beginning, colonists discovered a "New World" were the native Indians lived. The Indians lived in harmony with nature. They took only what they needed and conserved the resources; such as, land, water, minerals. Thus, their land was rich, clean and unpolluted.

The language may sound strange, but in 1607 a Virginia colonist wrote this about a Virginia river. It was known for "sweetness of tastes" ... and "so stored with sturgeon and other sweet fish as no man's fortune has ever possessed the like. We got good store of mussels and oysters which lay on the ground as thick as stones. We opened some and found in many of them pearls."

The colonist was writing about Lynnhaven Bay or what is now Virginia Beach. If you visit the same area today, you could hardly describe it as the colonist once did. The number of sturgeon (a type of fish) has dropped so low that they may face extinction. There are few mussels or oysters along the shore. If you were to eat any of these mussels or oysters, you might get sick. The water has changed from being "sweet" to unclean or polluted. A glass of it may even make you sick.

What has happened to make Virginia's waterways change from the time the Indians lived there? To begin, some European people sent colonists to America with the hope of making money (profit). The early settlers had hoped to find gold and other valuable minerals. When these items were not discovered, the colonists needed to find a valuable item that could be traded or exported.

The export item was found when John Rolfe brought a simple plant -- tobacco to the colonies. It was very fashionable to smoke tobacco in Europe in the early 1600's. Thus, there was a booming market to sell the dried tobacco leaves. The land around the lower James River was good for growing tobacco and other crops. The river shores also made it easy to ship exports to Europe.

By 1640 much of the land around the lower James River was used to grow tobacco; further inland wheat and other grains became important crops. Forests were cleared and the soil was tilted. As the land wore out, colonists moved further inland. Very little thought was given to taking care of or conserving the soil. The colonists had a "use and move on" attitude toward the land.

Forests continued to be cut along rivers to make way for farming. Wind and rain took away or eroded top soil. The topsoil began filling waterways around towns like Marlboro and Joppatown in Maryland. They could no longer export crops. By the late 1600's the colonists noticed muddy water. Water quality became bad and affected the plants and animals living in the water.

Much of Virginia's topsoil eventually drained into the Chesapeake Bay. So, the slow and constant erosion or wearing away of the soil began with the colonists. Though we have learned a lot about conservation, we still have a lot of pollution. The same soil erosion problem that started with the colonists now threatens the health of the Chesapeake Bay.

## Soil Erosion Harms Virginia's Waterways

Imagine fishing on a river where the water is clear and the fish are plentiful. Our forefathers wrote of the rich unpolluted resources like fertile soils, fresh water and an abundance of fish and mussels. Unfortunately, because of man's abuse of the land and lack of conservation, soil erosion has destroyed many of these resources to the point of threatening the health of the Chesapeake Bay and other Virginia waterways.

In 1607, a Virginia colonist wrote "A Virginia river known for 'Sweetness of tastes' ... and stored with sturgeon and other sweet fish as no man's fortune has ever possessed the like. We got good store of mussels and oysters which lay on the ground as thick as stones".

The early colonists discovered a rich, unpolluted land upon arriving in the "New World". Native Indians had live in harmony with nature for thousands of years prior to the colonists' arrival, taking only what they needed and not abusing the resources. It is well reported that the major reason for European colonization of the Americans was exploitation of natural resources, primarily gold and other valuable minerals. When these were not discovered, the colonists turned their attention to other resources of export value.

In order to make the colonies profitable for European backers, the colonists needed to find a valuable export item. Tobacco was soon a booming market and by 1640 much of the land along the lower James River had been taken up for tobacco farming; while further inland, wheat and other grains became important crops.

Forest were cleared; the soils tilled and crops planted and harvested with little thought to soil conservation. So began the slow but steady destruction of forests along rivers feeding the Chesapeake Bay. The bare, cultivated fields allowed wind and rain to erode topsoil. Colonists noted extensive erosion and muddy waters as early as the late 1600's; and by 1800 sediments had filled in waterways (once 8-15 feet deep) around towns like Marlboro and Joppatown in Maryland. These and other shipping towns became isolated from the shipping channels that were once their livelihood.

The colonists had no concept of soil conservation. The vastness of the new land led to a "use and move on" attitude. As one colonist is reported to have said, "You can't tell me how to farm, I've already worn out two farms."

Soil erosion has become a major problem of the Chesapeake Bay area. Water quality has steadily declined, land has been lost and waterways filled, farmlands have become unproductive, and plants and animals living in the waters have been affected. The sturgeon (fish) and other animals are now an endangered species. The problem of soil erosion has steadily worsened and now threatens the health of the Chesapeake Bay.

## Misuse of Natural Resources Damaged Chesapeake Bay

When the colonists arrived on the Chesapeake Bay in April 1607, they found a rich and unpolluted land. They discovered a river "so stored with sturgeon and other sweet fish as no man's fortune has ever possessed the like". According to early settlers, they found a plentiful supply of mussels, oysters and fish.

Between 1607 when the colonists arrived and now, many changes have taken place in the Chesapeake Bay and other Virginia waterways. Sturgeon (fish) are now facing extinction because they are an endangered species. There are few oysters and mussels along the shore and eating them would be risky because of the polluted water. The water is anything but sweet now. Drink a cup and you may end up in bed with an upset stomach.

The story of how this rich and productive land became fallow and polluted started with the arrival of European immigrants. While the native Indian tribes had lived in harmony with nature for thousands of years before the arrival of the colonists. The Indians took only what they needed and did not abuse the resources. The major reason for European colonization of the new world was to find valuable natural resources like gold and other minerals. When gold was not found, other materials to export were sought.

This valuable export commodity was established when John Rolfe brought the tobacco plant to Virginia in 1611. At that time tobacco was the rage of fashionable Europeans and there was a booming tobacco market. By 1640 much of the land along the lower James River had been cleared for tobacco farming; while further inland, wheat and other grains became important crops. Soil conservation was not well known at that time. Because this new land was so vast, colonists adopted a "use and move on" attitude. This attitude was expressed by one farmer who said, "You can't tell me how to farm, I've already worn out two farms".

The steady destruction of forests caused the erosion of soil along the rivers feeding the Chesapeake Bay. The forests were cleared, the soil tilled, crops planted and harvested with little attention to the land. As early as the late 1600's colonists noted extensive erosion and muddy water caused by the movement of soil from bare, cultivated fields into the rivers. Wind and rain quicken this flow of soil to the rivers.

Erosion along the rivers was greatest because the river shores provided ready assess to shipping docks and European markets. By 1800, sediments had filled the waterways 8-15 feet deep around Marlboro and Joppatown, Maryland. Some shipping towns became cut off from the shipping channels and their livelihood because of soil erosion.

The "use and move on" attitude of early Virginians created a problem for the present day Virginians. Soil erosion is now a major problem in the area around the Chesapeake Bay. Water quality has steadily declined, land has been lost, waterways filled, farmlands are less productive and the habitat of plants and wildlife have been disturbed. This steadily worsening problem threatens the very health of the Chesapeake Bay.

### 4-H Outdoor Adventure Project

It's true! You too can become an adventurer in the outdoor world, just like Daniel Boone and Davy Crockett. You can explore the meadows and the forest, the swamp, the rivers and creeks, the rocks and caves, and discover a whole new exciting world! You can peek under rocks and search for tiny critters in the creek, hike a forested trail and watch the sunrise from the top of a mountain peak, listen to the sounds of the night on a night hike, and feel the textures of the outdoors on a nature hike!

Now, you might do some of these things by yourself; but, more than likely, you'll be doing them with a small group of adventures just like yourself. Guiding you on these adventures in the outdoors will be an adult leader -- somebody who knows a lot about the outdoors and kids but still has lots to learn. And, that's important for you to know because you can help teach things to your teacher as you explore the outdoors!

Mother Nature has created a most exciting world for you to explore. She doesn't always provide the answers -- you are going to have to do a bit of research and discover those answers! This will be a chance for you to use your creativity!

Mother Nature doesn't always provide the best weather for your adventure outings -- it may rain or hail and you'll have to learn to cope with the challenges of being wet and cold! It may be hot and dusty and you'll have to learn how to prevent dehydration! Then again, it may be a sun-filled day. You never know and you'll learn to become prepared for any kind of day.

You'll become best buddies with the other kids in your club. Well, maybe most of them! There might be a kid or two that you just don't like for some reason. You'll learn how to get along with everybody because it is very important that the club work together when you are exploring in the outdoors.

There's lots to see, smell, feel, and do in the outdoors! The 4-H Outdoor Adventure Project is a great way for you to explore the outdoors. Become an adventurer today!

## 4-H Wildlife Project: Get Involved

As a 4-H member in the wildlife project, you will learn to be a better neighbor to the wildlife in your area. Wildlife, like you, have certain needs. You will learn to identify the three basic requirements of wildlife. What are they? Well, they are the same three that you have -- almost.

You will be "doing". After learning how, you will actually use information to improve the quality of life for wildlife in your community -- either, urban, suburban or rural. Through 4-H presentations you will be able to teach this knowledge to others.

Learning about wildlife will also help you to know more about yourself and your needs. You will learn that your life is related to the lives of wildlife. Your actions have either a positive or negative impact on the wildlife in your area.

The 4-H wildlife project will teach you how to analyze the wildlife situation in your community. With this knowledge you can work with others to improve the quality of life for wildlife and yourself.

Much of the actual work to improve the wildlife conditions in your area will involve other boys and girls. So you will get to make new friends and be successful in group projects.

Get involved today! Contact the 4-H office by calling xxx-xxxx or returning the completed form shown below.

-------------------------------------------------------------------

Yes, I'm interested in working to improve the wildlife population in my community. Send me information on what I need to do to get started:

Name: _____

Address: _____

Telephone number: _____

## Planning Attractive Meals

The visual impact of a meal is most important. Just as a painting captures the viewer's attention through a variety of colors, forms and shapes, so do the foods that are served together during a meal. The goal in meal preparation is to combine foods in such a way that they are so visually attractive and appealing that people will want to eat because their "mouths' are watering" In one part of the 4-H Foods project you will learn how to plan attractive, tempting meals.

The 4-H Foods project will help you increase your artistic abilities in food preparation by teaching you what to consider when combining foods. You will be using information about food's color, texture, and shape to help you plan attractive meals.

Color and color combinations of foods have a psychological impact that may make meals attractive and enjoyable to an individual. Combining foods that have a mixture of contrasting colors makes a meal much more interesting and enticing.

Texture is another important visual element to keep in mind when planning meals. That is, whether the food is hard or soft, liquid or solid. A hungry person's appetite may disappear at the sight of an all-soft meal or one which is so liquid that the foods appear to run together. The third element to keep in mind when planning visually attractive meals is the shape or form of the food. A meal made up of food in the same or similar shapes is likely to be uninteresting. Meals have much more visual appeal if a variety of shapes could be used.

The aim of the artist is to arrange a meal so that it is not only wholesome, but is a joy to all the senses. One of the first senses to be stimulated by food is its appearance or visual impact. For foods to be visually stimulating, they must be combined such that there is a variety of color, textures, and shapes.

This is an example of the kind of information you can learn in the 4-H foods project. You can learn this kind of information to help you plan meals for your family. Other areas covered in the foods project will help you with budgeting, planning and preparing nutritious meals, and storing and preserving foods. You could share what you learn about foods in 4-H presentations. Or you and your friends could use the information to plan a party. If you would like to learn more about the 4-H foods project call your local 4-H office.

## 4-H Economics Project

The ability to solve problems and make decisions can affect how satisfied you will be though out your life.  One particular field of study that was born from the need to help people make wise decisions is economics.  Yes -- can you believe it?  Most people think that economics is just about money.  Really, it is about the choices people face in life and how decisions are made about those choices.

Here are some choices you may already face as a 9-11 year-old:  To eat a good breakfast or not eat a good breakfast; to study or not to study; to learn how to play a musical instrument or learn how to play basketball; to spend your allowance on expensive tennis shoes or ones that don't cost to much; whether to join Scouts or 4-H.       There are many decisions to be made everyday of your life.  Every decision you make has an outcome.  For instance, if you decide to practice playing basketball instead of doing homework, you may not have grades good enough to attend college.  This may mean getting a low paying job at which you will be unhappy.

There are a variety of 4-H programs in the area of economics.   The word economics may not be used in the title -- but -- the program will let you practice how to solve problems and make decisions.  Just like basketball or swimming practice will improve your performance.  The more you practice making decisions, the more likely you will become a good decision maker.  An added benefit is that you will learn to manage resources to solve your problems.  You can even teach others about the information you gained through 4-H presentations.

The 4-H economics programs are designed to be an interesting and fun way to learn skills you'll use though-out your life.  For instance, with the Stock Market Game a team of up to six players will invest $100,000 of computer money in the stock market.  Other projects like the project on "entrepreneurship" (that means someone who takes a risk to go into business) helps guide you through starting a small business.   4-H economics projects will help you use new information to solve problems, manage money and other resources and work successfully with others.

Since economics affects every single person, you might as well learn more about it the easy, fun way through your local 4-H club.  See your local Extension Agent for more details.  Look under the county government section in your phone book.

## Learning Skills For Successful Living

The 4-H poultry project offers many fun activities for you to develop important skills you will use through-out your life. Activities like raising a fluffy baby chick, caring for a colorful adult bird or judging poultry on an award winning team. Whichever activity you get involved in, you will learn valuable skills like communication, how to use time and money wisely, and how to use information to solve problems.

One of the best projects for young members is the brooding/rearing project because youth get to raise their own birds and learn to be responsible for another living thing. You can raise everything from chickens to turkeys and ducks to pigeons. Many of these birds are raised to produce eggs and meat for the family; however, many birds are raised as pets. By caring for another living thing, you will learn to problem solve and make decisions on a daily basis about what is best for the bird.

As part of the rearing project you can do many other activities. Many youth exhibit their birds at fairs and show others how well they have done in their project work. However, showing your successful project work can also result in cash rewards and great personal pride.

Another project activity is poultry judging. This activity helps you make wise decisions and defend your decision to others. Poultry judging also teaches you what eggs and poultry meat are acceptable for humans to eat and why.

A project yearly plan and record book will help you set goals and record accomplishments over the period of a year. Then at the end of the year you can evaluate your progress. Presentations can be given to groups of people to teach them what you have learned or you could start a small business as your project grows.

Whichever 4-H poultry project you choose to participate in, you will find it a fun way to meet new friends and learn. All of the activities will help you to use information to solve problems, manage resources and communicate with others. Therefore, many of the skills you develop in the poultry project can be used throughout your life.

## Don't You Just Hate Your Clothes?

If you are like me, you help select most of your own clothing; and probably refuse to wear what your parents buy. Even though your closet is full, there is never anything to wear. Looking forward to junior high and becoming a young adult, I have become aware of how I look and feel. My clothes should all make me feel as good and comfortable as my favorite jeans. I wear them everyplace!

That is until I went to the 4-H Clothing and Textile meetings. I learned some things that will help me with my clothes, like forever. There I learned about shopping for myself; to pick clothes that all go together and may be worn to school or for fun. Plus I can make the most of my clothing budget. I've also learned how to keep them looking new and special. Although I'm not great with a sewing machine (but you sure could be!), I can fix a ripped hem or sew on a button. I even "did my colors". Now I know which shades look best on me and will match what I already own. I understand what clothes are made of and how they get to the stores where I shop.

The members of the club worked together to create a fashion show to show off what we learned. At the end of the course, I modeled in the 4-H Fashion Show -- I gained the confidence to smile at the audience -- and entered a wardrobe plan in a 4-H competition. I also made a lot of new friends; both boys and girls.

I used to ask my friends what I should wear to school. Now they ask me! Thanks to the 4-H Clothing and Textiles Program, I love my clothes! And you can too. For more information contact your local 4-H Agent.

Short Response Questions and Appropriate Answers For Original Text

1. What was the main idea of the passage you just read?
   Skills to be learned in the _____ project/program.
   How the _____ project/program will help youth develop skills.
   How you can learn skills in the _____ project/program.

2. How will this subject area help you use new information?
   Use new information to solve problems.
   Have better quality _____.
   Use information to make decisions.

3. What will you learn about communicating with others from this subject?
   How to give a 4-H presentation about _____.
   Sharing information about this project with others.
   Help other club members with this project.

4. In this 4-H project how will you learn more about problem solving?
   Learning to use time, money, articles to solve problems.
   Learn to use information to help make decisions.
   Working with others to solve problems with a _____ club project.

5. How will this subject area inform you about managing resources?
   Learn to budget time, money and materials.
   Learn to use resources wisely.
   Practice or "Learn By Doing" through _____ project work.

6. In this subject area how will you learn more about working with others?
   Working on a _____ club project.
   Working with a group of people.
   Exchanging information with other club members.

7. How can this 4-H area help you analyze new information?
   Use information to solve problems.
   Practice or "Learn By Doing" through _____ project work.
   Discussing project area with other members.

8. In what ways will this subject help you accomplish goals?
   Working as part of a group on a _____ club program.
   Learning to plan what I want to do.
   Working together to plan and carry out a club project.

9. What is the main point of this 4-H passage?
    Skills I could learn with this project/program.
    How the _____ project/program will help youth develop skills.
    The 4-H _____ project/program helps develop lifetime skills.

10. How can this project help you relate with other people?
    Working within a group to accomplish goals.
    Sharing information with others in the club about _____.
    Working with other members on a club project.

11. How will this 4-H subject teach you about acquiring, analyzing and using information?
    Knowing how to care for _____.
    Learning to give a 4-H Presentation.
    Sharing information with others.

12. How can this 4-H subject teach you to manage resources?
    Budgeting time, money, materials.
    Planning how time and money can be used.
    Completing _____ project work.

13. In what ways will this 4-H subject help your problem solving skills?
    Use new information to solve problems.
    Working with others to make decisions about a club project.
    Pooling resources to solve problems.

14. How will you learn to use knowledge in every day living?
    To work on _____ project exercises.
    Use knowledge to help make decisions.
    Club members working together on a club project.

15. What did you learn about 4-H from this passage?
    Learn skills for successful living.
    In 4-H I can learn skills that will help me through out my life.
    Skills to help me problem solve, communicate, and relate to others.

## Multiple Choice Test For Revised Text

**Place the correct letter in the blank.**

_____1. By the late 1600's
a. sturgeon were an endangered species.  b. the waterways had been filled in.  <u>c. the colonists noticed muddy water.</u>  d. tobacco was popular in Europe.
e. I don't know.

_____2. The sturgeon is an endangered species because of
a. poor air quality.  <u>b. polluted water.</u>  c. the colonists.  d. sweet water.
e. I don't know.

_____3. Soil erosion
a. was caused by the native Indians.  <u>b. has become a problem of the Chesapeake Bay.</u>  c. was stopped by the colonists.  d. does not affect the Chesapeake Bay.  e. I don't know.

_____4. The water in the Chesapeake Bay is now
<u>a. worse than it was in 1607.</u>  b. the same as it was in 1607.  c. safe to drink.  d. sweet.  e. I don't know.

_____5. The health of the Chesapeake Bay is threaten by
a. the native Indians.  b. the colonists.  <u>c. soil erosion.</u>  d. the tourists.
e. I don't know.

_____6. The colonists found
a. polluted land with few resources.  <u>b. a rich, unpolluted land.</u>
c. Indian tribes who plowed the land near rivers.  d. tobacco growing along rivers.  e. I don't know.

_____7. When gold and other valuable minerals were not found
a. the colonist when back to Europe.  b. the colonists polluted the Chesapeake Bay.  <u>c. the colonists sought other resources.</u>  d. the colonists moved west.
e. I don't know.

_____8. The topsoil was eroded by
a. the tourists.  b. the native Indians.  <u>c. the wind and rain.</u>  d. modern farmers.
e. I don't know.

_____9. Tobacco was an important export item because
a. people in America wanted to get rid of it.  b. the climate wasn't good for growing food.  c. the soil was to poor to grow crops.  <u>d. there was a market for it.</u>  e. I don't know.
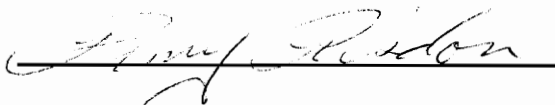
_____10. The native Indians
a. abused the land.  b. exploited the resources.  c. lived in harmony with nature.
d. did not live near the Chesapeake Bay.  e. I don't know.

_____11. Water quality of the Chesapeake Bay
a.  was improved by the colonists.  b. was improved by the native Indians.
c. has steadily improved.  d. has steadily declined.  e. I don't know.

_____12. The forests were destroyed
a. by native Indians.  b. to have land to farm.  c. because the colonist needed the
wood.  d. to build shipping docks.  e. I don't know.

_____13. When the colonists arrived, the water of the Chesapeake Bay
a. was not safe to drink.  b. was pure and unpolluted.  c. was a problem to the
colonists.  d. was damaged by modern farmers.  e. I don't know.

_____14. The colonists attitude toward the land was to
a. make a profit for the native Indians.  b. make a profit for the colonies.
c. use and move on.  d. restore the land.  e. I don't know.

_____15. The colonists needed a valuable export item
a. to make the colonies profitable.  b. to make the colonies attractive.
c. to make the colonies fashionable.  d. to destroy the Chesapeake Bay.
e. I don't know.


## Circle True or False

This lesson was well organized.      True        False


This lesson was written clearly.     True        False


This lesson was confusing.      True        False


This lesson was short and to the point.      True        False


I learned something new from this lesson.      True        False

VITA

Penny Risdon
105 Hutcheson Hall
Virginia Tech
Blacksburg, VA 24061
Phone: (703) 231-6371

## Professional Experience

1985 -- Present. Extension Agent, 4-H Youth, State 4-H Office, Virginia Cooperative Extension Service. Research and evaluation projects, and curriculum development.

1980 -- 1984 Extension Agent, 4-H Youth, Smyth County, Virginia. Responsible for a youth education program involving approximately 2,000 youth and 350 volunteer leaders.

1979 -- 1980 Social Worker, Smyth County, Virginia Department of Social Services.

1976 -- 1979 Professional Home Economist engaged in homemaking.

1975 -- 1976 Home Economics and Science Teacher, New Hanover High School, Wilmington, North Carolina.

## Education

Doctor of Philosophy Candidate: Educational Research and Evaluation, Virginia Polytechnic Institute and State University. Specializing in the practical application of research knowledge to improve educational practice.

Master of Science in Home Economics, Clothing and Textiles. Thesis: Surface Distortion of Polyester Knits. University of North Carolina - Greensboro.

Bachelor of Arts, Psychology. University of North Carolina - Wilmington.

## Skills

* Research and evaluation design, data analysis, report writing.
* Survey instrumentation development.
* Test instrumentation development and validation.
* Knowledge of SPSSX, NCSS, mainframe and micro-computers.
* Curriculum development and educational publications.
* Reading comprehension analysis.


## Professional Affiliations

National Association of Extension 4-H Agents
American Home Economics Association
American Educational Research Association
National Reading Association
International Reading Association