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Effective Industry Writing: The Power of Cohesive Language

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By
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Effective Industry Writing
Through
Better Training, More On-The-Job Practice, and
An Awareness of the Power of Language

This thesis is approved as a creditable and independent investigation by a candidate for the degree, Master of Arts, and is acceptable for meeting the thesis requirements for this degree. Acceptance for this thesis does not imply that the conclusions reached by the candidate are necessarily the conclusions of the major department.

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Chapter 1

Efficiently produced, clear writing for technical documents can dramatically affect the profits of today's high-tech industry. Industry management, however, often underrates the need for specific technical writing training among technical and support personnel. In addition, staff people commissioned to work exclusively on technical manuals, proposals, reports, and similar documents are rare in small industry.

Today's corporate environment demands skilled writers who can produce clearly written documents that are easy to understand. While industry demands skilled writers, many of its professionals claim their academic training did not adequately prepare them for their job requirements. Because effective writing truly has a bearing on the corporate profit line, management must find ways to provide continuing education for its employees. Because academia strives to prepare its students for the real world, it must keep pace with the demands of the corporate environment and seek to provide adequate writing training.

Researcher Barbara Couture suggests a direction to follow: ''We can hope to solve writing problems in school, in business, and in government through the studied observation of communication in actual contexts if we design research with the aim of resolving the communication dilemmas of those whom language serves'' (6). One way to achieve this is through consultations between university professors and industry.

Other researchers agree with Couture and call for specific study that gives useable information to teachers and practitioners of technical writing. Technical writing instructor Mark Haselkorn says such useful information must come from the world of work: ''Research in technical writing should consist of defining, both through practical and theoretical investigations, the relevant pragmatic conventions and how they interact,'' he says (29).

This master's thesis looks at current academic and industrial demands. It examines the historical and ethical foundation for technical writing in today's workplace. Specifically, it explores the demands of technical writing at Daktronics, Inc., focusing attention on the practical world which researchers say makes such study useful.

I have chosen Daktronics not only because I spend my work day there producing various kinds of promotional and technical writing, but also because it represents a high-tech industry with writing demands no different from the universal world of work. Its corporate management refers to itself as an ''engineering-based company'' involved with research, development, sales and installation of computer programmable, visual information displays. Those information display products include scoreboards, message centers, vote display systems, sports timing and judging systems, along with other smaller, diversified products. Daktronics markets its computer-controlled products worldwide to produce $20 million in annual sales. The company competes with high-tech, global industries for its profit. When much of that effort hinges on written documents, their clarity becomes paramount.

My thesis examines three Daktronics manual examples for their cohesiveness. I use the technical manual as a base for discussion because that common industrial document forms a powerful tool for maintaining satisfied customers and generating new ones through user testimonies of clear, easy to understand writing. A clearly written manual can give the perception of a ''user-friendly,'' product; ultimately, satisfied customers share, as dissatisfied customers do, their experience with others. Daktronics maintains that technical manuals become a secondary source of sales.

Through this thesis examination of industrial writing skills and needs, I offer recommendations for greater efficiency in technical writing at Daktronics. The company can see better technical documents through on-site, workshop training, unified writing guidelines, team writing of documents, and systematic planning before writing.

Feedback about each document's effectiveness after writing could be gained through a postage-paid, reader reponse card bound into the manual to make the company aware of product deficiencies which need to be addressed.

I also offer recommendations for a more productive university technical writing program. These university recommendations are directed to South Dakota State University, although their application could be made to other technical writing programs as well. The university should make technical writing coursework a requirement for completing any engineering program. The English department, which houses technical writing coursework, could strengthen its program through implementing rhetorical and linguistic strategies into course content, adding technical writing coursework to the graduate level and high school teaching methods classes, and encouraging instructor-industry consultations. Students should also be encouraged to put their knowledge to use through industry internships for credit.

Chapter 2

Ethics for Industrial Writers

At the beginning of any discussion of the work of technical writers, one should first consider ethical conduct for these industrial authors. In recent years, the topic of industrial ethical behavior frequently finds its way into discussions among professionals. Is this just a buzz phrase, or must technical writers concern themselves with some of the same issues and questions addressed by the industries in which they work?

Ethics and the scientific community sometimes produce conflict. Since the origin of engineering around 1850, the discipline has claimed to be not only the developer of science, but the reporter as well. Science deals with facts. Engineering develops those facts into helpful products. Because the facts are believed to state objective truths, scientists felt no obligation to make ethical choices about their actions (Rubens 16). In reporting and developing those scientific truths, however, the field of engineering has produced strong statements of ethics. The National Society of Professional Engineers calls its members to perform services with ''honesty, impartiality, fairness and equity'' (NSPF code). Technical writers often report the actions, which document many of those engineering developments. The writers' own code of ethics obligates these professionals to use language in its clearest state so that a written account fairly and accurately documents engineering innovations.

Not only does conflict come between ethical thought and engineering and science, but a difference in ethical thinking sometimes exists between professional technical writers and academicians. The former maintain that competence gives writing its fundamental principle and ''market success its purpose'' (Clark 140). Academicians believe that all ethical writing must address the well-being of society at large (140). As

my final recommendations suggest, cooperative efforts between industry and university benefit both. Learning and appreciating the thinking of one another creates a productive relationship between industry and academia.

Unethical Behavior in the Corporate World

Philip Rubens, of New York's Rensselaer Polytechnic Institute, presents three conditions capable of creating unethical conduct in corporate technical writers: personality devaluation, objectivity, and language manipulation. ''Personality devaluation,'' or not being directly accountable for the writing, says Rubens, exposes writing to manipulation by ''anonymous corporate voices'' (19) If the technical writer limits text writing to a mere recital of facts arrived at alone or received without question from a technical expert, Rubens implies, industry editors may change the text to present a positive corporate image. An erroneous image may present inaccurate product documentation, which brings about not only unethical behavior but legal repercussions as well (19).

The notion of reporting objectively creates a second circumstance for unethical behavior. Most technical writing requires objectivity, which becomes, in Rubens' opinion, impossible to achieve because even choosing the organizational pattern for describing an activity requires subjectivity. For example, the writer may structure critical findings sequentially rather than deductively, giving the most important item first. Such structure may bury information important to the reader's decisions. Even selective decisions about which observations to report also limit the likelihood of purely objective writing. The process of selection occurs at each stage of technical writing. Rubens says the writer's ethical responsibility is fair treatment of the facts (18).

Rubens' last circumstance for unethical behavior, the manipulation of language,

develops when the technical writer desensitizes images through the use of better sounding words that create an illusion (18). For example, claiming to produce 35 shades of color on a 4-color lamp display when the engineering for such a feature is six months away, taints the writing.

The astute technical writer needs to be aware of these circumstances for unethical writing behavior. When authors become responsible for their own writing, present their subjects fairly, and portray accurate images through honest language, they are behaving ethically.

Ethical Responsiblity

Ethical responsibility manifests itself through rhetorical choices. An understanding of rhetoric comes from study of the ancient masters. Plato and Aristotle defined rhetoric as information resulting from a cooperative exchange of ideas. Brigham Young University professor Gregory Clark says this idea exchange enables the author to arrive at the most clear intention (193). While technical writing does not always offer a strict give and take of ideas, the writer should strive for the clearest presentation of a text. Thoughtful word selection and sentence structure helps make the author's intent clearly understood. These careful rhetorical determinations produce responsible technical writing.

A technical writer has an obligation to the reader. According to Jack Griffin with the Naval Underwater Systems Center, the writer's primary obligation is to communicate unambiguously (64). Choices about the structure of the text, word selection, or even the placement of punctuation, are the writer's responsibility. As I later recommend, a study of rhetoric not only helps the professional technical writer make good rhetorical choices, but also helps the university student learn how to meet corporate writing demands.

In the corporate world, as in many other arenas, each time a person establishes a role as an expert on something, that knowledgeable person makes a commitment to provide precise rhetoric describing that expertise. This commitment channels through the technical writer, whose obligation to the reader intensifies that sense of ethic responsibility (66). When people communicate face to face, they question each other, and embellish and clarify their ideas. When those same ideas are presented in writing, their interpretation comes without any interaction. Griffin believes that commited technical writing simply reduces the chance of misinterpretation (67).

The Power of Words

What makes the technical writer's choice of words so important? An examination of the study of linguistics opens the way to choosing powerful words for technical descriptions. M.A.K. Halliday and his wife Ruqaiya Hasan, British linguists, have contributed significantly to a greater understanding of English. Their theory of cohesion provides a means to analyze text for its unity properties. In addition to examining how text maintains unity, Halliday looks at the power of word choice in describing a process. For example, he labels a class of verbs necessary for clear technical writing as ''performatives.'' This particular class offers a forceful means for communicating technical descriptions accurately. For example, active verbs such as ''execute,'' ''tighten,'' and ''maneuver'' provide more accurate imaging for the technical manual reader. Performatives are ''verbs with which saying is doing'' (68). Using performatives makes the writer commit to the text and take ownership for what it says.

Halliday evaluates each word and how it performs in a sentence to determine the text's success. Technical writing that uses Halliday's ''performatives,'' for example, becomes more forceful and, therefore, more successful. Such verbs as ''direct,''

''discover,'' ''validate,'' or other performing verbs show the author's commitment to the writing, and that commitment brings genuine concern for the reader. A writer cannot write in a vacuum. How will the reader benefit from the performance of the verb? Will the reader/user's job become easier? Will the product function better? Performatives help bring the reader closer to the writer's intent.

Aristotle's Taxonomy and Technical Writing

Using the classic tradition of Platonic or Aristotelian rhetoric for clear technical writing provides a solid framework for the writer. The writer uses a system of sound ethical word choices to present information based on a cooperative exchange with the reader. Such an interchange assures integrity in the presentation of that knowledge.

Technical writers using classical rhetorical theory as a basis for writing discover the permanence of ideas. Despite the passage of more than twenty-three centuries since Aristotle authored his Rhetoric[1], only refinements to his ancient philosophy are needed. Three typical technical writing documents--the technical report, the technical manual and the technical proposal--correspond to Aristotle's taxonomy for the divisions of speech presented in his Rhetoric. English professor M. Jimmie Killingsworth of Memphis State University and two other technical writing practitioners make comparisons between the ancient models and present-day documents. They contend that while there may be some overlap among the modes of discourse, their primary emphasis correlates with Aristotle's work (14).

Today's technical report draws from forensic examples in the ancient courtroom, using past events to influence the present. The master's reportorial mode of discourse provides the model for documenting facts which will affect present and future decisions.

[1]References to Aristotle's Rhetoric are made with information found in Killingsworth's article, "Amplification of Manuals: Theory and Practice."

The modern day technical manual compares with the ancient philosopher's ''epideictic,''[2] or operational mode, which functions in the present. The reader/user draws conclusions for action based on the manual's text. Finally, current technical proposals mimic Aristotle's ''deliberative'' or future mode. A proposal presents current corporate elements and projects images of their function into the future. In ancient times, this projection of possibilities influenced groups addressed in a public assembly (14).

Studying rhetorical masters proves valuable to students of technical writing. Discourse theories from Aristotle to Kinneavy provide models for effective writing and should be part of technical writing curricula. Even Aristotle's ''ethos'' theory provides a valuable model for students to use in accepting ethical responsibility for their writing.

Amplification in Technical Writing

Killingsworth, et al. say ''just as classical rhetoric in all its types aims to move the reader, all technical writing is action-oriented'' (16). Rhetorical analysts say Shakespeare's Mark Antony didn't come to ''praise Caesar'' but to rile the crowd against Brutus. Antony's epideictic speech prompted action by the listeners, just as the instructive nature of the technical manual must prompt its reader to take necessary action for a product to function properly (16).

While many technically written pieces aim at brevity, amplification or longer discourse demonstrating Aristotle's epideictic rhetoric provides useful direction for operations manuals (17). ''Amplification'' says Killingsworth, ''is not a mere matter of making the argument longer, but of adding force to the communication with the purpose of producing a carefully calculated action'' (19). Giving the user reasons for a particular action makes the reader more apt to perform according to the writer's intention.

[2] Aristotle's epideictic mode of discourse, according to Killingsworth, was used to move audiences with speeches of praise or blame.

Ancient Descriptive Devices

Quintilian[3], the 1st Century Roman educator, called for a great deal of thought and explanation in an author's description. Four such methods of amplification can apply to today's manual writer. First, the writer can use superlatives. Second, descriptions that flow from lesser to greater reflect the ancient method of comparison. A third method of enlarging description in manual writing shows cause and effect. And a fourth method uses synonyms or appositives for emphasis to parallel the intent of the classic method of accumulation (19).

While most technical manuals lay out and identify the operations necessary for a properly functioning product, those operations, tasks, and steps must be given ample descriptions. Readers or users must develop a clear sense of purpose for each operation (19). By adopting Quintilian's ancient method of giving ample description to technical manual sections, the material becomes more understandable and easier for the reader to remember. According to Killingsworth, ancient devices give direction to modern manual writing. For example, Quintilian's coverage parallels usability tests for manual selections to assure that they are complete. His rationale gives an explanation or reason for a task making sure the user takes proper action. Rationale also outlines the manual's table of contents which gives the document organization. A manual's warnings, like the ancient discourse, cover the technical writer's chief ethical responsibility to ensure ''correct and efficient performance.'' When the technical manual models Quintilian's use of alternatives, it presents tables or charts showing the product's full operational range. Giving examples in the modern manual imitate Cicero's[4] ''picturing results'' which show the desired task performance. The ancient practice of preview/review

[3]References to Quintillian also come from Killingsworth.

[4]Cicero's influence on technical writing is outlined in Killingsworth's article.

unfolds as summary checklists at the end of chapters or sections. The ancient call for emphasis finds its way through repetition, strong word choice, and effective sentence structures in the modern manual text (22-24). **Figure 1-1** graphically shows how these ancient techniques apply to the modern day manual.

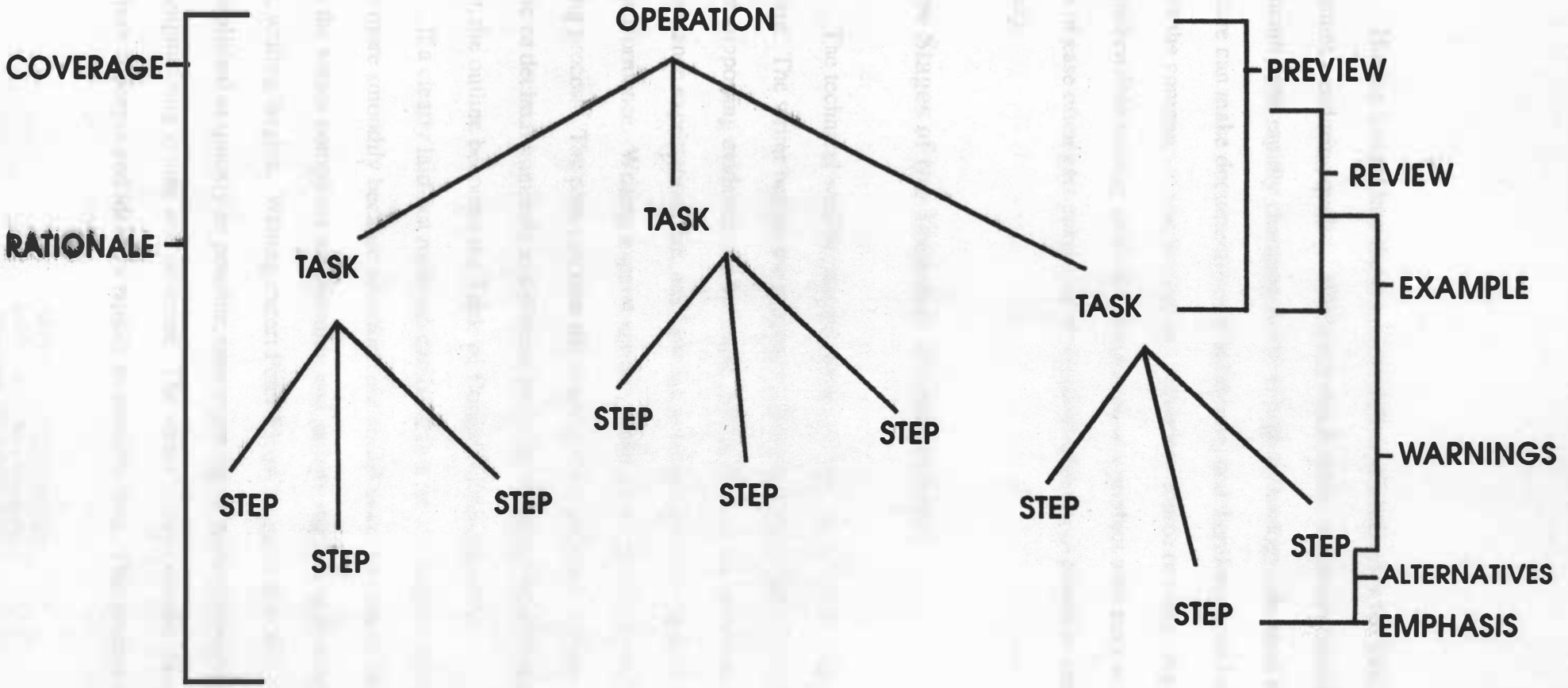

FIGURE 1. Classical rhetoric applied to a modern manual
from: *Amplification in Technical Manuals: Theory and Practice*
by M. Jimmie Killingsworth, Michael K. Gilbertson, & Joe Chew

Having insight into these ancient techniques increases the likelihood of the document's enduring quality. While not much seems to remain constant long in the continually and rapidly changing world of high technology, classical methods of writing structure can make documents more believable, and therefore more lasting. This in turn allows the company to use writing as a secondary source of sales. Again, comprehensible writing gives the perception of a product with easy accessibility. That sense of ease often gets passed on in recommendations to others in search of a similar product.

Three Stages of the Technical Writing Process

The technical writing process occurs in three stages: planning, writing, and revising. The writer begins the process by planning: planning what will be addressed, where supporting evidence can be found, who makes up the audience and what performance expectations are, and how the writing should be organized to accomplish that performance. Writing experts say this planning effort should take about 30% of the writing process. The plan can take the shape of the traditional outline, using Roman, Arabic or decimal numerals to delineate the relative importance of each component. Often, the outline becomes the Table of Contents for a document.

If a clearly laid-out roadmap can be drawn for the project, the entire process flows more smoothly because all efforts are aimed toward a clearly identified purpose. Once the author completes the planning and gathers supporting evidence, the second stage, writing, begins. Writing expert Peter Elbow suggests that this stage should be accomplished as quickly as possible, concentrating on getting thoughts recorded without overemphasizing syntax and structure. The writer's only concern should be to formulate text from concepts and ideas as rapidly as possible (64). This portion of the writing

process should comprise only about 10% of the total effort.

The third stage uses the remaining 60% of the writing process to make revisions. This process uses the initial planning work to compare the writing with the original plan. Because revision is the most critical effort in the writing process, the writer spends the largest share of time here. This stage should be accomplished in an organized, methodical fashion. Obviously, it becomes impossible to check for all aspects of text at once. One source of editing advice is writer/educator Richard Hatch's, Business Communication (144). He presents a systematic approach to editing that works well in the world of corporate communications.

Hatch suggests checking the writing for effective organization first. If the writer needs to make major structural changes, they can occur before the revision becomes more focused. Secondly, the writer reviews audience analysis notes to make sure the writing clearly addresses the reader. Third, the writer checks the overall tone to see that it leads toward the assignment goals. Careful scrutiny of the material's readability and continuity provides the next editing focus. Working with sentence phrasing and word choice makes the document more effective. Once the writer examines the structural, and syntactical aspects of the writing, the author makes a rudimentary analysis of grammar, spelling, and punctuation (144-147). Although the 30-10-60 percentages used in the stages of writing assume rough divisions, they do suggest the relative weight writers should give the writing process.

Technical Writing Feedback

This critical revision process sometimes carries the label ''feedback'' when it moves beyond the technical writer. Because others in industry involve themselves with documenting products or projects, technical writers need not accept sole responsibility

for the document's revision. In the first 1988 issue of the Journal of Technical Writing and Communication, Thomas Barker says technical writing feedback in the corporate world comes by way of three reviews: the technical review, the executive review, and the editorial review. Feedback through technical reviews comes from those individuals intimately involved with product research and development. Their feedback proves critical to the document's factual presentation. Executive reviews assess the same document in light of corporate goals and objectives. Editorial reviews by the technical writer assess structure and grammar. Such reviews give the document essential copyediting (36).

Barker calls this feedback-produced copy ''high-tech writing,'' technical writing for those industries engaged in the manufacture or use of electronics, computers and other advanced technologies. He says that this vital process assures the success and effectiveness of documents, even though reviewers are hard to find and often ''do not know what they are doing'' once they have been identified(36). The reviewers can feel more confident, however, if the feedback expectations are identified beforehand. Writers often complain that reviewers are inattentive, don't like doing the review, don't give it a high priority among tasks, and often criticize outside their area of expertise. The expense and time-consuming nature of the feedback process hinder the process (37).

My experience reflects each of these concerns among text reviewers, especially the difficulty with reviewers criticizing outside their areas of expertise. Finding errors in the syntax or grammar of a professional writer often represents a real coup for the text reviewer. While technical writers can make writing errors, the reviewer who looks at the text to check its factual accuracy should do just that. The semantical/grammatical editing should remain with the person assigned to that task, generally the supervisory or writing management person. Despite difficulties surrounding feedback, carrying it out can produce effective techincal documents.

Reviews based on levels of expertise should be clearly assigned before the feedback begins. Knowing the expectations of the feedback process streamlines the effort of each reviewer. A company SOP (Standard Operating Procedure) should clearly define the process. The review should be divided among the technical expert, the writing supervisor, and the corporate executive. The first checks for accuracy of content and the second proofs for such things as spelling, sentence structure, and organization. The executive gives a final check to see if the writing corresponds with corporate goals. Depending on the size of the document and the time constraints of the project, reviewers should complete the process within a few days.

The divisions of the feedback process compare to the three stages of the writing process. Like writing's planning, writing, and revising stages, feedback occurs in stages of planning, implementing, and analyzing. These often occur simultaneously throughout document production (38). Those involved with reviewing the text include technical experts, executive or management personnel, and editorial supervisors. They are responsible for proofing the text in their area of expertise (39).

The most effective feedback comes from empirical testing made with the document plan to promote consistent corporate style and format. Product technologists give accurate feedback reflecting the original Research and Development (R&D) notes (46-47). Some of the most valuable feedback comes from actual product users. Some high-tech companies have adopted a system of ''real-time feedback,'' which gives the user the opportunity to respond immediately (48). A direct line computer network on site or through telephone lines gives companies useful criticism when problems occur. The product user can key in the problem in word or code, and its direct input to the company lets developers address the problem immediately. Feedback should be part of the development process to change or modify the product as needed. Strong customer loyalty often comes from users who feel they have had a voice in the development of a

product that meets and even exceeds their needs.

Automatic, early feedback comes from word processors, text analysis programs, automated outlining, and spell checkers (44). A computer database of customer complaints used in data processing provides a way to see that product R&D and product user manuals address actual needs (45). Elbow says the most useful feedback lets the writer "listen and see if you can experience what your reader is experiencing. Avoid the temptation to keep talking about what **you** had in mind; try discovering what you got into **their** minds" (145). Obviously, the process of feedback during technical writing only strengthens the document and makes it more useful.

Academic and On-The-Job Training

Accurate and efficient technical writing plays a major role in the corporate world. Corporations lose large amounts of money each year because of ineffective written communication. Muddled reports require extra time to decipher. Ambiguous project specifications necessitate numerous addenda to clarify what should have been stated clearly in the first place. Unclear, poorly organized sales proposals affect the corporation's ability to perform timely and accurate work. Wordy, indecipherable users manuals which should be the introduction to the product's reliability and dependability have the opposite effect (Spretnak 133). Clearly, better preparation in technical writing would alleviate many of these problems.

Charlene M. Spretnak's survey of professional engineers returning to their University of California/Berkeley alma mater found that they "frequently complain that they were not prepared for the communication tasks expected of them; they were humiliated on the job by their inability to create coherent reports and presentations, which they perceive will hinder their advancement" (133). I surveyed Daktronics

engineering staff asking similar questions, and while their answers weren't nearly as forceful, there was an indication that they felt they needed better preparation in schooling for the writing tasks required by their job. Whether or not that feeling of unpreparedness came from ineffective curriculum or unfocused personal study, the impression of a void in skills found its way into both studies. That concern must be addressed by educators, students, and employers.

Spretnak's study revealed that "engineers spend 25% of their job-related time writing, 23% reading technical and business material, 11% supervising the writing of others, and 7% giving oral presentations" (134). Those percentages reveal that the professional engineer spends over half of the work day with written communication. Whether one reads technical communications or writes them, in terms of the company's profitability, the need for clarity becomes essential. My survey of Daktronics engineers also looks at their reading and writing habits.

Seventy-three percent of those Spretnak surveyed thought that writing skills aided their chance for advancement in the corporation (134). In a world that equates professional advancement with increased buying power, this fact alone should be enticement for students in scheduling their career preparation coursework. Nearly 80% of those engineers surveyed felt that the amount of writing they did increased with their job advancement. Sixty-two percent of them said that when they do write, it comes under a great deal of pressure. Over 95% of the survey respondents said they would consider writing skills when hiring someone.

When evaluating factors used by designated skilled writers, the respondents said a strong correlation existed between good writers and those who outlined before writing. Those same writers perceived as skilled also spent a great deal of their time each week in leisure reading (134). Many of those Daktronics engineers who felt strongly about developing and maintaining good writing skills also spend a great amount of time reading for both work and leisure.

The Process of Technical Writing

So then, what skills become necessary for the writer of technical documents? First of all, the writer must be aware of what makes up technical writing and what it should do. Thirty-five years ago, writing experts Gordon Mills and John Walter labeled the technical writing genre with four characteristics that are still valid. They said, that first, the writing must concern itself with science and technical matters; second, it should use scientific vocabulary and conventional format; third, it should be committed to objectivity and accuracy; and fourth, it must involve itself with the complex tasks of describing, classifying, and defining intricate problems (Britton 21). Others say the difficulty of defining technical writing comes from thinking about its subject matter, which generally works in terms of "sequential thought." Sequential thinking uses connectives like because and therefore. By contrast, the study of history, literature and art is done in terms of "associative thought." Associative thinking connects with then and rather (21-22). Because most of the writing and teaching of writing during our education follows a pattern of associative thought rather than sequential thought, technical writers must restructure their thinking process.

Reginald O. Kapp, another early technical writing theorist, said that the technical writer "confers on the words the power to make those who read think as he wills it" (Britton 22). Definers of technical writing label its primary function as conveying one meaning in text. Kapp underscores the significance of careful technical writing when he says: "the reader must be given no choice of meanings; he must not be allowed to interpret a passage in any way but that intended by the writer" (22).

In a different survey of adult writers, Pearl Aldrich determined that the number one reason for not writing is fear, fear of discovery of the writer's ineffective communication. Aldrich said this fearfulness often covers itself by clumsy writing full

of technical jargon (128). Many professionals feel that filling a text with jargon is the prerequisite for intelligent writing. Only experienced industry peers who understand the jargon can interpret this often clumsy, redundant writing. The inability to write comes not only from fear, but also from little or no advanced planning or organization (128).

A professional technician/writer team approach to technical writing attacks these communication problems. This does not mean that one member produces the information which is miraculously transformed into a fluent, readable document by the professional writer, but that the two work in tandem with feedback from one to the other to produce the most effective document. As indicated earlier, this vital feedback affects a product's profitability because a readable document gives the perception of an efficient, valuable product. The technical document produced through a writer/technician team effort meets the consumer's needs. Victoria Pundsack of Ohio's College of Applied Science writes: ''the most general principle of good technical writing, then, is to help the reader, to save the reader work; the reader's time comes first, the writer's time comes second'' (85).

Whether the writer is a technician charged with documenting intimate involvement with a project or a defined ''technical writer,'' success comes from clear writing. Those skills necessary to be successful at the endeavor must come not only from school study, but also from on-the-job training. No schooling can prepare the writer for every situation, but specific training can equip the writer with the tools necessary to approach any writing task.

Academia - Industry Conflict

Some experts feel a conflict exists between academia and industry. M.K. Gilbertson defines the difference as ''a sense of scholarship'' in the university

environment which provides academic focus, while the corporate world looks for more ''tangible results'' (250). Progressive employers search for communicators within their companies who use the academic sense of theory with the corporate sense of results. The ideal university technical communications program requires a ''balance among several disciplines'' (250). Necessary coursework for the program comes from the humanities and sciences in addition to scholarly learning from the applied discipline. Variety in coursework gives the opportunity for writing across the curriculum as well as providing exposure to various writers and thinkers in different fields. Such exposure, according to Gilbertson, ''prepares students for the problem-solving environment'' they will encounter once they leave school (250).

The technical communications program balance should encourage faculty consulting and student internships. Gilbertson suggests that ''consulting jobs with industry also benefit teaching by keeping professors current with the industrial demands their students will face'' (252). Such consulting also provides contacts so student interns gain practical experience.

Daktronics uses training seminars for employees to polish basic verbal and writing skills. In fact, such a training seminar gave me my introduction to Daktronics. On two different occasions in 1985, I presented a writing seminar to Daktronics employees. During my four years of employment with the company, I have participated in several personnel communication seminars, but I recall only one other writing seminar, and that focused primarily on producing printed literature. Nevertheless, the willingness to conduct training seminars is very much a part of Daktronics' corporate philosophy.

Technical Writing Curriculum

Gilbertson recommends a broad-based curriculum for university students

interested in technical writing. He contrasts the benefits of extensive exposure with the ''fill-in-the-blank'' programs of typical English degrees, suggesting that teaching ''formats rather than rhetorical strategies (does) an injustice to students who will face unique professional demands that no program can anticipate with complete accuracy'' (251).

In addition to study of early rhetorical strategies, the technical writing student also benefits from a knowledge of the history of the English language, which provides a better understanding of grammar and usage. Learning the thinking skills that produced the lasting theories of ancient masters may prove to be the means for the technical writer to cope with today's intense corporate environment.

An awareness of the place of linguistics in technical writing proves important to both the education and practice of technical writers. Linguistic principles give a clear understanding of what makes language work. Making language work forms the base for writing effective technical manuals. We need to know what happens in communication between the user of language and the perceiver of it. While the word ''pop'' might mean addressing someone's father in New York, the carbonated drink that it means in the Midwest describes a very different convention (26). Likewise, in the programmable display industry, a ''driver'' means the electronic mechanism designed to instruct the message center elements to turn on or off, not someone who chauffeurs passengers.

Effective Technical Texts

Pragmatics labels the study of these language conventions. Grammar refers to the formation of acceptable structures of language using symbols which apply in any situation. Syntax is combining these symbols to form sentences. Semantics is meaning formed from these complexities. Rhetoric describes devices for creating effective

situational meanings for language (27-28). Combining all of these elements results in Mark Haselkorn's definition of technical writing: ''the study of Pragmatic Structure and Rhetoric for those communication situations that are actually encountered by people working in technical contexts'' (29). Research into the effective usages of all these conventions needs to determine just what makes effective technical documents and how to produce similar texts.

Accomplishing this study of what makes effective technical documents helps solidify technical writing as a research field. It also helps distinguish the teaching of technical writing from that of composition and other communication courses (29-30). Actual examples of technical writing produced for today's industry reveal some of the demands of the environment. Evaluations of the text's syntactic and semantic integrity determine areas for specific training. Determining the writers' prior linguistic training could bear influence on the curriculum direction for both industry-continued education and academic degree programs. Both industry and academia can benefit from the study's findings. Halliday supports the idea of linguistic training for technical writers when he says there must be a ''creative interplay of linguistic theory and application'' (Couture 5). Linguistic research has responded to the demand for skilled writers. Halliday heeds this call by uncovering how written language works, ''how it affects its readers, and what it demands of authors'' (1).

Cohesion and Coherence

Corporate technical writers can make use of Halliday's linguistic research for producing effective texts in the workplace, particularly his work with that mechanism called ''cohesion.'' In the text Solving Problems in Technical Writing, author Lynn Beene says technical writers must structure information carefully, evaluate the text

critically, and revise conscientiously. When they do this, the documents become cohesive and coherent (109).

Both cohesion and coherence address the logical ordering of ideas, only they arrive at conclusions on different levels. Beene defines cohesion as "articles, nominals, conjunctions, or sentence patterns writers use to connect sentences to one another." Coherence "describes the strategies and structures writers use to distribute information and to communicate ideas in an orderly manner" (109-110). To use those techniques successfully, the writer must try to anticipate reader questions.

For a text to be coherent, the image built in the reader's mind must be the same as that of the author's (117). Accurate imaging comes when a user follows instructions to successfully complete a task described by the writer. When the reader/user follows the text's structured signals accurately, the text is successful. Beene insists "coherence, therefore, entails explanations of semantic relationships beyond those indicated in the actual words of the text" (118). When a manual reader understands why inaccurate readings result from placing a device that senses the universal air temperature in the direct sun, some experiential wisdom comes into play. For a text to be coherent, reader knowledge must come from two levels. First the reader must have "world knowledge," or all that information generally understood by a reader from experience in the world. Second, "text-presented knowledge," or knowledge arrived at from new information combined with old/given knowledge, determines the coherence of a text. The writer's ability to connect these knowledges for readers makes a text coherent (118). Useful manuals come from coherent text.

Knowledge about both cohesion and coherence can be extremely useful to the technical writer of high-tech manuals. Consciousness about their application to text reduces reader confusion and helps make complex information easier to understand. The writer must take into account who reads the manual and what that reading must do for

them. Should the readers be able to assemble a device from written instructions or should they merely gain understanding of the process which must be performed by a professionally trained expert? Using the appropriate words at the appropriate reader level of understanding helps make a text more cohesive and thus more coherent. Writing to industry practitioners capable of understanding its terminology focuses word choice differently from when the writing addresses a casual user. Combining these words into a systematic flow of information also makes the text more useful. Finally, organizing the overall structure of the text into recognizable patterns makes the information more memorable (120). When lists of facts use parallel structures, they can be remembered more easily.

Researchers have discovered syntactic patterns which help make texts easier to comprehend. For instance, placing the main clause before the subordinate clause makes complex sentences easier to understand. Parallel constructions help give emphasis to related ideas and make them more memorable (125). A conscious effort to place items in parallel structure for various written documents at Daktronics over the last few years has produced more readable and substantial texts. The use of the active voice in corporate writing makes it easier to verify information because important sentence components can be identified more easily (125). There may, however, be situations where use of the passive better benefits the text's purpose. When the agent or actor is unimportant or unknown, the passive voice may serve the author better, or the passive voice can permit the author to pace the information more slowly and deliberately (125). Passive writing also helps get around sexist language. Conscious use of alternative language in place of he or she avoids offending a manual reader of either sex. Paragraphing also helps coherence by creating visual units of text (126).

Syntax and cohesion helps the writer/technician team to produce useable, memorable, and helpful manuals. Consistent style based on successful study ensures

profitable documents. A readable document can make a complex product seem less intimidating.

Manual Production

A structured approach for manual production should include a corporate team made up of product development, technical communication, and marketing people. The technical writer creates the useful link between development engineers and marketing analysts. The person in charge of manual production must have administrative authority over all three areas to produce useful documents. Killingsworth says today's trend moves ''away from development-oriented managers and toward managers with experience in communication and marketing'' (24). He also recommends writing the manual during product development. This may seem cumbersome and frustrating logistically to those team members whose work requires constant changes when development occurs, but the process is effective in producing both a product and manual that smooths out difficulties before the product's introduction.

Many high-tech companies include reader/user response cards in manuals to help identify their audience. The manual and any revisions, ''written for the least experienced, most easily frustrated member of the target audience,'' addresses ''the 'weakest link' among actual and potential users'' (25). Identifying the potential audience and conducting extensive in-house reviews before releasing the document and product produces a more profitable document.

Chapter 3 of this thesis examines the role technical writing plays in the work responsibilities of Daktronics engineering staff.

Chapter 3

Maintaining company growth at Daktronics comes through accurately documenting products and projects, or contracts. The writing also provides a historical perspective for viewing successes and modifications during the lifetime of the product or contract. An Engineering Document, or ED system, catalogs the writing. Its maintenance is performed by the company's engineering secretarial staff. Their responsibility includes typing and formating the text, reproducing any materials found in the system, storing the documents on computer disk, and retrieving and making necessary changes to documents whose product has changed. A Users Manual Development Guide written in 1983 by Engineering Technician Gary Borgstadt attempts to give company direction to manual writing. However, few of those assigned to write company manuals know it exists.

Daktronics corporate operation philosophy revolves around the use of modular components, or small, easily manipulated units. The design of these units makes their use and reuse easy once the initial unit has been engineered. Modular philosophy carries over from the design and construction of company products to the use and reuse of written text and graphic drawings for company documents. In fact, the first objective of the Manual Development Guide identifies the philosophy by stating its purpose as ''to utilize fully every document generated for User Manual reproduction'' (1). In other words, once a drawing is created or a text is written, the company benefits from reusing or modifying these materials for other documents.

The Development Guide lists its purpose as providing ''standard operating procedure which supports the generation of User's Manuals in a consistent format'' (1.1). The document presents format guidelines, but provides little direction for structuring the content of a manual. The outline for manual components defines them by reference to the weight of paper for text and divider sheets and the layout of the title page, and includes brief, general descriptions of the type of information that might be found in

different kinds of manuals. Definitions are made for users manuals, product installation manuals, or project installation manuals. The text's content generally comes from the design engineer or the product or project manager. Recent Daktronics manuals appear to reflect a format and style different from the Development Guide style. In fact, the layout and design might reflect that manual most recently observed and used by the writer.

If the Development Guide seeks to standardizes the assembly of Daktronics manuals, the goal is accomplished. But if the Guide attempts to standardize the manual content by identifying what information should be covered, it falls short. Because of the rapid growth of Daktronics, its 1990 needs are much different from what they were in 1983, and the Guide should reflect this expansion.

The 1983 Guide's first section introduces the concepts of Daktronics manual writing in only three pages. According to the Guide, a typical table of contents should include a ''General Introduction, Safety Considerations, Mechanical and Electrical Installation, System Operation, Equipment Maintenance, and Equipment Service''(2.4). It also directs the writer's attention to the ''Document as Sales Literature.'' While each of these elements should be described at length, addressing ways in which text could be written and what types of information it should contain, the Development Guide defines each in a paragraph.

An outline in the Guide's next section shows a typical Daktronics manual format and structure, including the layout of the title page and the function of the ''Reproduction Reference.'' This step-by-step list of instructions guides the secretary in the manual's copy and assembly.

The final section of the Guide essentially repeats what the rest of the document has said, only now it is called ''Operating Procedure.'' The Guide's text provides clues as to why it is unknown and unused by most Daktronics writers. Complicated sentence structures make reading it more work than help. The following example shows the

difficult sentence structures the Guide's readers encounter: ''This brief section outlines the course of action which directs the author towards the objectives discussed in Section 1'' (3.1). The section concludes with 100 pages of sample drawings, tables of content, and text from previously written manuals.

Even a publication from the Society of Technical Communication does little to guide a technical writer in structuring manual content. The title itself indicates the limitations of the text--Interim Standards - Technical Manual and Report Formats. Rather than addressing what the document's content should contain, it only discusses the placement and spacing for headings and subheadings (Wischerth). Examples of a manual and a report with their various tables, illustrations and text components give the reader format models and no more.

While an SOP needs to give company manuals consistency, manual writers must bring their own experience as readers and users of technical manuals to the text writing process. Writers should adopt successful text methods they observe elsewhere. When they encounter a manual that seems easy to understand and use, they should examine it to discover what made it so. Their own consciousness of what makes a successful manual provides them with a greater concern for the reader.

English professor Donald Cunningham and corporate writer Gerald Cohen say the writer must consider the reader. In their text Creating Technical Manuals: A Step-by-Step Approach to Writing User Friendly Instructions, they suggest making a reader analysis. When this comes early in the writing process, they believe it assures that the manual addresses what the reader needs to know to perform a job (64). The authors call for a joint effort between the ''subject-matter expert'' and the writer in order to produce an effective, readable manual. Appendix D at the end of this thesis includes planning sheets developed by the authors to produce such manuals.

A survey of Daktronics engineering personnel taken in March of 1990 helps us better understand how those charged with designing products and managing projects at Daktronics perceive the relationship of writing to their job. Forty-eight people were given the survey and asked to return it in a week. I expected that the short deadline might encourage them to answer it immediately instead of putting it aside and forgetting about it. They were not asked to identify themselves. I felt such anonymity might give greater freedom to respond. Only 27 people, or a little more than 50 percent, completed the survey. Because I had no way to determine who completed surveys, I could not solicit ones not returned. Appendix C gives a sample survey showing the questions asked. Bar graphs illustrate the answers. The questions reflect Bloom's taxonomy, which requires progressively more cognitive skills in answering the questions.

Figure 2-1 shows the number of years of post high school study completed by the survey respondents. Five of those surveyed had completed 2-3 years of post high school training, 12 had completed 4 years of study after high school, and 10 had completed classes 5-9 years beyond secondary training. The average number of years the survey population participated in post high school training was 3.5 years.

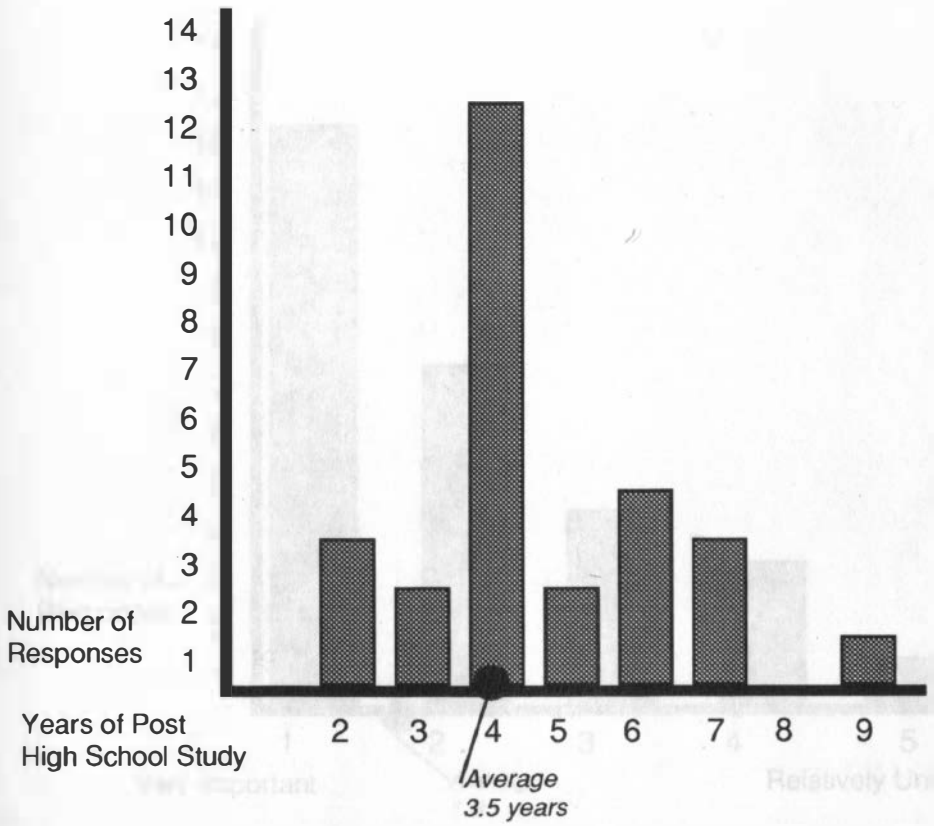

Figure 2-1 Years of Post High School Study for Survey Respondents

Figure 2-2 identifies how important the ability to spell was to those completing the survey. Even though some commented that knowing how to spell is relatively unimportant with the use of word processing spell checkers, 12 people rated spelling ability as being very important to writing. One respondent commented, ''If your spelling ability is good, it speeds up your writing.''

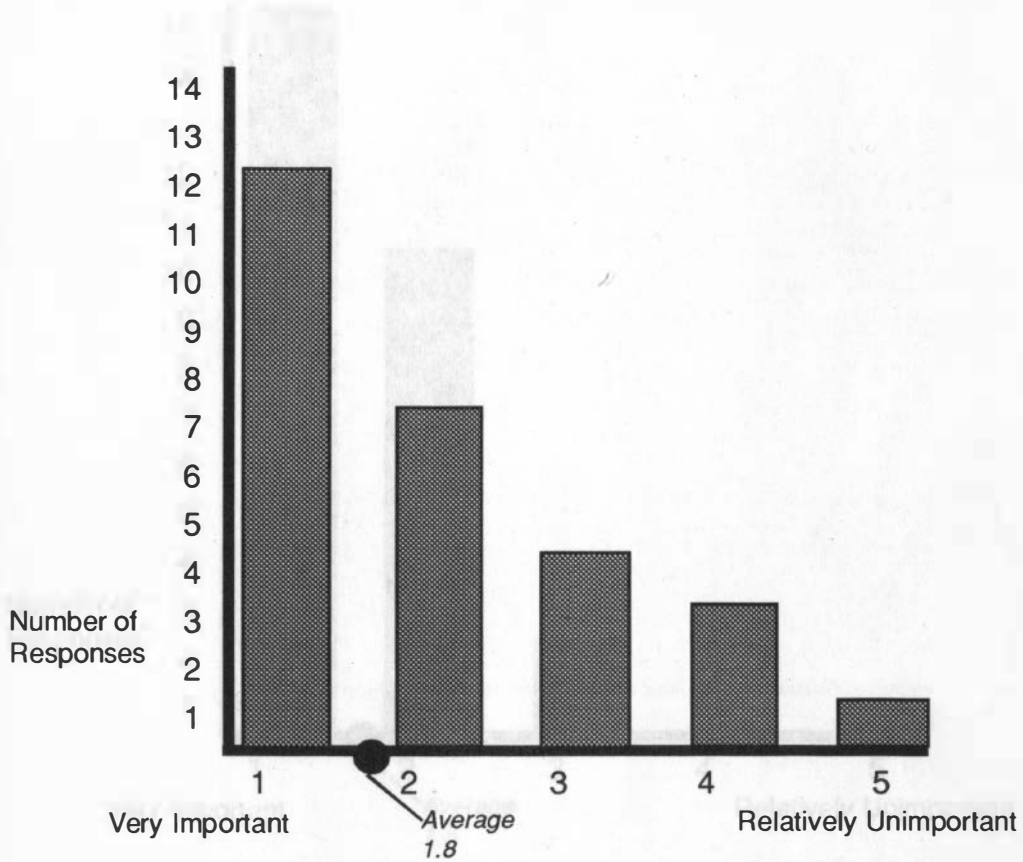

Figure 2-2 Importance of Spelling to Daktronics Writing

Figure 2-3 shows that 15 survey respondents found the ability to use correct English grammar very important to Daktronics writing and another 10 rated the skill only one step less. One respondent thought the skill was ''essential in order to communicate,'' and another said the ''skill will become more important'' as a career progresses.

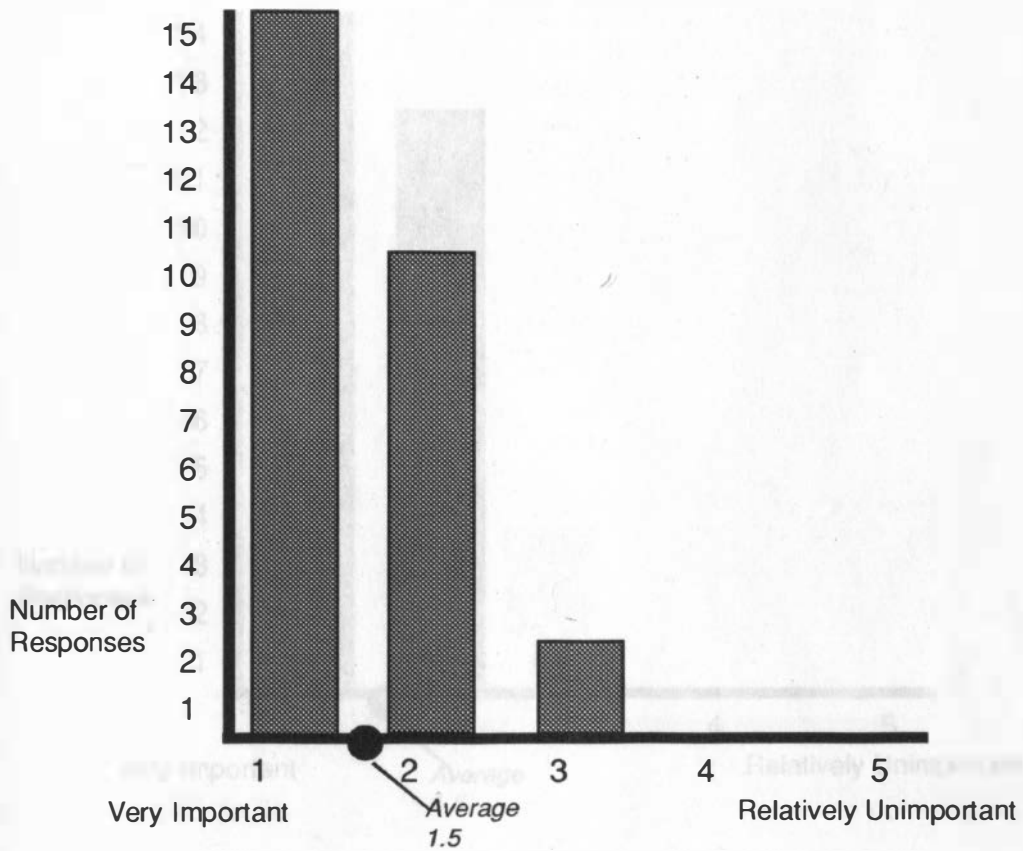

Figure 2-3 **Importance of Correct English Grammar to Daktronics Writing**

Responses identifying the importance of producing mechanically correct sentences and paragraphs leaned toward the very important end of the scale, as shown in **Figure 2-4.** Fourteen people called the ability very important and another 12 chose the next level of importance.

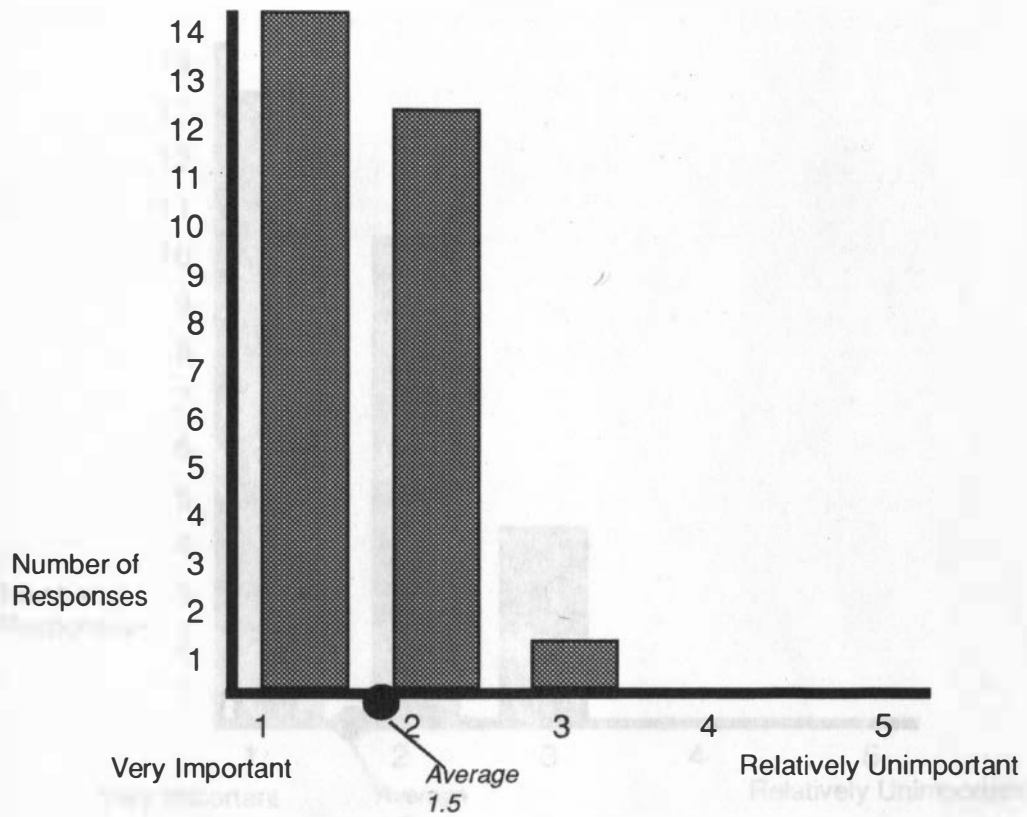

Figure 2-4 Importance of Mechanically Correct Sentences and Paragraphs to Daktronics Writing

When respondents were asked to indicate the relative importance to the writing process of the ability to research information, 13 people called the skill very important, while another 10 rated the skill next on the scale of importance. **Figure 2-5** shows that four respondents rated the ability in the mid-range of the skill's importance for writing at Daktronics.

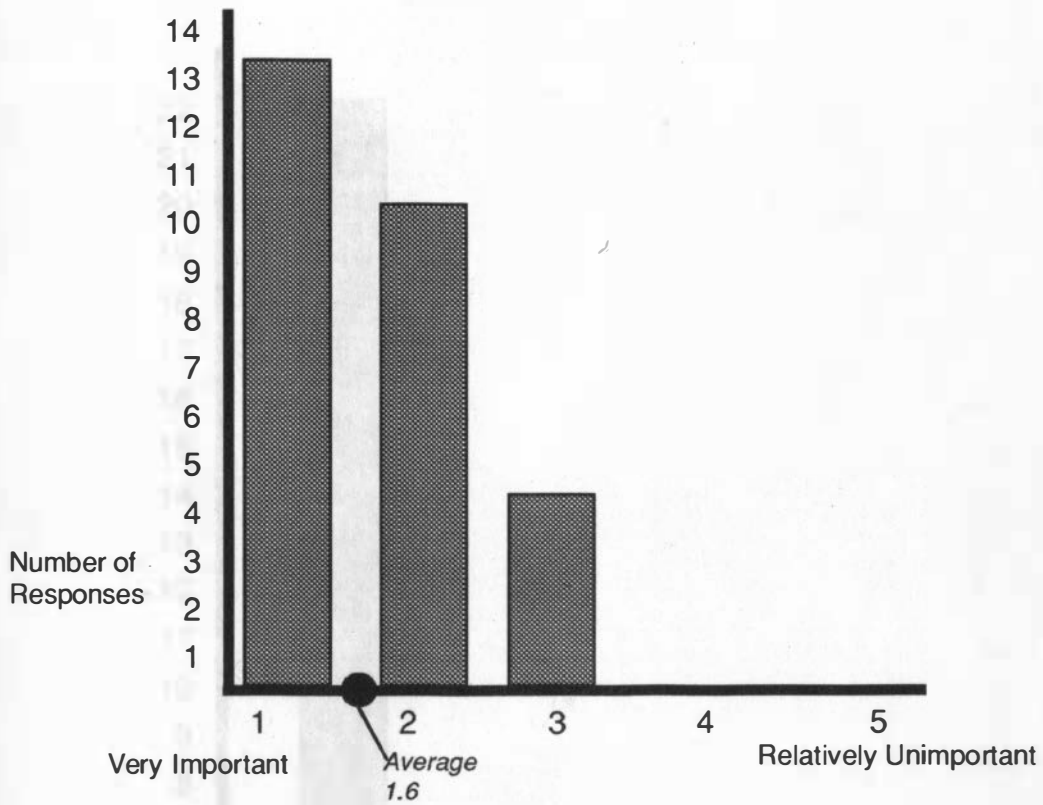

Figure 2-5 **Importance of Research Ability to Daktronics Writing**

While respondents weren't as uniform in their rating of the ability to research information for writing, **Figure 2-6** shows that they overwhelmingly thought the ability to organize ideas and produce data held an important place in the writing process. Twenty-two rated the ability to organize very important to the writing process, and the population's other five ranked the skill next in importance. One respondent said, ''Your ideas are only as good as their presentation.''

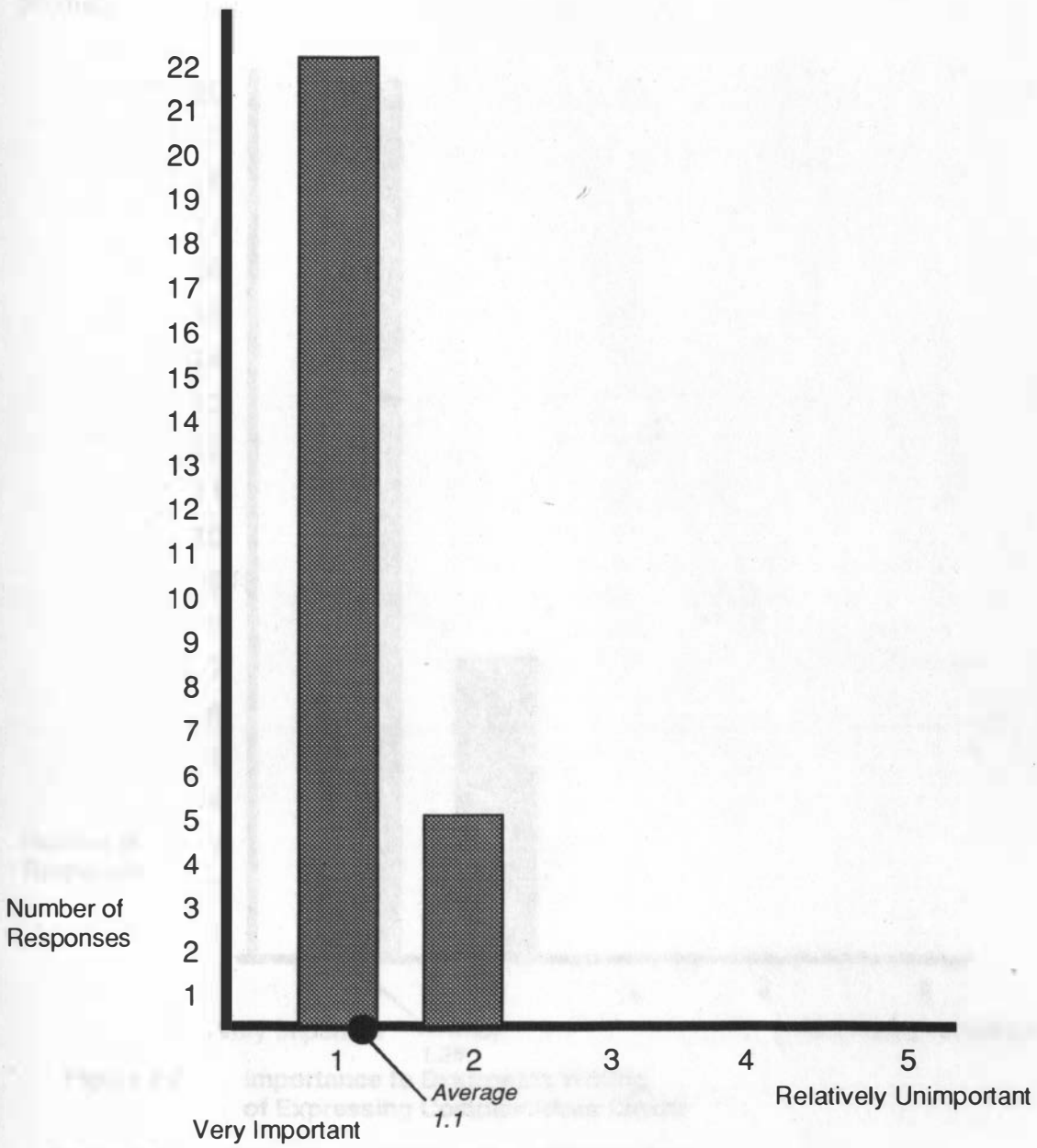

Figure 2-6 **Importance of Organizing Ideas & Data to Daktronics Writing**

As **Figure 2-7** shows, the ability to express complex ideas clearly filled a very important place in the writing process for 20 people questioned. Another seven ranked the skill second in importance. One respondent said ''It's also important to be able to express complex ideas in laymen's terms.'' Another person felt the skill served an important place in ''writing packet assembly and test instructions.'' Such writing involves relaying complex design information to workers who must build and test the product.

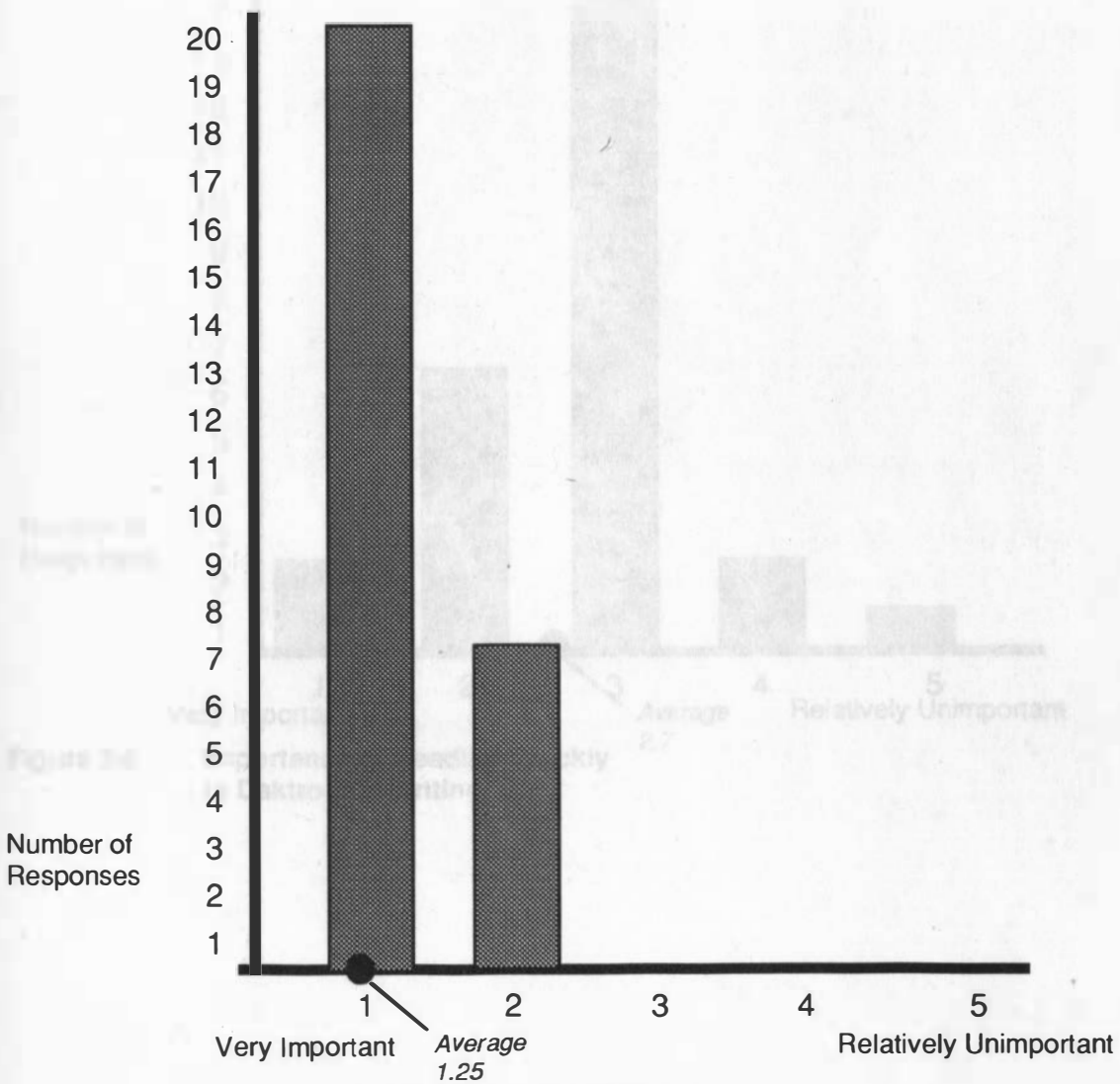

Figure 2-7 **Importance to Daktronics Writing of Expressing Complex Ideas Clearly**

Survey respondents apparently felt that reading quickly was not as important to the writing process as other writing skills. **Figure 2-8** shows that 16 people ranked quick reading ability in the middle of the importance scale, with eight people ranking the skill toward the very important side and three ranking it relatively unimportant to the writing process.

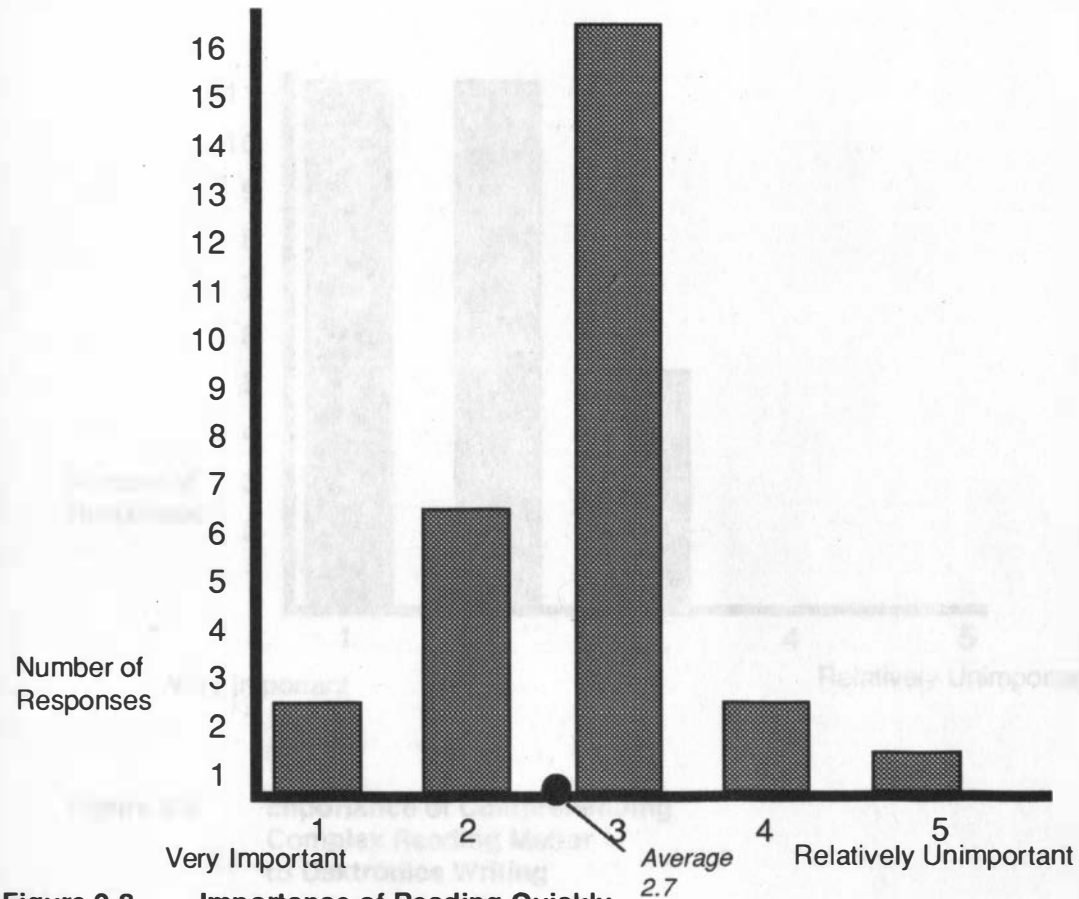

Figure 2-8 **Importance of Reading Quickly to Daktronics Writing**

Figure 2-9 weighs the ability to comprehend complex reading material. Most people felt that the skill was relatively important to the writing process. Eleven people said the skill was very important, another 11 gave the skill a 2 rating, and the remaining five said comprehending complex reading material ranked in the middle.

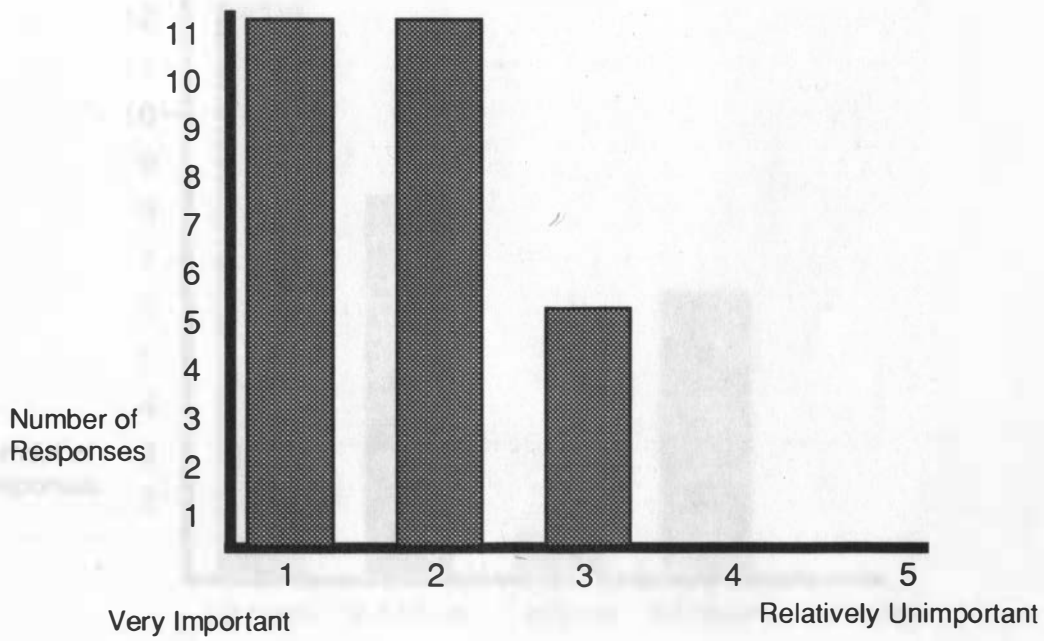

Figure 2-9 **Importance of Comprehending Complex Reading Matter to Daktronics Writing**

Figure 2-10A is divided into two graphs to identify the reading habits of those respondents surveyed. Twelve people said they read 1-2 hours a day, eight said they read 2-5 hours daily, one person read 1-2 hours a week, and 6 people said they read 2-5 hours a week. The greater number of survey respondents said they were engaged in reading for a good portion of each day.

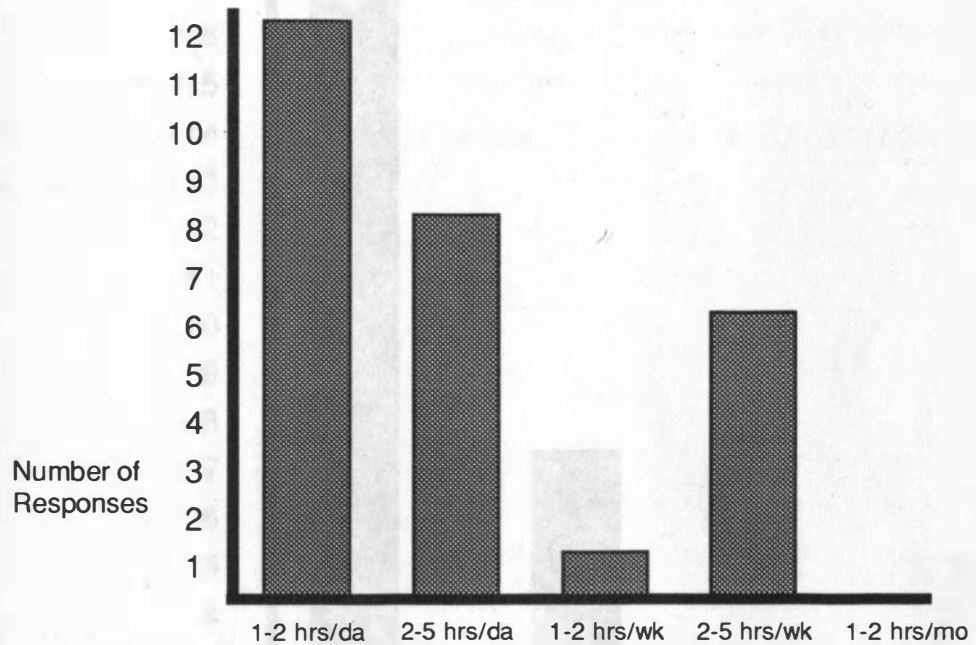

Figure 2-10A Frequency of Respondent's Reading

Just why those respondents read is identified by **Figure 2-10B,** which says that 18 respondents read for both work and enjoyment, seven read only for work, and two reported they read only for enjoyment.

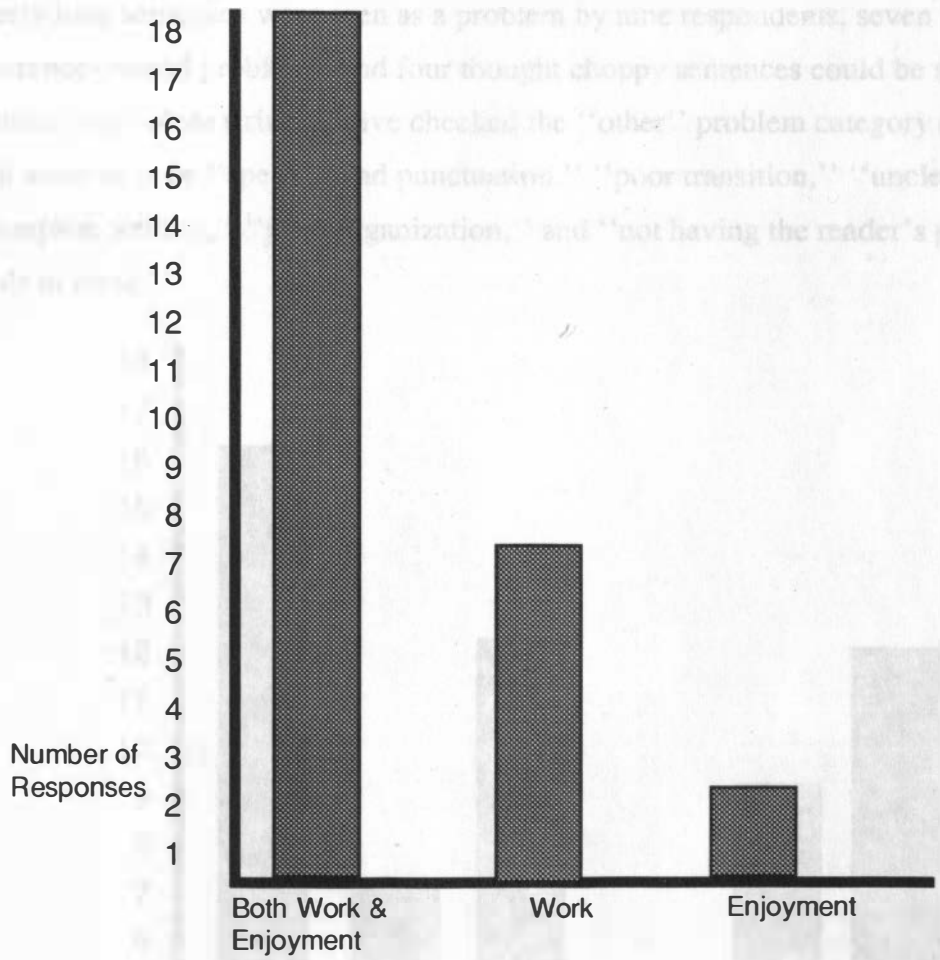

Figure 2-10B Why Respondent Reads

Figure 2-11 identifies common writing problems respondents observed in their own or a colleague's writing. Sixteen people identified grammatical errors as a problem with Daktronics writing. Twelve said the illogical ordering of ideas interfered with effective writing, and another 12 said they noticed wordiness in writing at Daktronics. Overly long sentences were seen as a problem by nine respondents, seven felt lack of coherence created problems, and four thought choppy sentences could be noticed in the company's problem writing. Five checked the ''other'' problem category and identified such areas as poor ''spelling and punctuation,'' ''poor transition,'' ''unclear and incomplete writing,'' ''poor organization,'' and ''not having the reader's perspective or needs in mind.''

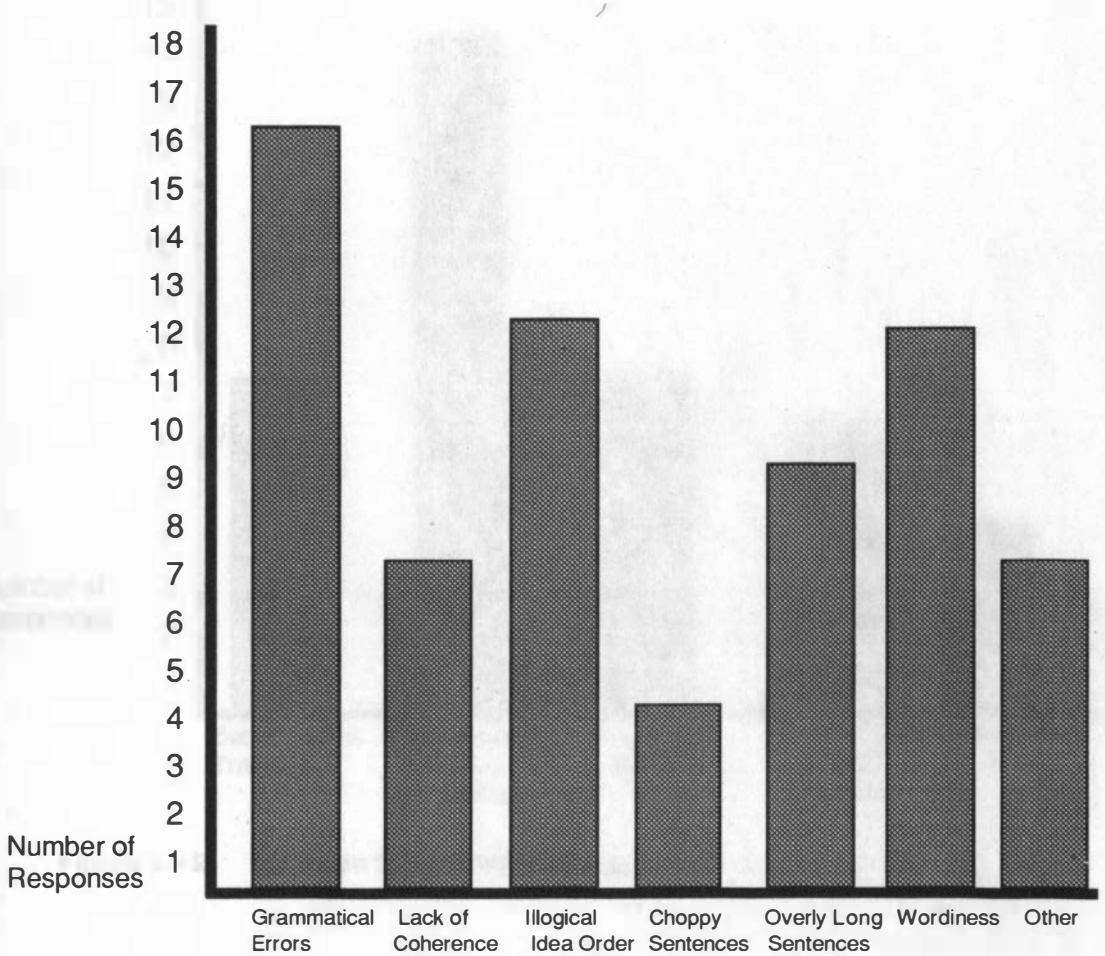

Figure 2-11 Noticed Writing Problems in Writing of Self or Workmates

When asked to give a solution to problem writing at Daktronics, the majority felt that learning should continue through on-the-job practice and training after school. **Figure 2-12** shows the division of their suggested solutions. Some gave more than one solution, generally feeling that there is no one-time fix to writing deficiencies, but learning and perfecting the skill must take place continuously. Fourteen said on-the-job practice and training would solve problem writing. Seven said better training in school could provide some answers. Seven said specific people within the company should be assigned to write, but another six said the writing process should be shared by technical product people and people assigned to just write.

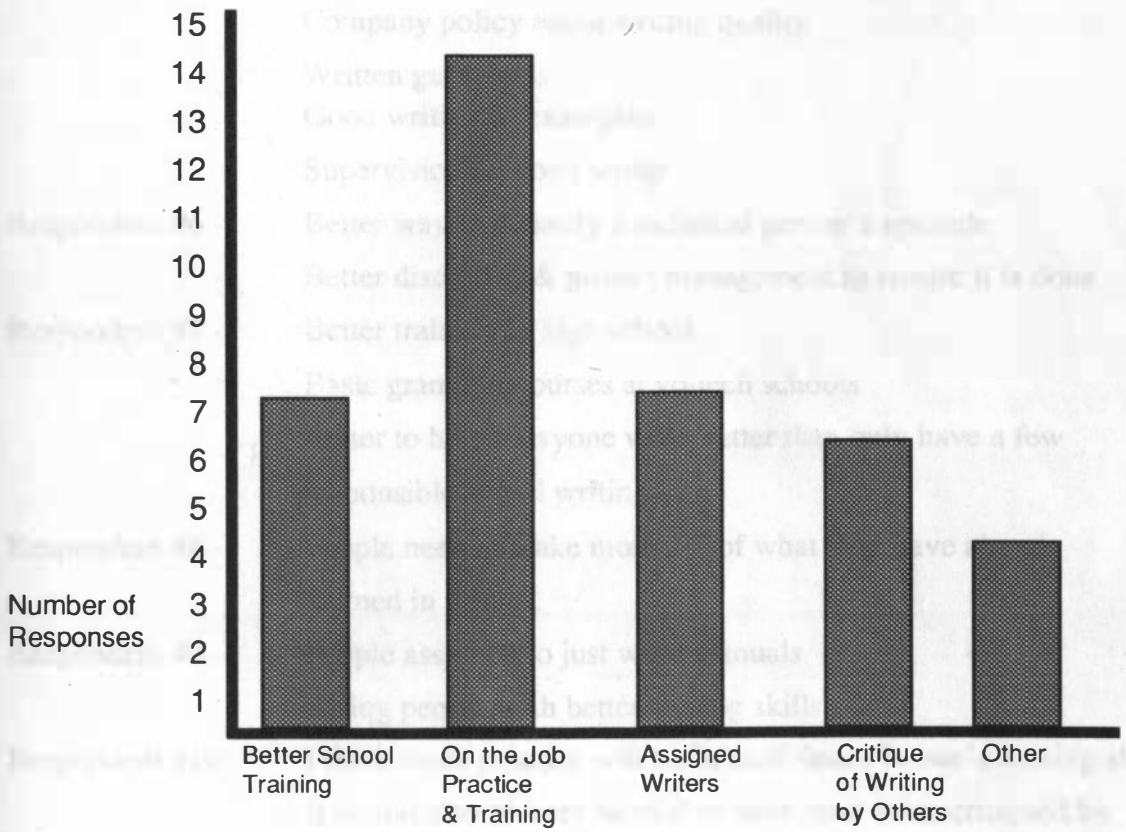

Figure 2-12 Solution to Problem Writing

Some survey respondents went beyond the rating and made various suggestions and recommendations for writing problems at Daktronics. Their comments are:

Respondent #1 - Remedial grammar and style training

Respondent #2 - Technical people with understanding of product should write manuals. English-minded people should proof for grammar coherence, understandability.

Respondent #3 - Need grammar course at SDSU. Private tutor to assist problem areas

Respondent #4 - Others writing should be checked by assigned writers

Respondent #5 - Better training in school
Company policy about writing quality
Written guidelines
Good writing as examples
Supervision by good writer

Respondent #6 - Better way to quantify a technical person's aptitude
Better discipline & project management to ensure it is done

Respondent #7 - Better training in high school
Basic grammar courses at vo-tech schools
Better to help everyone write better than only have a few responsible for all writing

Respondent #8 - People need to make more use of what they have already learned in school.

Respondent #9 - People assigned to just write manuals
Hiring people with better writing skills

Respondent #10 - I think more practice will build confidence in one's writing ability. It would also be very helpful to have your work critiqued by someone with good writing skills.

Respondent #11 - There are some people who write very poorly and probably always will unless they were given lots of training - probably not in Daktronics best interest. There are others who are very reluctant to write but could do a fairly good job if somehow

Respondent #11 - (con't)	forced or inspired to do so. These people could be encouraged by showing them the power of written communication.
Respondent #12 -	Better structure (mechanics or rules for consistency) People with knowledge of what they are writing about
Respondent #13 -	Hire people with good writing skills (good grades in English) Recommend classes or workshops to those who display sub-standard writing skills
Respondent #14 -	I think a department which writes user manuals would be good.
Respondent #15 -	Training in school and on the job Technical people need to be able to write. Can't expect non-technical people to write a technical manual. They can help but they can't be the originator.
Respondent #16 -	Manual writing workshops
Respondent #17 -	Mandatory writing & communication classes for everyone at Daktronics
Respondent #18 -	Better training in school
Respondent #19 -	Focus on the writing task. Allow those with writing skills to do their job and train others who want to write. Don't allow or force just anyone to write a publication - marketing or technical.
Respondent #20 -	What is the problem?
Respondent #21 -	Better training in school Recognition of importance of effective writing Recognition of need for on-going training Recognition of benefits that result from good writing

Figures 2-13A-I show rankings for nine different writing tasks. Respondents ranked the tasks in the order they performed them. They could give the same number to tasks they performed simultaneously. Fourteen respondents gave similar rankings for some tasks, and eight people did not rank all the tasks listed. Those not ranking all tasks may not have performed those things when they wrote. One respondent did not answer the question at all.

Fourteen people determine the purpose for writing before they do anything else. **Figure 2-13A** shows which of the other nine writing tasks the writer does first when given an assignment.

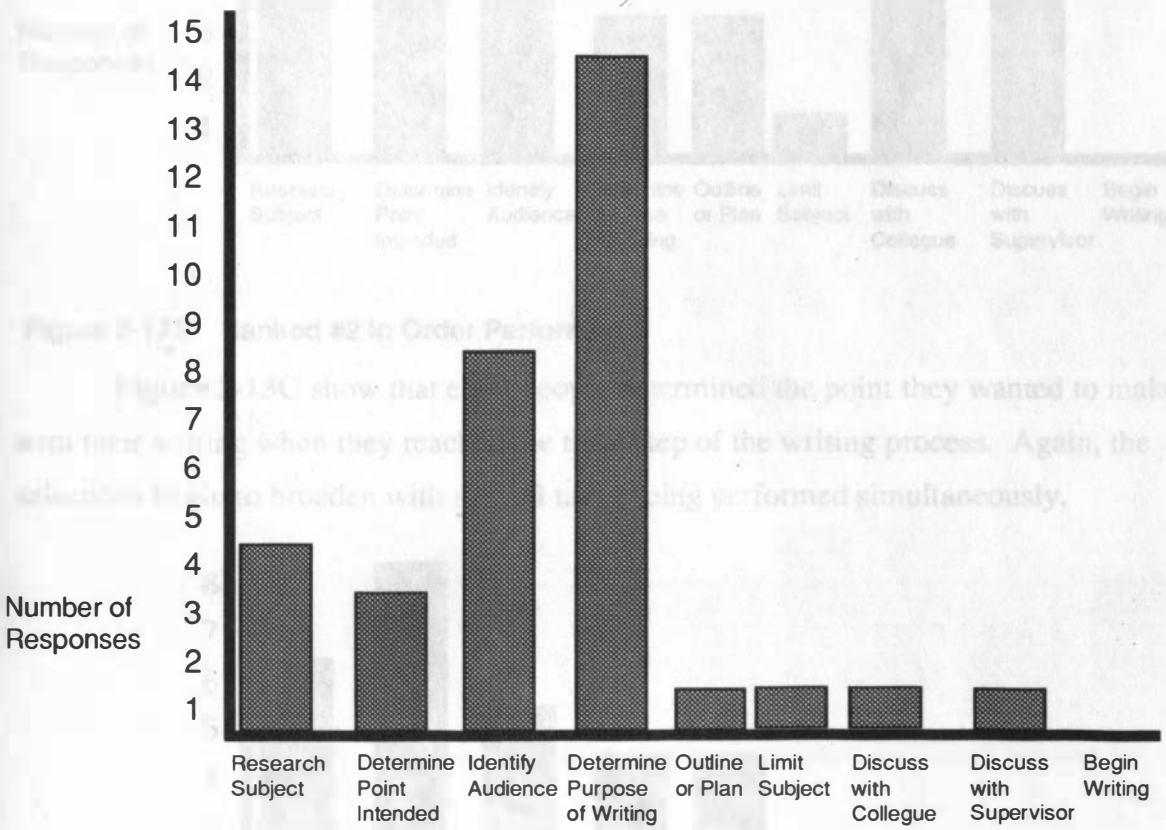

Figure 2-13A Ranked #1 in Order Performed

Figure 2-13B demonstrates that nine respondents identified their audience secondly during the writing process. The selection of tasks that were performed second begins to show responses broadenings, although only one person limited the subject at this juncture of the writing process.

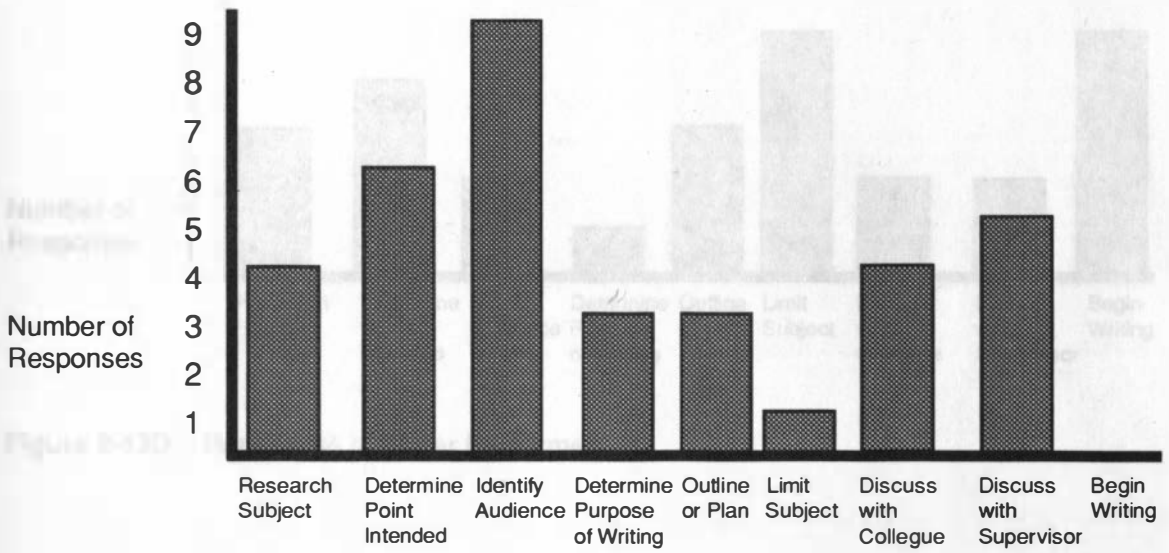

Figure 2-13B Ranked #2 in Order Performed

Figure 2-13C show that eight people determined the point they wanted to make with their writing when they reached the third step of the writing process. Again, the selections begin to broaden with several tasks being performed simultaneously.

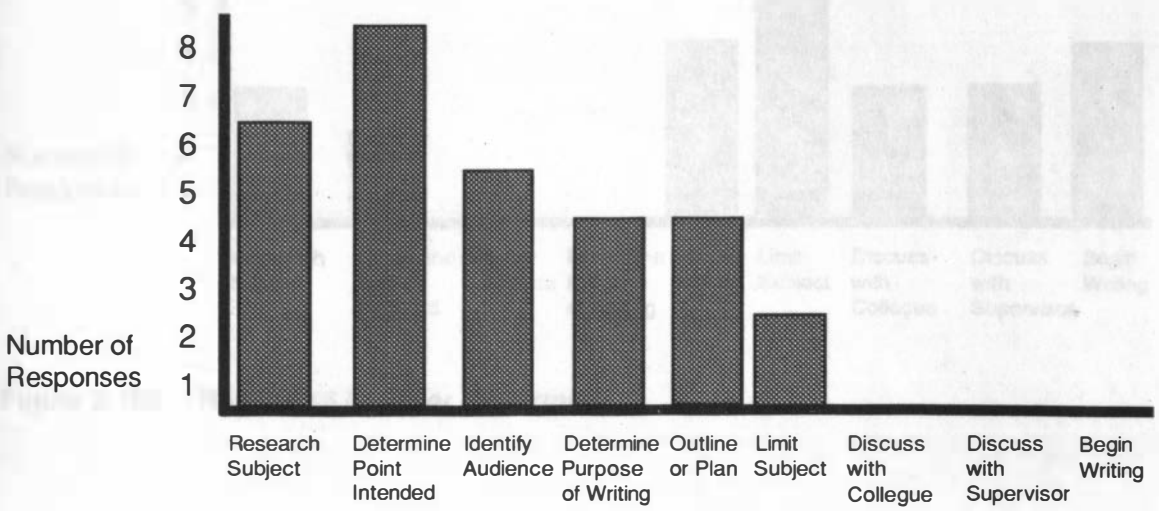

Figure 2-13C Ranked #3 in Order Performed

Some people only identified four tasks used during their composition process. **Figure 2-13D** shows that while five people began the actual writing, another five were limiting their subject. Two people said they either discussed the writing with their supervisor, discussed it with a colleague, or identified to whom they were writing.

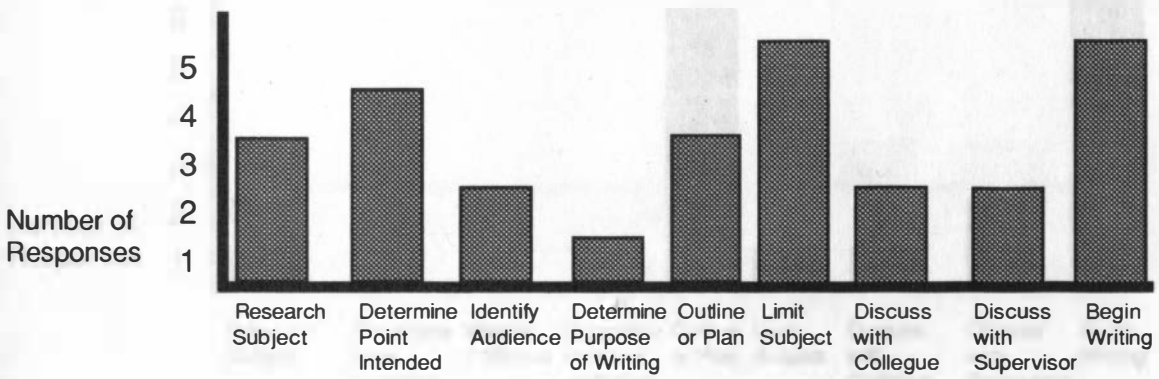

Figure 2-13D Ranked #4 in Order Performed

Five respondents said they limited their subject during the fifth phase of the writing process. As **Figure 1-13E** shows, four people chose this point of the process to make an outline or plan for their writing.

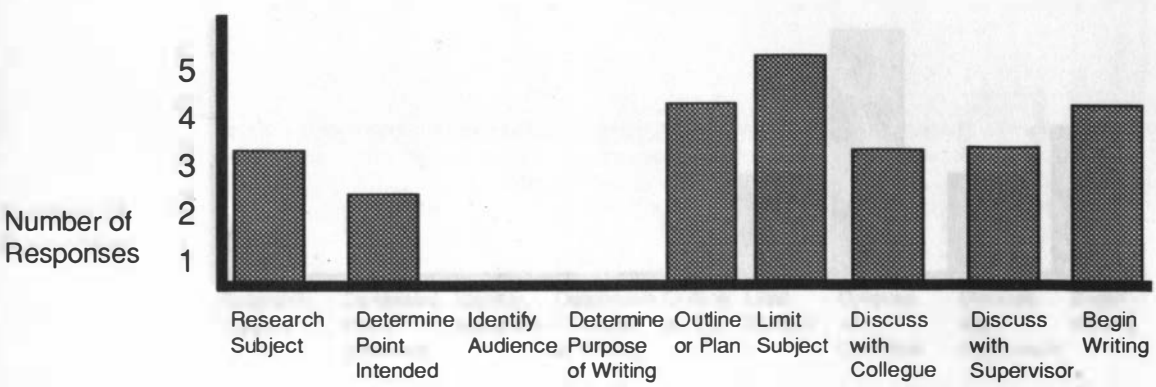

Figure 2-13E Ranked #5 in Order Performed

Figure 2-13F shows that seven people have begun the actual writing at this point of the composition process. Another six people, however, outline or plan at this point. The number of people ordering six tasks separately is becoming fewer.

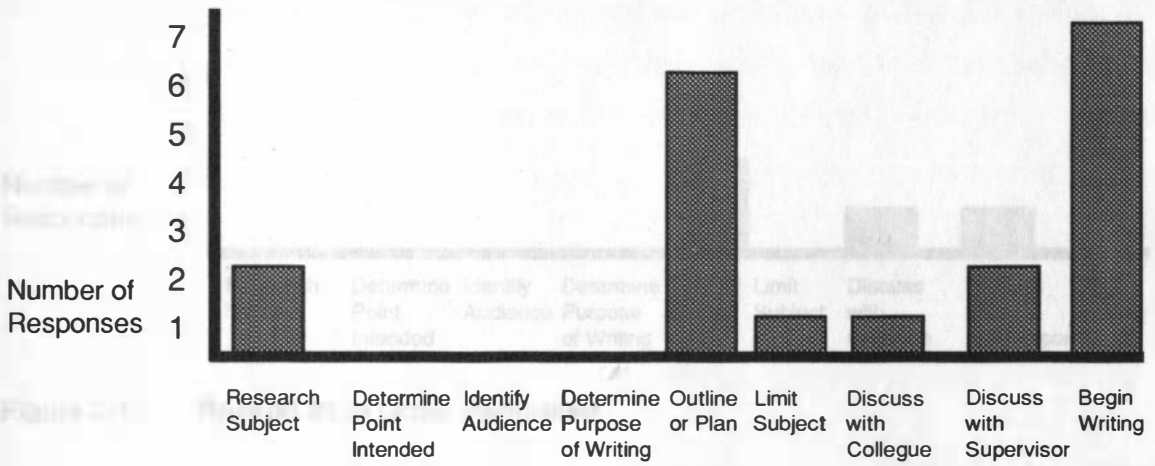

Figure 2-13F Ranked #6 in Order Performed

Figure 2-13G shows that five people discussed their writing assignment with a collegue as the seventh task in the process of writing. One person said the subject was researched at this point.

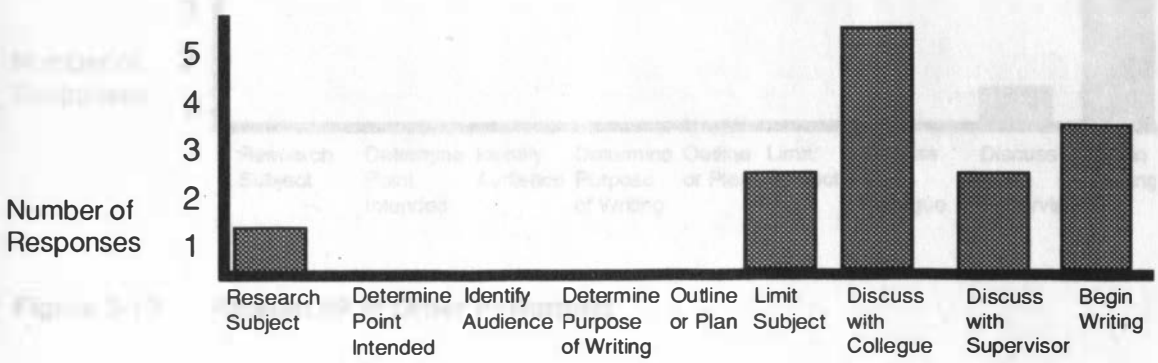

Figure 2-13G Ranked #7 in Order Performed

Figure 2-13H shows that three people have begun to write at this stage of the writing process. Another two outline or plan their writing, one person discussed the project with a colleague and another one discussed the writing with a supervisor.

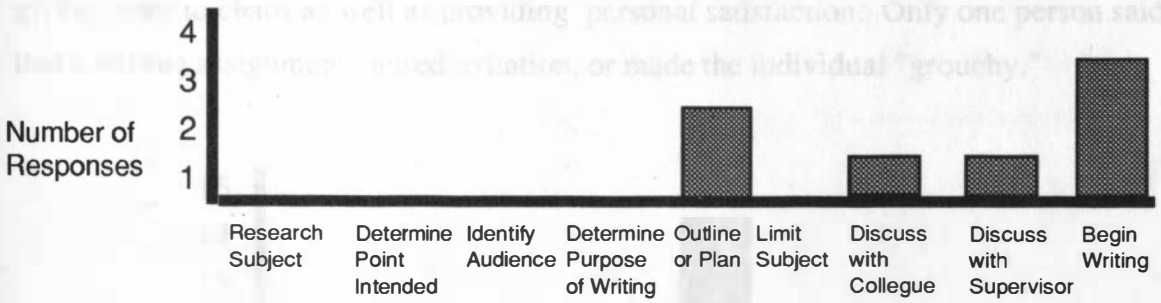

Figure 2-13 Ranked #8 in Order Performed

Only four people performed all nine tasks during their writing. Of those four, **Figure 2-13I** shows that three began to write after first accomplishing the other eight tasks. One person used the final step of the writing process to discuss the project with a supervisor.

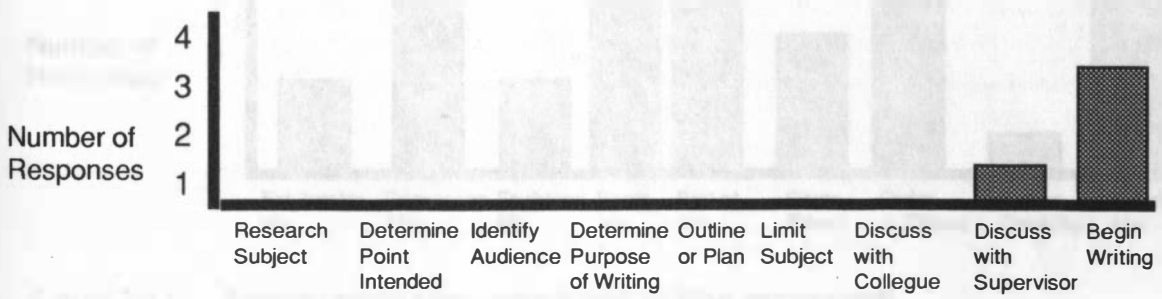

Figure 2-13 Ranked #9 in Order Performed

Two final questions addressed the writer's feelings about the composition task. **Figure 2-14** shows that while the majority of survey respondents felt that writing was just another part of their job, they did experience a variety of emotional responses. Two impressions chosen ten times by those surveyed said writing gave them the feeling of giving order to chaos as well as providing personal satisfaction. Only one person said that a writing assignment caused irritation, or made the individual "grouchy."

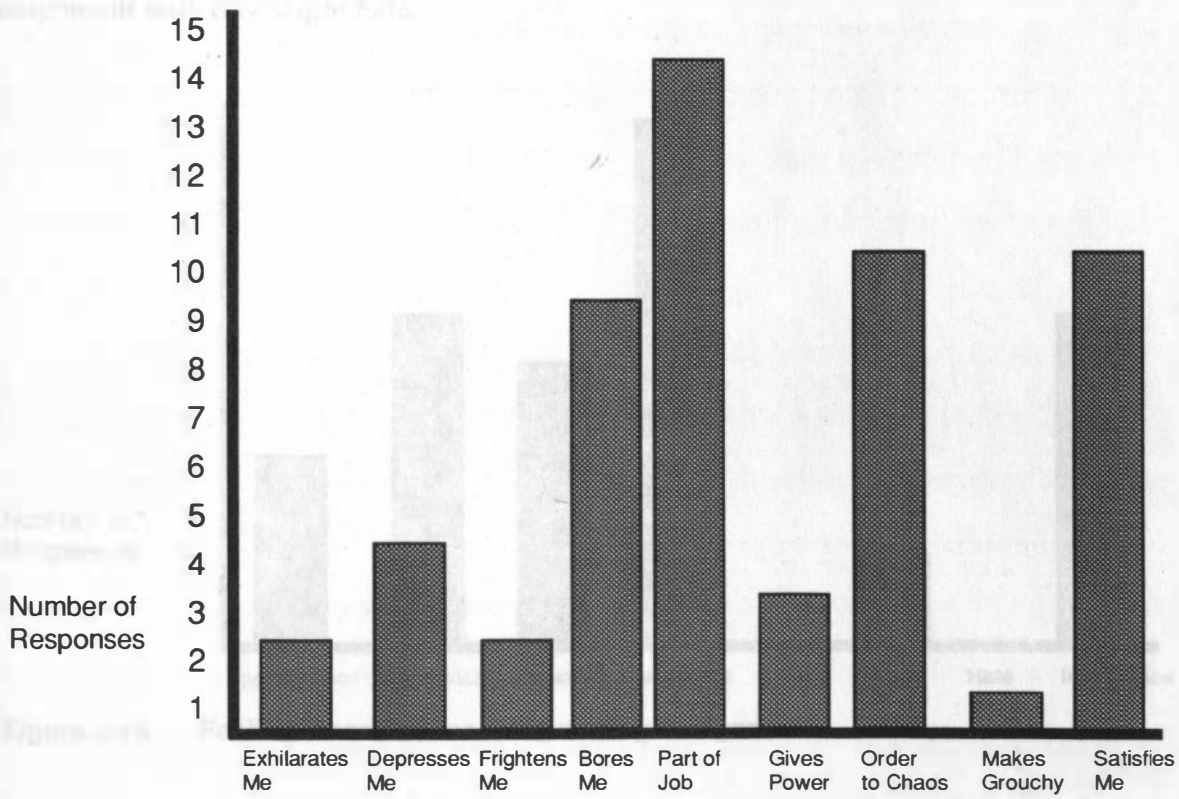

Figure 2-14 Feeling when approached with writing assignment

The last question in the survey asked for one overall feeling when approaching a writing assignment. **Figure 2-15** shows the results of the answers. The majority of respondents said they approached writing with reluctance. Seven said an assignment made them enthused, but another seven said they felt indifferent toward a writing assignment. While six approached it with enthusiasm, another four said a writing assignment was greeted with apprehension. Only two people said they dreaded the assignment. While no one came to an assignment with joy, no one addressed an assignment with downright hate.

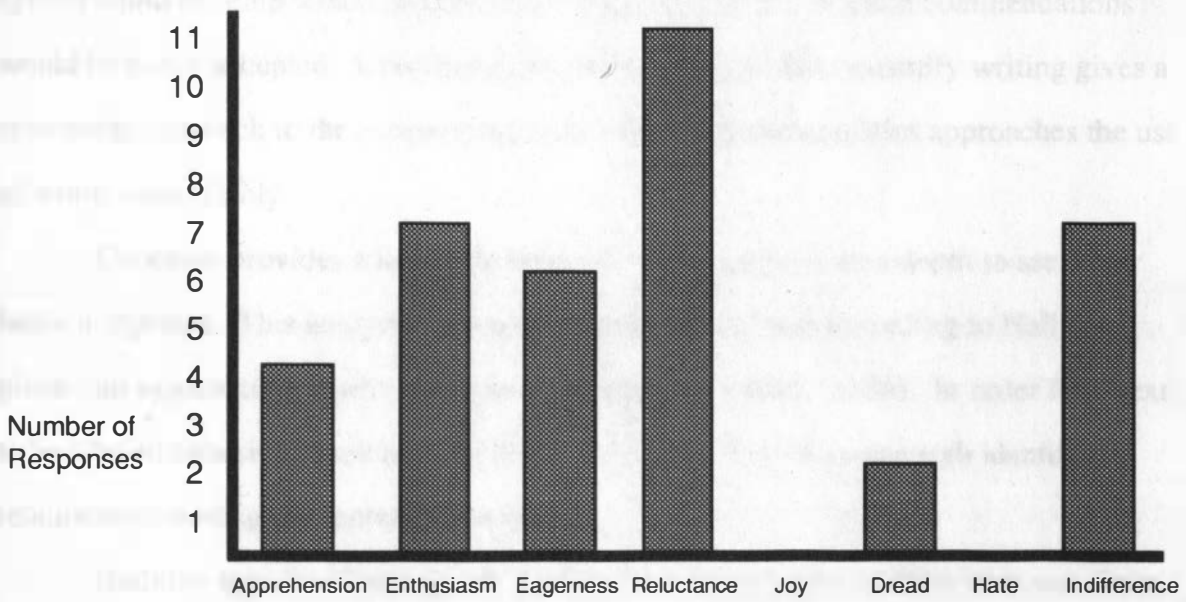

Figure 2-15 Feeling when approaching writing assignment

The survey should be repeated after a writing workshop to see if opinions changed any about writing difficulties at Daktronics or the individual's own perception of the process. Perhaps some of the questions could be re-written to address new or different Daktronics writing demands.

Chapter 4

The survey of Daktronics engineering staff gave those charged with technical writing the chance to be heard with regard to what they consider important to the writing process. It also identified how they feel when assigned to write. Most of them approach writing with reluctance, but they feel, nevertheless, that their job includes writing.

Quantifiable tasks dominate the thinking of engineers. Numbers and things which can be measured define the profession's mission. It seems likely then, that if a system could develop which quantified writing, its conclusions and recommendations would be better accepted. Identifying and teaching a method to quantify writing gives a systematic approach to the composition task. The study of linguistics approaches the use of words quantifiably.

Cohesion provides a linguistic theory for analyzing a text in depth to see what holds it together. This analysis does not interpret the text but, according to Halliday, gives ''an explanation of why and how it means what it does'' (328). In order for a text to be labeled cohesive, there must be links between the sentences through identifiable relationships among the sentence elements.

Halliday says that ''as English has increasingly come into world-wide use, there has arisen a correspondingly increasing need for more information on the language and the ways in which it is used'' (vi). Daktronics, Inc. markets and sells computer programmable products to worldwide entities, so the company's success depends on satisfying existing customers. Customer satisfaction provides a framework for future sales. Product manuals can be written more clearly through the use of cohesive devices.

A 1983 memo introducing the Daktronics Users Manual Development Guide states that a manual's system specifications and installation site requirements serve as sales literature for future sales of the same equipment (2). Clearly written manuals help give a sense that the product is easy to use or install. That sense of ease can be passed to

potential customers through satisfied customer testimonies. Linguistic taxonomy can help determine how language influences a text in order to make it clear.

According to Halliday, linguistics divisions address three major functional, semantic components: ideational, interpersonal, and textural. Addressing a text's ideational sense helps the linguist see it as an expression of content: what is the text about? The interpersonal lets the linguist look at the reader's attitude about the social or expressive message of a text. In textural analysis, the linguist looks at the patterns of form and meaning the writing incorporates (26-27). Cohesion functions in that textural realm. Examination of cohesive devices found in passages from Daktronics manuals can determine the degree of success these documents will produce. These devices make products seem easier to use.

Cohesion examines the textural elements of a piece of writing. It looks at how structurally unrelated elements link together. Halliday says that ''without cohesion, the remainder of the semantic system cannot be effectively activated at all'' (27). To Halliday, cohesion is a semantic concept referring to the structure of the text's meaning (4).

Cohesion significantly applies to the text of technical manuals because the linguistic theory looks at how words and sentences work to bind the information together. A technical manual reveals how all the product's components work together to produce a functioning device. The linguistic theory and the written document both concern themselves with how well their subjects hold together. The technical document must be readable, informative, and persuasive. Lynn Beene says technical writers produce cohesive documents by ''structuring the information carefully, by evaluating the prose critically and by revising a draft conscientiously'' (109).

Most technical writers create documents by gathering pieces of data from a variety of sources and piecing them all together without any organizational plan. The writer's responsibility, however, should be to provide the reader with necessary information to

perform a task. A writer knowledgeable about the function of cohesive elements, can make the document more useful (120).

For a text to hold together, an interchange of meanings must occur among its sentences. Cohesion seeks to describe those semantic interchanges. Sentence elements which produce cohesion contain links or ties between the sentences. The ''tie'' represents the relation between the cohesive element of the text and that which it presupposes (329). For example, ''The addressable driver provides instructions for the message center to tell certain lamps to turn on or off. This unit becomes the very core of the display.'' The words ''driver'' and ''this'' form a cohesive tie.

The interrelationships among sentences in a text constitutes ''texture'' (3). This texture comes through a co-referential working between the sentence elements. In other words, an item in one sentence refers to an item in another sentence. That reference can be either anaphoric or cataphoric. Anaphoric means that the pre-supposed item comes before the cohesive word. Cataphoric reference prepares the reader for an item that follows. For example, ''The addressable driver sends information to the message center. This unit links the controller and the message center.'' ''This unit'' refers anaphorically to ''driver.'' In the example, ''When is the driver changed? After testing proves it faulty,'' ''when'' refers cataphorically to ''after.''

When the linguist evaluates the texture of a passage, two different observations are made. The linguist looks at the relations **within** the language--its grammar and vocabulary--and relations **between** the material and the reader's experience (27).

Cohesion examines relationships within a text by looking at five elements. These elements are reference, substitution, ellipsis, conjunction, and lexical reiteration. The first three address the text's grammatical nature. The categories look at repetitions, omissions, and occurrences of certain words and constructions. The fourth element, conjunction, acts on the border of grammatical/lexical elements. Not only do

conjunctions join sentences, but they also connect ideas within the sentence. A fifth way, lexical reiteration, observes connections made through synonomous or similar phrases. Each of these cohesive elements signal the reader that their interpretation depends on something else (13).

Awareness of the significance cohesion plays in effective writing strengthens the document during editing and before publishing. While the Daktronics writer need not be expertly versed in the minute details of cohesion analysis, understanding what it can do for a text makes technical writing that much more powerful.

A basic understanding of the cohesion theory must look at the elements by which a text can be analyzed.

REFERENCE. Certain items within a text have a reference property which produces cohesion. Sentences become cohesive by examining the elements that refer to something else (31). Reference elements are usually nominal (43). Pronouns make reference ties personal. Showing proximity to the cohesive element, makes the ties demonstrative. For example, ''this lamp'' versus ''that socket'' gives a sense of proximity. Ties show a comparative reference when they identify or show similarity like, ''the first step'' versus ''the last step'' (37).

Personal reference finds its way into technical manuals when the text directly addresses the operator or reader. Studies have shown that readers respond more positively when addressed directly through second person. ''The operator chooses'' becomes cohesive with a later item ''You should select'' when the pronoun refers anaphorically to the operator. Demonstrative reference provides cohesion when ''this'' or ''that'' refers cataphorically forward or anaphorically backward from the element (68). ''Choosing to edit'' makes connection with ''this choice can mean.'' Verbal pointing showing where something occurs results from this kind of reference. Demonstratives often ''refer exophorically to something within the context of the

situation. This is the primary form of verbal pointing'' (58). Exophoric references connect to something outside of the text like an experience or previous knowledge. Technical manuals use this method of cohesion when they refer to an entire process or method of operation. The danger with relying on this too frequently is that it disregards the reader with little or no prior knowledge.

Finally, reference elements take on a comparative relationship to establish cohesion when they express identity, a similarity or difference between items. The word used for the comparison, like personal and demonstrative reference, may be in the situation described; it may refer either forward or backwards; and it may be internal or make the comparison among an entire category. For example, ''The operator chooses the feature...'' becomes cohesive with the comparative ''Additional choices are offered....'' Another cohesive comparison links ''The controller's hard drive gives more storage,'' and ''This feature has the advantage of storing more information .'' Halliday says the superlative makes the most common comparison (78). For example, ''Daktronics offers the best'' uses a superlative in a comparative sense. However, technical manuals use superlatives cautiously because the choice generally calls for an opinion or judgment that may not be necessary. This technique could be useful, however, for making the reader aware of the soundness of a certain selection.

Using reference to provide cohesion in a technical manual must be done carefully because the writer cannot afford to have items misinterpreted when their referents are not clear. Most often lexical cohesion provides the text's necessary glue through repetition of a term, eliminating any chance of misinterpretation. Using synonyms or near synonyms also provides lexical cohesion.

SUBSTITUTION. Substitution establishs cohesion when it acts as a counter element in the sentence structure instead of repeating or eliminating the item (89). The substitute item functions the same grammatically, but can provide variety in sentence

structure and cohesion for the text as a whole. Variety sustains the reader's interest, and technical writing must be readable as well as factual. While an element's definition does not change in its place as a referent, some redefinition always occurs in substitution (95). A redefined item requires a modifier. Substitution lets the manual writer condense verbiage used to describe the product. Briefer, more condensed manuals satisfy audiences who must have a product up and running in minimal time. Substitution shortens reading time when it provides text cohesion by replacing an entire nominal or noun group (105). For example, ''same'' can act in substitution for a nominal group in formal business language (107). ''We have shipped your message center manual. Kindly accept delivery of the same.'' And ''same'' can represent a process description substitute (107). ''Attach the control cable to the serial port on Controller #1; do the same with Controller #2.''

ELLIPSIS. Ellipsis produces cohesion with ''substitution by zero.'' Ellipsis is used when something structurally necessary for a sentence is left unsaid, without sacrificing meaning, it produces understanding. Success for the process comes only if the item left out makes an anaphoric reference (142). Halliday says, ''the elliptical use of deictic [identifying] elements is a major source of cohesion in English texts. The Deictic is the element in the nominal group that relates to here and now, linking the thing referred to its verbal and situational context'' (159). For example, ''What happens when lightening strikes?'' becomes cohesive with the elliptical answer, ''Zapped file,'' which has substituted the nominal phrase with zero. Ellipsis, as a cohesive mechanism, is rarely used in technical manual writing, because while condensation is a virtue for product manuals, the risk of misunderstanding critical information becomes too great when items are left unsaid.

CONJUNCTION. Conjunctions provide a final cohesive mechanism to hold

documents together. Conjunctions make text cohesive when they act in one of four ways. First, additive conjunctions marking additional information use the word "and." A second conjunctive sense provides cohesion in an adversative or contrary sense with such words as "but" or "yet." Causal conjunctions, the third function, make texts cohesive by providing links through the use of elements like "so" or "consequently." And finally, conjunctions which mark a conclusion to the text's meaning are said to be temporal when they use devices like "then" (237). The cohesive nature of conjunctive elements produces technical manuals with a greater readability factor. Manuals that are easier to read give the perception that the product is easier to use, and so the product has greater value.

LEXICAL. Lexical cohesion makes connections through meanings rather than through grammatical relationships. The links occur through synonyms or near synonyms, subordinates or descriptive elements of a group or class, opposites and complementaries, antonyms, converses, and words in a series (245). Most of the cohesive elements providing the glue for technical manuals fall into this category. Connecting sentences through joints in their meanings seems to provide the safest way to hold technical information together.

Using reference, substitution, ellipsis, conjunction, and lexical cohesive devices helps strengthen technical documents. Halliday says "it is the continuity provided by cohesion that enables the reader or listener to supply all the missing pieces, all the components of the picture which are not present in the text but are necessary to its interpretation" (299).

A summary of a cohesion coding scheme used by Halliday to examine text appears in Appendix G of this paper. The summary provides the base for my analysis of text from three recent Daktronics manuals. Glossaries of relevant Daktronics terminology and cohesive terms are also found in Appendices E and F.

In my analysis of each example, I numbered the sentences and then looked at some of their cohesive devices. The items identified are not all inclusive of the text's cohesive terms, but offer a number of the strongest ones. First of all, I counted the number of cohesive ties made in the example paragraph. I listed the item making the reference and followed it with a letter corresponding to the cohesive type and a numerical designation for each tie. I also indicated the distance between the cohesive items. Whether the cohesive items were in adjacent sentences or had several sentences intervene, symbols corresponding with the coding scheme found in Appendix G were given. Finally, I listed the presupposed item, or the other part of the tie.

Because I worked as the editor of the first example, the Venus® 6000 installation manual, and because I was studying cohesion for its usefulness in technical writing, a more conscious effort was made to produce cohesive ties in the first text. The second and third examples which follow were written without any knowledge of cohesion. Their subject matter determined their selection from other company manuals. Each reflects current product information since they were written within the last 18 months. Each analyzed paragraph, however, was chosen arbitrarily from the many pages of the manual. The analyses neither prove nor disprove the idea that cohesion helps make better technical writing. What they do show, however, is a quantifiable method for assessing how the text holds together. A cohesive document may bolster sales by producing a document that is easier to read, understand, and remember.

As Halliday points out, to codify a text in cohesive categories is a ''means to an end.'' It is not the end itself (332). By looking at sample texts, we can see if cohesion needs to be considered more often. We can also detect patterns of texture that may be used frequently and either correct them if they are ineffective, or use

them more often if they provide positive force.

The first piece of manual text talks about choosing a location for a temperature sensor, or electronic device which measures the intensity in degrees of the air temperature around the sensor.

Venus ® 6000 Manual Sample #1

The third choice for locating a temperature sensor is on the sign itself (1). To keep the sensor shaded, a light-colored sign is preferred (2). Mount the device on a lower, northern edge of the sign being installed(3). Grass, rather than concrete or other solid material, at the base of the sign helps give greater temperature accuracy (4). Sign-mounted sensors are generally discouraged because of the potential for display overheat from both the sun and the lampbanks, thereby causing inaccurate temperature readings (5).

Sentence Number	# of Ties	Cohesive Item	Type	Distance	Presupposed Item
1	1	third	R34.7	M[4]	A first choice...
2	2	sensor	L1.6	o	sensor
		sign	L1.6	M[4]	sign*
3	3	device	L2.8	o	sensor
		edge	L3.9	o	sign
		the	R23.6	N[2]	sign
4	2	base	L2.7	o	lower
		sign	L1.7	o	sign
5	4	sign-mounted	L1.7	o	mount
		sensors	L2.7	o	device
		display	L2.7	o	sign
		readings	L3.9	o	temperature shown

The **generic sign must be differentiated from the **specific** sign being installed.*

Sentence #1 has one tie made anaphorically with ''third.'' The quantity comparison refers to the presupposed item four sentences earlier which reads ''A first choice.'' Sentence #2 has two ties. ''Sensor'' makes a lexical cohesion with the same item in the previous sentence. ''Sign'' in Sentence #2 also becomes cohesive with the same word in the previous sentence. Sentence #3 has three ties. ''Device'' makes an exclusive lexical cohesion with ''sensor'' in the previous sentence. ''Edge'' represents an unrelated lexical cohesion with ''sign'' in the sentence before. The definite article ''the'' makes a reference as head in a non-mediated sense with the word ''sign'' three sentences earlier. Sentence #4 has two ties. ''Base'' makes an inclusive lexical cohesion as a synonym for ''lower'' in the previous sentence. ''Sign'' becomes lexically cohesive identically with the same word in the previous sentence. Sentence #5 has four ties. ''Sign-mounted'' makes a near synonym, mediated tie with ''mount'' two sentences earlier. ''Sensors'' also uses an inclusive, mediated tie with the synonym two sentences before. ''Display'' makes an immediate tie with its synonym ''sign'' in the previous sentence. Finally, ''readings'' makes an unrelated, superordinate, lexical tie with ''temperature shown'' in the previous sentence.

The second example is taken from the Venus®6000 operators' manual and gives instruction to the operator on how to create an information frame that gives the time of day and the current air temperature.

Venus ® 6000 Manual Sample #2

Since T&T information cannot be entered into a graphic frame the first thing that must be done is to insert a T&T frame into the sequence(1). To do this enter "FRAME" from the EDIT menu and insert a T&T frame(2). The system will insert this frame after that current frame and advance to it(3).

Sentence Number	# of Ties	Cohesive Item	Type	Distance	Presupposed Item
1	2	since	C34.1	N[...]	...requires slightly more memory
		first*	R34.7	N[13]	...frame can be changed
2	1	this	R21.6	o	thing
3	2	this	R21.6	o	T&T frame
		it	R21.6	o	T&T frame

Punctuation also makes a text more cohesive , and so its absence produces noise that interferes with the text's cohesiveness.

Sentence #1 contains two cohesive ties. "Since" gives causal conjunctive cohesion with a remote presupposed item. Several sentences earlier the phrase, "requires slightly more memory," becomes the presupposed item. The second tie is made with "first" which makes a quantity comparative reference. The reference is made in a non-mediated sense with the phrase, "frame can be changed," thirteen sentences earlier. It is non-mediated because the intervening sentences are not part of a chain of pre-supposed items. Sentence #2 has one tie. "This" makes a demonstrative

reference to its near nominal. The nearness joins with ''thing'' in the previous sentence. Sentence #3 has two ties which make it cohesive. Again ''this'' is used as a demonstrative reference for the Deictic ''T&T frame'' in the previous sentence. ''It'' makes a Deictic reference to the ''T&T frame'' in the earlier sentence as well.

The third example comes from an installation manual for 100 Series Incandescent Lamp displays. Graphic drawings and tables identifying the product's components give the manual its primary substance. The limited amount of text was written by the technician responsible for the product's design and operation; however, a graphic artist produced the drawings, formated the text, and designed the manual's pages.

Series 100 Incandescent Lamp Manual Sample #3

7. Control Cable

Daktronics has identified four general categories for control cable(1). See the controller installation and maintenenace manual for more detailed discussions and recommended selections for control cable(2). Most commonly used for installation in conduit are shielded and unshielded cable(3). Table H lists the requirements for these cable types and their recommended conduit sizes(4).

Sentence Number	# of Ties	Cohesive Item	Type	Distance	Presupposed Item
1	1	categories	L2.7	o	(heading)Control Cable
2	1	control cable	L1.6	o	control cable
3	2	most commonly used	E11.1	o	control cable
		cable	L1.6	o	cable
4	2	these	R21.6	o	cable
		their	R14.8	o	cable

Sentence #1 makes one cohesive tie. ''Categories'' joins in Lexical cohesion with an inclusively similar item. The Section heading provides the presupposed item. Sentence #2 uses ''control cable'' for its single cohesive tie. It ties with the same item in the previous sentence. Sentence #3 has two ties. ''Most commonly used'' makes a cataphoric, elliptical tie with ''control cable'' which appears in the following sentence. The specific Deictic serves as head or nominal group in the sentence. The second tie in the sentence joins ''cable'' in lexical cohesion with the same term in the previous sentence. Sentence #4 has two reference ties. ''These'' connects anaphorically by demonstrative reference with the nominal ''cable'' in the previous sentence. The pronoun ''their'' makes a pronominal reference with ''cable'' in the sentence immediately before.

Some of the manual examples use cohesion more consistently than others. While there is no way to specifically measure the effectiveness of cohesion in producing better manuals, an awareness of the positive influence it has for making a text more coherent can make the texts more readable. Readable texts that give information by linking sentences together with cohesive devices are easier to understand, and their messges are remembered longer.

Chapter 5

Daktronics has grown from six to over 400 employees during its 20+ years of existence. The company's manufacturing cycle has created the growth. The development of new products gave credibility which brought new contracts. The new contracts caused refinements and enhancements to existing products and the development of other new products. The development of new products brought more contracts, and the company came full circle back to developing more new products.

Producing documents that sell the products and detail their operation has also matured. An in-house, desktop publishing system makes document creation easier, faster and more professional looking. Existing product and project manuals have been refined, speeding up the production. Typesetting their text through desktop publishing and creating graphics through a CAD (Computer Aided Drafting) system gives the documents a finished, published look.

Daktronics

To continue the company growth in document production, I offer these recommendations to produce more efficient technical writing at Daktronics. The recommendations come from my preparation study for this thesis and my experience writing for the company. Their adoption and implementation can produce well-written documents which can significantly influence the company's profit.

Daktronics should implement a quarterly writing workshop. The company should develop a consistent SOP (Standard Operating Procedure) to guide corporate writing. It should establish a team approach to document writing. It should adopt a systematic way to begin manual writing through the use of content guide sheets. Finally, it should encourage client involvement in manual and product development through a postage-paid, reader response card bound into each manual.

1. **Quarterly Writing Workshop**. Daktronics shows its commitment to continued education by encouraging and subsidizing worker coursework taken outside work hours. Because of the great influence of clear writing on the company, a quarterly writing workshop could be required during work time for those technical people closely associated with products and projects. Since most learning occurs after repeated exposure, a quarterly course could emphasize the skills needed for different writing tasks required at different times.

My survey of the Daktronics engineering staff indicated they recognized that a large part of their learning should have come while they were in school rather than on the job. A majority of those questioned said more specific training was an answer to company writing deficiencies. Their reasoning may have come because their degree program did not include writing classes, the writing classes they had did not address their current needs, or they were not as motivated during school to learn what was taught about writing. Now that their job requires it, though, they are interested in learning how to improve the writing process. A writing workshop could provide at least part of the continued education necessary to improve their writing skills.

The workshop should consist of at least three components: a refresher of expository methods; re-aquaintance with or introduction to syntax, semantics and linguistics; and application to current needs. The first part could refresh participants with the basics of expository composition. Patterns of expository writing could be applied to various kinds of Daktronics writing. For example, the process method of writing becomes necessary for installation and operator manuals. It could also be used in Customer Service bulletins. The cause and effect structure becomes critical to manual writing to guarantee that the product gets used correctly. The comparison/contrast format provides effective writing for sales proposals making comparisons with competitor products. At the same time that these and other expository patterns are

presented, information about effective sentence structure, length and variety could also be reviewed.

The second workshop component could further address syntactic elements of writing. Introducing linguistic cohesion into participants' writing could result in more powerful documents. Exposure to linguistics, semantics, and syntax could help the writer produce more effective writing. Even an encouragement to read and observe other writing styles could build writer awareness of effective writing techniques.

The final component of the writing workshop should be in application. Whether participants focus on a hypothetical assignment created for the class or an individual's actual project brought for direction and guidance, group writing could give swift feedback. The immediate application of workshop material not only helps solidify learning, but for those who bring current writing tasks, professional advice could be received.

2. **Thorough SOP**. The development of a thorough SOP could facilitate more efficient technical writing for Daktronics. This document should be a revision of the Manual Writing Development Guide. In addition to giving production formats for specific manual types, the SOP could also include a style sheet directed toward consistent text format. The SOP should contain guidelines to organize writing in different expository patterns. Design guidelines provide company writing with a unified look. Text consistency could help those owners of several pieces of Daktronics equipment move comfortably from one document to the other. Another recommendation from the Daktronics survey called for company writing guidelines to serve as a basis for text comparisons. A thorough company SOP could assure a consistency for company documents and serve as a guide for their creation.

3. **Team Technical Writing**. Several pieces of the literature I reviewed recommended a team approach for better technical writing. Instead of producing hurried,

last minute documents by technical persons rushing to finish a product or project, a team effort could assure more complete writing. When the writer is removed from the subject, a more thorough coverage often results. Over-familiarity sometimes causes the writer to miss items necessary for complete understanding. Writing by a non-technical person could bring the writing closer to the reader's frame of reference. Likewise, however, the technical expert most familiar with the product can address those items necessary for reader knowledge to use the product to its greatest potential. The collaborative efforts of a subject-matter expert and a writing expert could produce technically sound and readable writing.

5. **Manual Planning Guide Sheets**. Daktronics manual production could be less difficult and more complete through consistent document planning. Some or all of the 10 planning sheets in Appendix D could serve as a base for manual preparation. A technical expert completes the sheets, and a technical writer writes and formats the text. The exercise could lead to consistent manuals which thoroughly cover the subject and yet are easy to understand. The Planning Sheets address all the items needed for complete coverage. Establishing a name for the product or procedure begins the process with Sheet A. Sheet B asks for a description of what the product or procedure does. Defining these initial items not only helps the writer find language to accurately present the designer's intentions, but it also helps make the subject-matter expert more aware of strengths and weaknesses in the product or project. When a technical expert translates technical facts on Sheet C, the expert must consider the user or reader of the document through explaining facts. Providing the writer with the distinguishing characteristics of the product or procedure helps produce writing that clearly meets the expert's intentions. Planning sheets D and E compare the new product or procedure with older, more familiar products. Readers remember new information better when it is compared with something more familiar. Sheet F produces a flow-chart schematic for the product or

procedure. Once the expert has identified the procedures, each task is analyzed by details defined in the next planning sheet. Before the planning effort ends, the technical expert must complete an alternatives sheet, Sheet I looks at the advantages and disadvantages of each method of production. Finally, a troubleshooting table, Sheet J, shows the reader/ user how to respond in the event of performance difficulty. Careful completion of these sheets could give the writer a basis on which to begin. Frequent questions during the writing process could be eliminated, freeing the expert for pressing new tasks. The sheets could make it easy to identify areas needing more development. They could also provide a means by which to compare the final document.

6. **Postage-Paid, Reader-Response Card**. To increase user feedback and involvement with manual production and product development, each manual could include a postage-paid, reader-response card. A perforated, postage-paid card at the end of the manual asking pertinent questions could encourage immediate feedback. Daktronics could get information about the usefulness of its manuals and also a sense of what product developments are considered necessary by the product users. Questions directed toward manual clarity and its design and layout could also provide feedback about manual production. A side benefit to the reader/response card is that it encourages user loyalty. Asking the user's opinion fosters a feeling of contribution to Daktronics product development. It could also tell Daktronics who the reader/user is for better audience identification and to make future contacts.

University

A second set of recommendations made from this study addresses a university technical writing program. The university should require technical writing coursework in different colleges. The English department should strengthen technical writing course content with stronger linguistic/rhetorical emphasis. It should also provide graduate-

level technical writing courses and add a technical emphasis to the English teaching methods course. The department should encourage professor-industry consultations. Finally the department should suggest technical writing internships to its students to provide necessary practical experience. My suggestions address South Dakota State University, although the recommendations could apply to any school's communications program. SDSU has made significant strides over the past few years to strengthen its technical writing coursework. These recommendations would add to that commitment to provide students with technical writing skills.

1. **Required and Encouraged Technical Writing Coursework**. In light of the literature survey of professional engineers and through my own study, a technical writing course required for all engineering degree programs could strengthen the abilities of graduating engineers. Only three engineering options at SDSU, Agricultural Engineering, Electrical Engineering, and Electronics Technology, require technical writing to complete the degree. Civil Engineering and Physics give students the option of taking it in place of Junior Composition. Computer Science and Mechanical Engineering require only Junior Composition for an advanced writing course. The overwhelming majority of professional engineers surveyed by technical writing instructor Richard Davis felt that a technical writing course should either be required or strongly encouraged in an engineering curricula (86). The majority of those I surveyed at Daktronics felt that better school training could improve company writing. Numerous other studies reveal a lack of writing skills among professionals entering the workforce. Our land-grant institution provides an ideal setting to help correct the problem. The course requirement could be extended to Nursing and Pharmacy Majors. Graduates of those programs also face the challenge of communicating clearly in writing. A technical writing course could offer the skills necessary to meet those challenges.

2. **Rhetorical and Linguistic Course Content**. Technical writing course content should place a greater emphasis on rhetorical strategies and linguistics. Brief conversations with instructors and substitute technical writing teaching tells me that while there is discussion of word choice and its influence on technical writing, a history of English and rhetoric presentation could also give students a greater understanding of how language and writing have evolved. That historical evolution could introduce the student to rhetorical debates that continue to be relevant. Kinneavy says the debate continues about how to arrive at truth among Plato, Isocrates and Aristotle. Does truth come through theoretical discussions or practical experience (69-81)? While not all technical writing tasks are likely to be covered in one technical writing course, rudimentary thinking and organizing skills could address the needs of any assignment. An introduction to cohesion as a method for producing clear and cohesive documents could help students learn to write better. An understanding of the function of cohesion could help writers make more careful choices of words and the syntax in which they are placed.

3. **Technical Writing Coursework at Graduate-level and in the Secondary School Teaching Methods Class**. Graduate-level writing courses and a study of technical writing in teaching methods courses should be part of the English department's curricula. Graduate-level technical writing courses could provide graduate students with a greater opportunity to examine writing techniques and determine how those techniques can be applied to industry. The coursework could be divided between physical and applied sciences.

In addition to offering graduate classes, the undergraduate teaching methods class should address technical writing. Secondary students could be introduced to expository methods of discourse to present technical information. For example, assignments which call for an explanation of a process or a description of an object can show students the

typical writing at work. Better preparation of secondary school instructors could produce more skilled writers coming to college or entering the workforce. Much of the high school writing teacher's instruction appears to be experiential rather than methodical, and a technical writing emphasis could provide practical structure to the teaching methods course content.

Incorporating these assignments at the high school, college, or graduate level in a computer writing lab could allow the students to experience a real, work-world setting. Because of frequent, short deadlines and congested work areas in industry, composing at the keyboard in a filled classroom could make the exercises more true to life.

4. **Faculty-Industry Consulation**. Technical writing professors could be encouraged to substantiate their instruction through industry consultation. Consultation could provide a win-win situation. The industry could certainly benefit through expert composition advice for its technical documents and instruction of its corporate writers. During these consultations, corporate writers could practice better writing techniques. Better industry writers could persuade industry management of the need for continued writing training. Just as corporations could be "sold" on the value of specially trained writers on staff, the university professor could benefit by learning firsthand some of the demands faced by students after graduation. Kinneavy says Aristotle taught writing techniques through having his students imitate models of actual writing (76). Industry consultation could give professors some of those models. This industry consultation should also apply toward university tenure requirements.

5. **Industry Student Internships**. Technical writing internships could be encouraged both for the industries consulted and by students looking for practical experience. Again, a win-win situation could result. The corporation could receive documents written by someone with recent effective writing instruction. A student-intern generally has the time necessary to focus on the corporate writing task. By contrast,

documenting a product or project sometimes comes last on the technician's agenda. Again Kinneavy describes Aristotle's teaching method as ''first stating the principles, illustrating them by examples, and then having the students apply them to the subject matter at hand in the right environment'' (76). It seems to me that the industry environment could provide the student with some of the best experiential knowledge. That knowledge could be applied to undergraduate credit and to the workplace after graduation.

Through implementing these recommendations, the University would gain a reputation for sending its graduates out better prepared for the corporate environment. A positive university image also results from professor-industry consultations. John Naisbett claims in his book Megatrends that the world is moving from an industrial age to an information age (xxi). Adoption of these recommendations and further study of the role of technical writing for industry would help the university focus on meeting the needs of its constituents.

This thesis reinforces the industry demand for better trained technical writers. By closer examination of Daktronics writing--its demands on technicians and samples of their writing style--the need for better, more continuous training becomes apparent. While I do not claim to have given a panacea for industry/education writing dilemmas, this study does aim at addressing those needs. Greater emphasis on rhetorical and expository organizational techniques can provide both the student and industry writer with a stronger document. Understanding and using a linguistic analysis method like ''cohesion,'' can provide writers with the tools necessary to create fail-safe documents. In turn, corporate profits stand to increase when companies produce efficient and clearly understood writing for their customers.

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Appendices

Appendix Table of Contents

Appendix A

*Summary of Code of Ethics for Engineers (**National Society of Professional Engineers**)*

PREAMBLE

Engineering is an important and learned profession. The members of the profession recognize that their work has a direct and vital impact on the quality of life for all people. Accordingly, the services provided by engineers require honesty, impartiality, fairness and equity, and must be dedicated to the protection of the public health, safety and welfare. In the practice of their profession, engineers must perform under a standard of professional behavior which requires adherence to the highest principles of ethical conduct on behalf of the public, clients, employers and the profession.

FUNDAMENTAL CANONS

Engineers, in the fulfillment of their professional duties, shall:

1. Hold paramount the safety, health and welfare of the public in the performance of their professional duties.

2. Perform services only in areas of their competence.

3. Issue public statements only in an objective and truthful manner.

4. Act in professional matters for each employer or client as faithful agents or trustees.

5. Avoid improper solicitation of professional employment.

Appendix B

Code for Communicators - ***Society for Technical Communication***
(Published February 1979, Revised October 1988)

As a technical communicator, I am the bridge between those who create ideas and those who use them. Because I recognize that the quality of my services directly affects how well ideas are understood, I am committed to excellence in performance and the highest standards of ethical behavior.

I value the worth of the ideas I am transmitting and the cost of developing and communicating those ideas. I also value the time and effort spent by those who read or see or hear my communication.

I therefore recognize my responsibility to communicate technical information truthfully, clearly, and economically.

My commitment to professional excellence and ethical behavior means that I will

- Use language and visuals with precision.
- Prefer simple, direct expression of ideas.
- Satisfy the audience's need for information, not my own need for self-expression.
- Hold myself responsible for how well my audience understands my message.
- Respect the work of colleagues, knowing that a communication problem may have more than one solution.
- Strive continually to improve my professional competence.
- Promote a climate that encourages the exercise of professional judgement and that attracts talented individuals to careers in technical communication.

M E M O

TO: Al Kurtenbach, Jim M., Carla G., Seth H., Scott R., Dave G., Dan B., Bryon C., John M., Brian G., Sharon O., Al VB., Craig F., Jim L., Brian L., Mark R., Dale S., Jim A., Robin B., Pete J., Karla M., Craig T., Tom W., Tim W., Jerry Y., Brent B., Clark D., David L., Layne M., Dan S., Joe S., Steve T., Tim T., Vern V., Jack T., Wayne T., Howard J., Glenn H., Kartheek K., Larry K., Troy L., Boon P.L., Connie M., Jim A., Deb E., Nancy O., Glenn R., Craig W.

FROM: Joanne Manzer

SUBJ: Engineering Writing Survey

DATE: March 14, 1990

I am working to complete my masters thesis in English focusing on Technical Writing and would appreciate your help. Please take a minute or two—or more--at break and complete the attached survey of Daktronics writing needs. I don't need your name, but I would like you to fill in the number of years of post-high school schooling you've had.

My thesis is looking at manual writing, specifically a couple paragraphs in the Venus® 6000 installation manual, and doing some linguistic analysis with them. I'm also looking at the Daktronics Manual Development Guidelines and the function of manuals for current and future business. Through it all I hope to make some recommendations that would make the writing process easier and more effective.

Your help completing the survey will help provide more value to my effort so I would really appreciate your completing the survey by **March 21**. You can either route it to me or put it in my basket.

Thanks.

Appendix C

Survey of Writing Needs at Daktronics

Please rate the following skills on the scale from 1 to 5, circling the 1 if you think the skill is very important to your job or a higher number if you think the skill is relatively unimportant to your work. Use the Comment space to express your thoughts on the skill's place in your job. Will the skill become increasingly important or unimportant as your career advances?

Years of post high school study _____

Writing Skills

1. The ability to spell is

1 2 3 4 5

very important relatively unimportant

COMMENTS:

2. The ability to use correct English grammar is

1 2 3 4 5

very important relatively unimportant

COMMENTS:

3. The ability to write mechanically correct sentences and paragraphs is

1 2 3 4 5

very important relatively unimportant

COMMENTS:

4. The ability to research information is

1 2 3 4 5

very important relatively unimportant

COMMENTS:

5. The ability to organize ideas and data is

1 2 3 4 5

very important relatively unimportant

COMMENTS:

6. The ability to express complex ideas clearly is

1 2 3 4 5

very important relatively unimportant

COMMENTS:

7. The ability to read quickly is

1 2 3 4 5

very important relatively unimportant

COMMENTS:

8. The ability to comprehend complex reading matter is

1 2 3 4 5

very important relatively unimportant

COMMENTS:

9. How often do you read?

1-2 hours daily 2-5 hours daily 1-2 hours weekly 2-5 hours weekly 1-2 hours monthly

Do you read for work and/or enjoyment?

10. What common problems do you notice in your writing or the writing of those with whom you work?

___ grammatical errors
___ lack of coherence
___ illogical ordering of ideas
___ choppy sentences
___ overly long sentences
___ wordiness
___ other (explain)

11. What do you think is a solution to problem writing at Daktronics? Better training in school? More on-the-job practice? People assigned to just write? (Use the back if necessary.)

12. Number the following in the order that you perform them when you are assigned a writing task. If you perform two or more simultaneously, give them the same number.

____ Research subject.
____ Determine point you intend to make.
____ Identify audience.
____ Determine purpose of writing.
____ Plan or outline writing.
____ Limit subject.
____ Discuss writing with colleague.
____ Discuss writing with supervisor.
____ Begin writing.

Circle the most appropriate number response to the following:

13. Writing

(1) exhilarates me
(2) depresses me
(3) frightens me
(4) bores me
(5) is just another part of the job.
(6) gives me a sense of power
(7) makes me feel that I have given order to chaos
(8) makes me grouchy
(9) satisfies me.

14. I approach a writing task with (Underline one)

(1) apprehension
(2) enthusiasm
(3) eagerness
(4) reluctance
(5) joy
(6) dread
(7) downright hate
(8) indifference.

Plan Sheet A:
Naming the Product or Procedure

· **By what it does**

It	*1: Action word*	*2: Object of action*	=	*2*	*1*
			=		
			=		

· **By what it looks like**

Modifier	*Noun*	=	*Name*
		=	
		=	

· **By blending words**

First element	*Second element*	=	*Name*

· **By easily pronounced acronyms**

	=	

· **By popular names having the psychological effect of favorable connotation**

Plan Sheet B:
What the Product or Procedure Does

To explain what a product or procedure does, you need to:

- **Think about its function just as the designer thought about it**
- **Explain the function, using the simple subject-active verb-object formula**

Name of product or procedure	+	*Active functional verb*	+	*Object of action*

Plan Sheet C:
Translating Technical Facts

The fact	*The significance*

Plan Sheet D:
The Distinguishing Characteristics of the Product or Procedure

1. Use details

2. Use illustrations.

3. Use comparisons and contrasts.

   Answer questions such as: Why is it better? How does it differ from older equipment, methods, procedures, products? What is it like? What is it unlike? What does it look like? What does it work like?

4. Use analogies.

5. Use analysis.

6. Use definitions.

   - Definition by illustration
   - Definition by comparision or contrast
   - Definition by analysis (defining a product or procedure by placing it in a general class and then explaining how it differs from other members of the same class)

The term	*Its general class*	*How it differs*

   - Definition by history (defining the product or procedure by showing the changes in meaning it has taken on over a long period of time)

Plan Sheet E:
The Old Product or Procedure

Title of product or procedure _____

Plan Sheet F:
The New Product or Procedure

Title of product or procedure _____

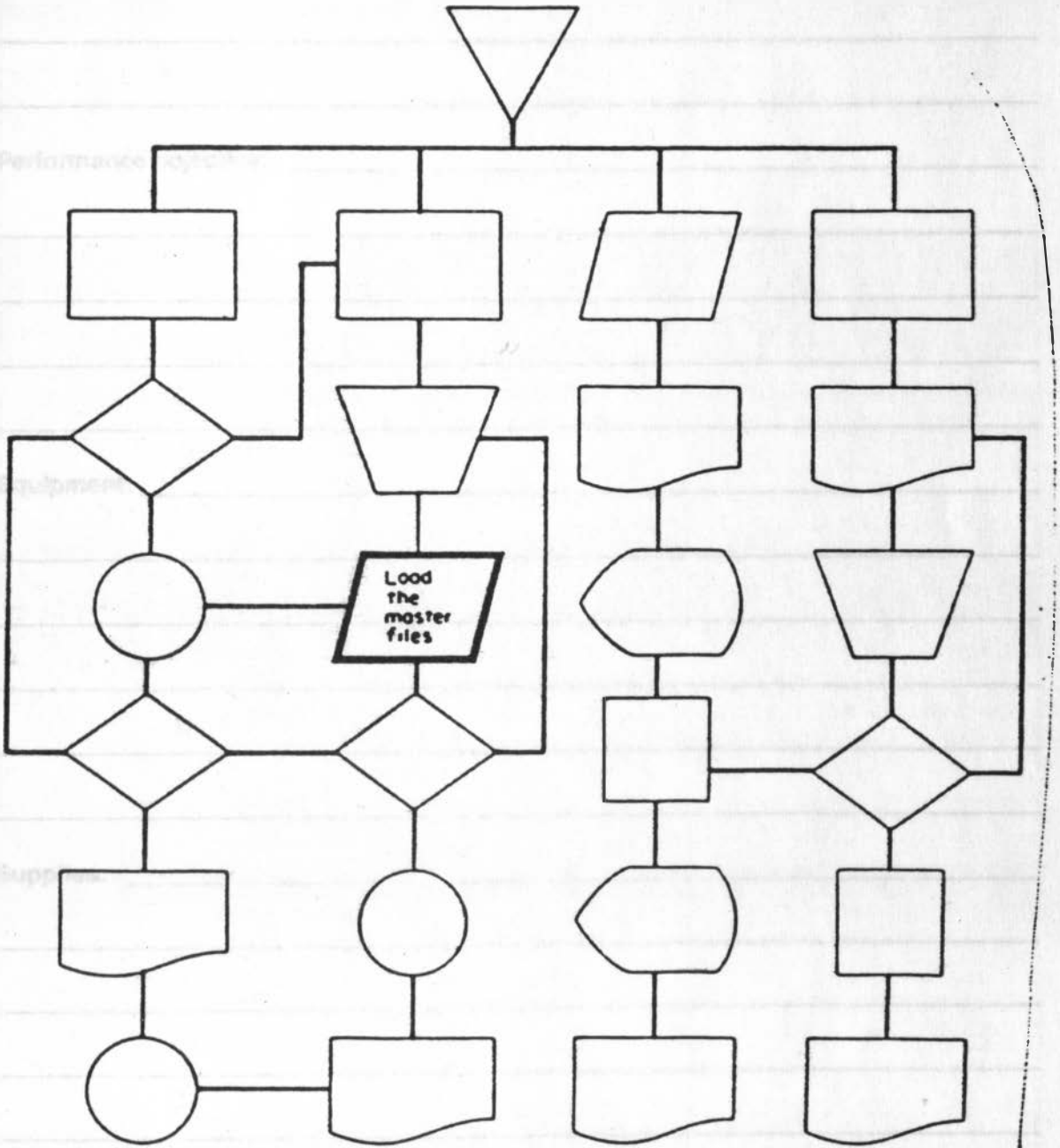
Commentary

Commentary

Commentary

Plan Sheet G:
The Task Outline Sheet

Name of the product or procedure _____



Plan Sheet H:
The Task Detail Sheet *(first page)*

Task: _____

Performance objective: _____

Equipment: _____

Supplies: _____

Plan Sheet I:
The Alternatives Sheet

Procedure _____

Method	*Advantages*	*Disadvantages*
1.		
2.		
3.		

Plan Sheet J:
The Troubleshooting Table

You notice	*This may mean*	*Caused by*	*You should*

Appendix E

Selected Glossary of "Cohesion" Terminology

adjunct - elements in a clause other than subject, predicator or complement

anaphoric - reference to a previous item

cataphoric - presupposed item follows

classifier - reference to a subclass (ex. express trains, passenger trains)

cohesion - linguistic means whereby texture is achieved; semantic relation between an element in the text and some other element that is crucial to the interpretation of it; one item pointing at another

collocation - the tendancy of lexical items to occur regularly near each other

context - meaning through situational reference

coreference - identical in reference

deictic - refers to and specifies by identity; determiner

delicacy of focus - subtleties of likenesses and differences in meaning

ellipsis - substitution by zero

embedding - depending one clause on another, but not integrating with it

endophoric - reference within the text further divided into anaphoric or cataphoric reference

epithet - adjective reference to a property

exophora - not cohesive; reference to elements outside the text; sound in context of the situation

field - total event in which the text functions

head - an element of group structure

lexical cohesion - cohesion established through vocabulary

nominal group - the kind of group which can typically operate as subject element or complement element in the structure of a clause

presupposition - interpreting a relationship with another element by referring back to previous elements

qualifier - reference to a characterizing relation or process

register - set of semantic configurations associated with context

reference - relation between meanings of linguistic items and elements outside the text

repudiation - all that is not carried over when a cohesive element acts in substitution for another element

semantics - the meaning of language

substitution - replacing one linguistic item with another

text - the stretch of language under consideration at a given time

texture - interrelationships among sentences in a text which give them unity

tie - pair of cohesively related items

Appendix F

Selected Glossary of Daktronics Terminology

command - using keystrokes on the computer keyboard to direct the controller and/or display to do something

conduit - a pipe, tube, or tile for protecting electric wires or cables

control cable - electric wires or cable through which instruction signals pass from the computer to the display

controller - computer with specially designed circuit boards to enable it to direct peripheral equipment

cursor - moving, sliding, or blinking symbol on the computer monitor to indicate the point at which information can be entered onto the screen

display - a group of either incandescent lamps, reflective elements, light emitting diodes, or other elements which broadcast information visually by electronic means

driver - modular unit which receives display information from the computer controller and converts it to drive signals to tell the elements how to respond

file - group of instructions which contain a message

frame - program information indicating all of the words and graphic that appear on the display matrix at any one time

hard drive - part of the computer which makes it capable of storing a great deal of information

highlight bar -engaging a whole section of information on the computer screen through darkening, or highlighting the secion

lampbank - group of incandescent lamps built into a matrix to broadcast information visually

menu - a list of options within a computer program which the operator may choose to interact with

mouse - device which allows an operator to make selections through its movement

pointing device - implement used to make operator selections on a computer

program - a series of instructions that will cause the computer to process data

sequence - a series of word and/or graphic information frames grouped into a message

software - computer programs which allow an operator to perform certain functions

system - the computer controller, printer, video image reader and any other peripheral equipment required to operate the specific equipment

temperature sensor - device which senses the ambient air temperature surrounding it

trackball - pointing device which allows the operator to make selections through its movement

Appendix G

From: *Cohesion in English* - M.A.K. Halliday and Ruqaiqa Hasan pp 333-39, 1976.

Summary of cohesion and coding scheme

A. Type of cohesion

		Coding
REFERENCE		R
1. Pronominals		1
(1) singular, masculine	he, him, his	11
(2) singular, feminine	she, her, hers	12
(3) singular, neuter	it, its	13
(4) plural	they, them, their, theirs	14
1(1-4) functioning as:		
(a) non-possessive, as Head	he/him, she/her, it they/them	6
(b) possessive, as Head	his, hers, (its), theirs	7
(c) possessive, as Deictic	his, her, its, their	8
2. Demonstratives and definite article		2
(1) demonstrative, near	this/these, here	21
(2) demonstrative, far	that/those, there, then	22
(3) definite article	the	23
2(1-3) functioning as:		
(a) nominal, Deictic or Head	this/these, that/those, the	6
(b) place adverbial	here, there	7
(c) time adverbial	then	8
3. Comparatives (not complete lists)		3
(1) identity	eg: same, identical	31
(2) similarity	eg: similar(ly), such	32
(3) difference (ie:non-identity and dissimilarity)	eg:different, other, else additional	33
(4) comparison, quantity	eg: more, less, as many; ordinals	34
(5) comparison, quality	eg: as+adjective; comparatives and superlatives	35
3(1-5) functioning as:		
(a) Deictic	(1-3)	6
(b) Numerative	(4)	7
(c) Epithet	(5)	8
(d) Adjunct of Submodifier	(1-5)	9

Note: Not all combinations of (1-5) with (a-d) are possible; the usual functions are those indicated here in the last table.

		Coding
SUBSTITUTION		S
1. Nominal substitutes		1
(1) for noun Head	one/ones	11
(2) for nominal Complement	the same	12
(3) for Attribute	so	13
2. Verbal substitutes		2
(1) for verb	do, be, have	21
(2) for process	do the same/likewise	22
(3) for proposition	do so, be so	23
(4) verbal reference	do it/that, be it/that	24
3. Clausal substitutes		3
(1) positive	so	31
(2) negative	not	32
3(1-3) substitute clause functioning as:		
(a) reported		6
(b) conditional		7
(c) modalized		8
(d) other		9
ELLIPSIS		E
1. Nominal ellipsis		1
(1) Deictic as Head		11
i. specific Deictic		1
ii. non-specific Deictic		2
iii. Post-deictic		3
(2) Numerative as Head		12
i. ordinal		1
ii. cardinal		2
iii. indefinite		3
(3) Epithet as Head		13
i. superlative		1
ii. comparative		2
iii. others		3
2. Verbal ellipsis		2
(1) lexical ellipsis ('from right')		21
i. total (all items omitted except first operator)		1
ii. partial (lexical verb only omitted)		2
(2) operator ellipsis ('from left')		22
i. total (all items omitted except lexical verb)		1
ii. partial (first operator only omitted)		2

Note: Where the presupposed verbal group is simple there is no distinction between total and partial ellipsis; such instances are treated as 'total'. Where it is above a certain complexity there are other possibilities intermediate between the total and partial as defined here; such instances are treated as 'partial'.

		Coding
3. Clausal ellipsis		3
(1) propositional ellipsis		31
i. total (all Propositional element omitted)		1
ii. partial (some Complement or Adjunct present)		2
(2) modal ellipsis		32
i. total (all Modal element omitted)		1
ii. partial (Subject present) [rare]		2

Note: Lexical ellipsis implies propositional ellipsis, and operator ellpisis implies modal ellipsis, unless all clause elements other than the Predicator (verbal group) are explicitly repudiated.

(3) general ellipsis of the clause (all elements but one omitted)		33
i. WH- (only WH- element present)		1
ii. yes/no (only item expressing polarity present)		2
iii. other (other single clause element present)		3
(4) zero (entire clause omitted)		34
3(1-4) elliptical clause functioning as:		
(a) yes/no question or answer		6
(b) WH- question or answer		7
(c) 'reported' element		8
(d) otherwise		9

Note: Not all combinations of (1-4) with (a-d) are possible.

CONJUNCTION (items quoted are examples, not complete lists)		C
Note: (E)=external, (I)=internal.		
1. Additive		1
(1) simple: (E/I)		11
i. additive	and, and also	1
ii. negative	nor, and...not	2
iii. alternative	or, or else	3
(2) complex, emphatic: (I)		12
i. additive	furthermore, add to that	1
ii. alternative	alternatively	2
(3) complex, de-emphatic:(I)	by the way, incidentally	13
(4) apposition: (I)		14
i. expository	that is, in other words	1
ii. exemplificatory	eg, thus	2

		Coding
(5) comparison: (I)		15
i. similar	likewise, in the same way	1
ii. dissimilar	on the other hand, by contrast	2
2. Adversative		2
(1) adversative 'proper': (E/I)		21
i. simple	yet, though, only	1
ii. +'and'	but	2
iii. emphatic	however, even so, all the same	3
(2) contrastive (avowal): (I)	in (point of) fact, actually	22
(3) contrastive: (E)		23
i. simple	but, and	1
ii. emphatic	however, conversely, on the other hand	2
(4) correction: (I)		24
i. of meaning	instead, on the contrary, rather	1
ii. of wording	at least, I mean, or rather	2
(5) dismissal: (I)		25
i. closed	in any/either case	1
ii. open-ended	in any case, anyhow	2
3. Causal		3
(1) general: (E/I)		31
i. simple	so, then, therefore	1
ii. emphatic	consequently	2
(2) specific: (E/I)		32
i. reason	on account of this	1
ii. result	in consequence	2
iii. purpose	with this in mind	3
(3) reversed causal: (I)	for, because	33
(4) causal, specific: (I)		34
i. reason	it follows	1
ii. result	arising out of this	2
iii. purpose	to this end	3
(5) conditional: (E/I)		35
i. simple	then	1
ii. emphatic	in that case, in such an event	2
iii. generalized	under the circumstances	3
iv. reversed polarity	otherwise, under other circumstances	4

		Coding
(6) respective: (I)		36
i. direct	in this respect, here	1
ii. reversed polarity	otherwise, apart from this, in other respects	2
4. Temporal		4
(1) simple: (E)		41
i. sequential	then, next	1
ii. simultaneous	just then	2
iii. preceding	before that, hitherto	3
(2) conclusive: (E)	in the end	42
(3) correlatives: (E)		43
i. sequential	first...then	1
ii. conclusive	at first/originally/ formerly...finally/now	2
(4) complex: (E)		44
i. immediate	at once	1
ii. interrupted	soon	2
iii. repetitive	next time	3
iv. specific	next day	4
v. durative	meanwhile	5
vi. terminal	until then	6
vii. punctiliar	at this moment	7
(5) internal temporal: (I)		45
i. sequential	then, next	1
ii. conclusive	finally, in conlusion	2
(6) correlatives: (I)		46
i. sequential	first...next	1
ii. conclusive	in the first place...to conclude with	2
(7) here and now: (I)		47
i. past	up to now	1
ii. present	at this point	2
iii. future	from now on	3
(8) summary: (I)		48
i. summarizing	to sum up	1
ii. resumptive	to resume	2
5. Other ('continuative')	now, of course, well, anyway, surely, after all	5

	Coding
6. Intonation	6
(1) tone	61
(2) tonicity	62
LEXICAL	L
1. Same item	1
2. Synonym or near synonym (incl. hyponym)	2
3. Superordinate	3
4. 'General' item	4
5. Collocation	5
1-5 having reference that is:	
(a) identical	6
(b) inclusive	7
(c) exclusive	8
(d) unrelated	9

B. Direction and distance of cohesion

IMMEDIATE	o
Not immediate:	
MEDIATED (number of intervening sentences)	M[n]
REMOTE NON-MEDIATED (number of intervening sentences	N[n]
CATAPHORIC	K

Note: Any cohesive instance, or 'tie', may be 'immediate' (presupposing an item in a contiguous sentence) or not immediate. If not immediate, it may be 'mediated' (having one or more intervening sentences that enter into a chain of presupposition) or 'remote' (having one or more intervening sentences not involved in the presupposition), or both. Finally it may be anaphoric or cataphoric; cataphoric ties are relatively infrequent and almost always immediate. A tie is assumed to be anaphoric unless marked 'K'.

The coding scheme provides a means of representing the cohesive patterns in a text in terms of the present analysis. Each sentence is given an index number, and the total number of ties in that sentence is entered in the appropriate column. Then for EACH TIE we specify (A) the type of cohesion and (B) its distance and direction.

The coding is designed to allow for variation in the delicacy of the analysis.