

## **An Online Technical Vocabulary Reference Tool for Deaf Students**

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## Abstract

Deaf students in technological programs face a major challenge in developing sufficient knowledge of the specialized technical vocabulary required for success in their fields of study and in their future careers. To help students address this challenge, we developed an *Online Technical Vocabulary Reference Tool* for deaf students enrolled in college-level science and technology programs. The user-friendly reference tool was designed based on best practices in technical education, instructional technology, and vocabulary teaching. Currently, students can access definitions of 150 technical terms from four engineering sub-fields. Each definition is illustrated within its real-world technological context including an actual photographic image or diagram depicting the tool, process, or description conveyed by the targeted term. The resource also links to technical data associated with specific terms (formulas, problems, or web sites). Following best practices articulated, for example, in Schmitt (2000, *Vocabulary in Language Study*), the online reference provides a number of encounters with each term, promotes a deep level of processing, facilitates imaging, connects words to the student's world, incorporates several pedagogical techniques, and encourages independent learning strategies. Feedback from faculty and deaf students who have used the vocabulary reference tool not only affirms its usefulness and educational importance but also suggests that its design can be broadly extended to vocabulary teaching and learning in multidisciplinary contexts.

## Introduction

### *Background*

Within the Industrial and Science Technology (IST) programs at the National Technical Institute for the Deaf (NTID) at the Rochester Institute of Technology (RIT) in Rochester, New York, a major obstacle facing deaf students is the development of technical vocabulary skills required for success in their courses and programs as well as for success in their future careers. This issue is related to the general English-literacy challenge facing deaf students in their struggle to acquire receptive and expressive skills in a language that they cannot hear. For technical faculty, a related long-standing and time-consuming struggle has been the search for appropriate and effective methods for teaching technical vocabulary (and related English skills) to their deaf students. Despite the availability of both electronic and text teaching resources, providing students with effective, appropriately contextualized vocabulary reference materials remains a serious challenge.

To address this specific teaching-learning challenge, this project involved the creation of an *Online Technical Vocabulary Reference Tool for Deaf Students*. The Vocabulary Reference currently contains descriptions and supplementary information for 150 technical terms specific to the four IST programs. The reference tool incorporates best practices from the fields of technical education, instructional technology, and vocabulary teaching. The employment of these best educational practices, and nothing less, offers the greatest promise for the implementation of a technology-oriented teaching/learning tool that will satisfy an identified need, that will be pedagogically sound and user-friendly, and that will achieve the desired educational outcomes for which it was designed.

### *Rationale*

Given the solid research base, technological validity, and pedagogical soundness driving the development of the Vocabulary Reference, it was anticipated that this project would have a positive impact on student success in at least four important ways. First, it was anticipated that

students' English receptive and productive knowledge of the language of engineering technologies would improve and that students' performance on projects and exams would improve accordingly.

Secondly, this project directly contributes to the mandate at NTID for infusing English teaching principles and practices across the curriculum, a mandate directed specifically at promoting student retention and success. NTID research on student retention and success has identified low English literacy levels as a significant factor contributing to NTID student attrition. Viewed as a general English language teaching/learning tool, the English Vocabulary Reference Tool may contribute significantly to enhancing NTID students' overall English proficiency levels. Therefore, to the extent that the vocabulary resource contributes to gains in students' English language proficiency, it should also contribute to promoting deaf student retention and success.

Thirdly, it was anticipated that students' general knowledge of engineering would increase within an environment that emphasizes the cross-disciplinary application of technology. This increase should greatly augment ongoing efforts within the NTID IST programs to increase the number and quality of transfer opportunities for students who wish to continue their education in other colleges of RIT. The courses which the Vocabulary Reference Tool currently targets are either approved for transfer to other RIT colleges or are currently under review for transfer approval. A key component of ongoing efforts to improve course transferability is the creation of opportunities for NTID technology programs to share resources with other RIT programs. Within this context, it was anticipated that the Vocabulary Reference would provide a model of effective English teaching/learning strategies for a wide range of RIT faculty as the students who use the tool transfer to other colleges of RIT.

Finally, it was anticipated that the Vocabulary Reference would ultimately be a valuable resource to students enrolled in two of NTID's student recruitment and preparation programs and to students supported by the NTID Science and Engineering Support teams. Even more broadly, this resource should serve as a model for vocabulary instruction in any of NTID's technological and general education programs.

## Planning

Planning the development of the *Online Technical Vocabulary Reference Tool for Deaf Students* was driven by the logical necessity to utilize the following: (i) best practices in vocabulary teaching and learning, (ii) specific technical vocabulary required for success in the targeted programs, and (iii) deaf students' orientation to visual learning. The interaction of these three factors is apparent in the structure and content of the Vocabulary Reference Tool.

### *Best Practices in Vocabulary Teaching and Learning*

Because the educational purpose of the online resource is to foster English *vocabulary* development, it was essential that the best practices in vocabulary teaching and learning be identified. Deaf learners of English comprise a minute fraction of the millions of English language learners around the world. Therefore, most of the research on English language teaching targets hearing learners of English as a second or foreign language. Because of the recognized similarities between deaf learners' and hearing second language learners' English language development (Berent, 1996), it was clear that the repertoire of vocabulary teaching methods and materials should be sought in the broader context of second/foreign language teaching and learning. Accordingly, the identification of best practices in vocabulary teaching

was undertaken through a review of English vocabulary teaching and learning in this broader context (see References for a listing of some of the relevant literature).

### *Selection of Technical Terms*

For the initial development of the Vocabulary Reference Tool, we identified 150 technical terms critical to four of the NTID engineering and science technology programs. To succeed in these programs, students need to have receptive and productive knowledge of these terms in order to understand and explain the fundamental concepts, materials, and operations that these terms describe. These 150 terms represent a core technical vocabulary that is a minimum for effective English discourse in these technical fields. The initial selection is a starting point for the hundreds of other technical terms that students need to master for optimal success.

In this phase of the project, the majority of the 150 terms chosen for inclusion are nouns or noun phrases. In addition there are smaller numbers of verbs, gerunds (i.e., *-ing* forms of verbs that describe processes), and adjectives. A sampling of the 150 technical terms is provided in Table 1 according to their part of speech.

Table 1

### *Sample listing of technical terms included in the Vocabulary Reference Tool*

<b>NOUNS AND NOUN PHRASES</b>	<b>VERBS</b>	<b>GERUNDS (PROCESSES)</b>	<b>ADJECTIVES</b>
metallurgy	apply	drilling	accurate
nominal size	attain	knurling	analog
ohm	countersink	necking	Cartesian
pad	fracture	reaming	ceramic
photo-eye	jog	turning	consecutive
piping	wring	welding	conventional
plc			crucial
precision			digital
printed circuit board			durable
probability			inferior
process capability			minute
product design			random
prototype			standard
proximity switch			symmetrical

### *Visual Learning*

As a consequence of deafness, deaf students process information largely through the visual channel. Therefore, an appropriate medium for providing visual access to technical vocabulary would be an online teaching/learning tool. In addition to providing a visual medium for deploying vocabulary teaching and promoting learning, an online technology provides convenient and continual access to the resource. In addition, an online technology affords optimal flexibility to the teaching/learning environment. Instructors can display and teach from

the Vocabulary Reference during class; students can access the resource to complete individual or group activities during class; students can complete homework assignments using the online resource outside of class; and students can access and use the resource for independent learning at any time.

The framework for the reference tool is a PowerPoint presentation file with internal links to indexes and all the components within the file. For certain technical terms, it also provides links to web sites and other posted reference materials. Use of this framework in an online medium allows the developers to continually expand and refine their resource without the need to revise and produce new print materials or instructional CD-ROMs or DVDs and to do so without any interruption of the teaching/learning process.

## Contents

The identification of current best practices in vocabulary teaching and learning, the selection of specific technical terms to include in the initial version, and the determination of the most appropriate use of online instructional technology for promoting visual learning have resulted in an *Online Technical Vocabulary Reference Tool for Deaf Students* containing the following specific features and components.

### *Index of Technical Terms*

The Vocabulary Reference Tool begins with an alphabetical menu of letters in which each letter is linked to the listing of technical terms that begin with that letter. Clicking on a letter in the menu takes you to the associated list. In each list of alphabetized technical terms, clicking on a specific term takes you to a page which provides a variety of information about that term. The “home” button on that page returns you to the alphabetized list of terms beginning with the chosen letter, and clicking on the “home” button on that page returns you to the original alphabetized menu of letters. This kind of linked indexing makes navigation of the resource effortless.

### *Page Contents*

Figure 1 illustrates the page entry for the technical term *assembly*. The figure shows that the technical term is accompanied by a direct, simple definition of the term relevant to the technological context in which the student will encounter the term. As visual support for understanding the term, a diagram is provided illustrating a typical assembly. Also included is a table of information related to the term’s part of speech (e.g., noun, verb, adjective), usage in a complete sentence, and relevant aspects of meaning. There are synonyms (“similar words/phrases”), antonyms (“opposite words/meanings”), and related words. In this example, for the noun *assembly*, the related verb *assemble* is provided. The “pieces of meaning” break the term down into its semantic associations, which are the categories of meaning that words embody.

### *Semantic Associations*

Describing vocabulary according to semantic associations is an effective vocabulary teaching and learning method that allows students to categorize their word knowledge according to attributes, functions, actions, affiliation, and other aspects of meaning (Miller & Fellbaum, 1991). In analyzing the 150 technical terms included in the Vocabulary Reference Tool, we determined that the following semantic associations, alone or in combination, could suitably characterize the targeted technical terms.

characteristic	energy	planning
action	electricity	knowledge
process	assembly	location
measurement	equipment	relationship
movement	result	surface
material	representation	shape

The “pieces of meaning” assigned to the term *assembly* in Figure 1 are [process, assembly, equipment]. In this case, it happens that, because many of the targeted terms in the Reference Tool are associated with assembling, “assembly” was chosen as a meaningful association to include. Thus, the term *assembly* is a process involving the assembly of equipment.

## Assembly

- **Parts connected together for a purpose.**

Word Category/Usage	NOUN: An <b>assembly</b> is a collection of parts fitted together.
"Pieces of Meaning"	[process, assembly, equipment]
Similar Words/Phrases	collection, joining, resulting product
Opposite Words/Meanings	disassembly, separation, dismantling
Related Word(s)	VERB: <b>assemble</b>

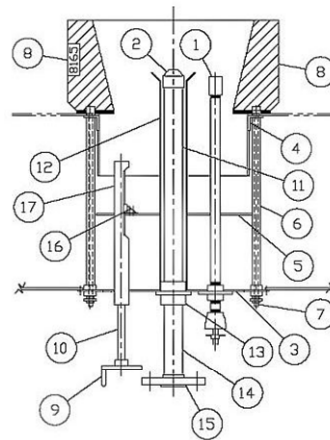


Figure 1. Page entry for the technical term *assembly*

Other examples of technical terms and their semantic associations are illustrated in Table 2. The use of these associations to reinforce meaning not only clarifies the categorization of terms; it also helps students to recognize small feature differences that distinguish two terms. For example, from the table entries for *grooves* and *fracture*, the student can see that both terms refer to the result of something that affects a surface. However, the middle feature highlights the distinction between an action that results in *grooves* in a surface and the natural result (a *fracture*) that energy (e.g., heat or impact) can have on a surface.

Table 2. Technical terms and their semantic associations

TERM	SEMANTIC ASSOCIATIONS	RATIONALE
<i>watt</i>	[measurement, energy, electricity]	A <i>watt</i> is a <u>measurement</u> of <u>electrical energy</u> .
<i>sheet metal</i>	[material, surface]	<i>Sheet metal</i> is a <u>material</u> that forms a <u>surface</u> .
<i>grooves</i>	[surface, action, result]	<i>Grooves</i> are made into a <u>surface</u> through an <u>action</u> that has a specific <u>result</u> (i.e., a linear indentation).
<i>symmetrical</i>	[characteristic, shape, relationship]	When something is <i>symmetrical</i> , it has the <u>characteristic</u> that its <u>shape</u> involves two parts in a balanced or identical <u>relationship</u> .
<i>fracture (noun)</i>	[surface, energy, result]	A <i>fracture</i> occurs in a <u>surface</u> because of <u>energy</u> that creates a <u>result</u> .

### Visual Processing

The visual representation of technical terms in the Reference tool is achieved not only through the use of diagrams, as shown in Figure 1, but also through the frequent inclusion of real-world photographs depicting the technical term as in Figure 2 below.

## Casting

- **Shaping melted or liquid materials by pouring into a mold**
- <http://en.wikipedia.org/wiki/Casting>

Word Category/Usage	NOUN: <b>Casting</b> involves pouring a liquid material into a mold.
"Pieces of Meaning"	[action, process, result]
Similar Words/Phrases	shaping, molding
Related Word(s)	VERB: <b>cast</b> (= to make a form by pouring a liquid into a mold)



Figure 2. Page entry for the technical term *casting*

The page entry for *casting* includes an actual photograph of the casting process. Note that this page entry also includes a hot link to a web site that contains a wealth of additional information, photos, descriptions, examples, and other links associated with casting. Thus the Reference Tool is not a closed set of materials but an open resource that takes the student beyond the tool for further learning in real-world contexts.

### Employment of Best Practices

The contents of the Vocabulary Reference Tool reflect sound English teaching pedagogy and best practices in the area of vocabulary teaching and learning as articulated, for example, in Schmitt (2000):

- (a) providing a number of encounters with the word
- (b) connecting the word to the student's world
- (c) promoting a deep level of processing
- (d) facilitating imaging
- (e) using a variety of techniques
- (f) encouraging independent learning strategies

The Vocabulary Reference Tool provides students with a number of encounters with each technical term—at the beginning of the page entry, in the sample sentence illustrating the term's usage, in supplementary charts, on web sites that some pages link to, and of course in combination with the course materials and activities that this resource is designed to support. Second, the resource connects each targeted term to the student's world, through its direct connection to the student's course content, to hands-on lab activities requiring an understanding of the term, and to the student's developing repertoire of technical vocabulary employed in the student's specific field within Industrial and Science Technology. Through the inclusion of information from diverse supplemental—sources, the term's definition, synonyms, antonyms, related words, and semantic associations—the resource undoubtedly promotes a deeper level of vocabulary processing. The visual orientation of the reference tool through the inclusion of photographs, charts, diagrams, drawings, and other visuals strongly facilitates students' imaging of word meanings and associations. The resource uses a variety of techniques to teach meaning (the definitions and related supplementary information, the illustrated usage, the visuals, and the links). However, this is an area where the resource needs to be expanded to incorporate additional techniques. Finally, the resource encourages independent learning strategies by virtue of its ease of navigation, its flexibility for in-class or out-of-class usage, and its direct relevance to course and program vocabulary, factors which should no doubt motivate students to take advantage of the resource.

In developing the definitions that accompany technical terms in the Vocabulary Reference, we also followed principles of established best practices. Some second language research on vocabulary teaching and learning has concluded that shorter definitions are preferable to longer definitions because elaborations may actually cause confusion. Other research has shown that longer definitions are more effective. In interpreting such research findings, Nation (2001) concluded that length is not the issue and that effective definitions are those that are specific, direct, unambiguous, and simple. These are the precise criteria that we have employed in formulating definitions for the technical terms included in the Vocabulary Reference.

Aside from the population-specific rationale for orienting the Vocabulary Reference toward visual processing, the prominent use of visual material in the resource is also supported widely in the literature on vocabulary teaching and learning. For example, Nation (2001, p. 85) pointed out



that “an advantage of using actions, objects, pictures, or diagrams is that learners see an instance of the meaning [of a word] and this is likely to be remembered.” Nation cited Paivio and Desroches’ (1981), who maintained that combining definitions with visual representations leads to “dual encoding,” whereby the learner stores word meaning both linguistically and visually. The Vocabulary Reference is a prime example of an approach that capitalizes on the dual processing of linguistic and visual information.

### Implementation and Feedback

Pilot testing of the Online Technical Vocabulary Reference Tool was planned for spring quarter 2005. For two reasons, however, that may be of interest to readers contemplating such a project, the Vocabulary Reference Tool was not ready for implementation until late in that quarter. First, the large scope of the project proved to be a challenge; managing this volume of information takes time. Second, we tried several approaches to creating the Vocabulary Reference in consultation with colleagues in the NTID Educational Design Resources department. We created an HTML trial document, which, though elegant and efficient in its use of computing resources, posed other problems. It appeared that the front-end preparation of text and images for the HTML version would simply take too long, partly because of the learning curve for non-experts. We ultimately decided to use MS Power Point. Power Point requires huge computing resources but offers a number of efficiencies for the non-expert. For example, lists can be prepared in MS Word and translated into Power Point slides automatically. Such utilities proved to be the deciding factor.

Nevertheless, the Vocabulary Reference was introduced and used in two courses offered in the Industrial and Science Technology Department—Precision Management and Automated Systems. The instructors of these two courses provided students with access to the Vocabulary Reference through "myCourses," the RIT course management software used in these courses. We asked the two instructors to encourage students to use the Vocabulary Reference for the remainder of the quarter, including preparing for the final exam.

To assess initial usage of the Vocabulary Reference and reactions from the instructors and students, we developed and administered two assessment surveys. The "Vocabulary Reference Tool: *Faculty Survey*" was completed by the instructors of the two target courses and is provided in Appendix A. The instructors were asked to complete the surveys at the end of the quarter after submission of course grades in order to determine any possible effects of the Vocabulary Reference on student outcomes. As for student feedback, the "Vocabulary Reference Tool: *Student Survey*" was completed by a total of 12 students taking the two courses and is provided in Appendix B. Despite limited utilization of the Vocabulary Reference because of time constraints, respondents' preliminary feedback provided valuable information.

#### *Faculty Feedback*

In completing the faculty survey (Appendix A), one instructor indicated that he/she encouraged students to access the Vocabulary Reference through myCourses and to use it as much as possible for the remainder of the quarter, including to prepare for a quiz and the final exam. The other instructor noted that, although it was really quite late in the quarter, he/she *did* introduce students to the Vocabulary Reference. Both instructors indicated that, from their observations, students were "somewhat receptive" (as opposed to "very receptive" or "not receptive at all") to using the Vocabulary Reference as a course supplement.

One survey question asked whether there was any indication, in comparison with previous experiences teaching the course, that the Vocabulary Reference positively affected students'

technical vocabulary growth toward the end of the course. One instructor indicated that the students' usage of the Vocabulary Reference seemed to have a positive effect on their knowledge of technical vocabulary as demonstrated on the final exam. The other instructor indicated that it was simply too late in the course to discern any differential improvement.

Question 8 of the faculty survey (Appendix A) asked instructors to assess seven specific components of the Vocabulary Resource with respect to their potential for promoting the teaching and learning of technical vocabulary and to their ease of use by students. One instructor felt that the first five components in the list were "good" in this regard but that the last two were "great": photographs describing technical terms and drawings and charts describing technical terms. Interestingly, these are the two most visually oriented components of the seven. The other instructor rated the same two visual components highly as well as the sample sentences containing target terms and the "pieces of meaning" (i.e., semantic associations) that characterize technical terms. In response to question 9, whether it would be easy to expand the use of the Vocabulary Reference Tool to other NTID technical courses, both instructors were emphatic in supporting such an expansion. One emphasized his/her observation that deaf students learn better when technical terms are supported by visual supplements, and the other encouraged continual expansion of the Vocabulary Resource for implementation in other settings.

The two instructors made some specific recommendations—to have "topical groupings" of technical terms into categories such as electrical terms, mechanical terms, and machining terms with search options for accessing such groupings. One strong recommendation was to bring more consistency into descriptions of terms. Some terms have fully developed components; others are somewhat underdeveloped. This is an important and valid recommendation and a problem which we are aware of. In the building of the components related to each technical term, some components are inherently easier to develop than others. Fuller development of underdeveloped components is in progress.

### *Student Reactions*

The responses of the 12 students who completed the "Vocabulary Reference Tool: *Student Survey*" (Appendix B) are summarized in Table 3. Examination of Table 3 reveals that, despite the short period available to the students during spring quarter for using the Vocabulary Reference, their initial usage of the resource was a positive experience. Most noteworthy were the students' responses to survey questions 8 and 9: "How helpful is the Vocabulary Reference Tool for studying and learning technical terms?" and "How helpful was the Vocabulary Reference Tool in preparing for your final exam?" Table 3 reveals that three-fourths of student respondents answered "a little helpful" to each of these questions and one-fourth answered "very helpful." These responses based on such a short period of usage suggest that the students' positive assessment of efficacy is highly reliable.

Students' reactions to specific components of the Vocabulary Reference Tool are also promising. As shown in Table 3, three of the components received "Like," as opposed to "Not sure" or "Don't like," ratings from three-fourths of the respondents. Another component received a "Like" rating from two-thirds of respondents. These "Like" ratings were assigned to the alphabetical listing of terms, simple definitions, and the most visual components—photographs, and drawings and charts. Assessment of the other three components was roughly split between "Like" and "Not sure." Four components each received only one "Don't like" response. Along with student responses to the other survey questions, these ratings provide strong preliminary evidence that the Vocabulary Reference is a useful and effective resource for the learning of discipline-specific technical vocabulary and that it consists of pedagogically sound components associated with the targeted technical terms.

Table 3

*Summary of Responses to the "Vocabulary Reference Tool: Student Survey" in Appendix B*

	Number of students (N = 12)			
	NOT AT ALL	LESS THAN ONE HOUR	ONE OR TWO HOURS	MORE THAN TWO HOURS
During spring quarter, how often did you use the Vocabulary Reference Tool?	1	8	3	0
Did you use the Vocabulary Reference Tool in class or out of class?	BOTH IN CLASS AND OUT OF CLASS 6	ONLY IN CLASS 4	ONLY OUT OF CLASS 2	
Did your instructor show you how to use the Vocabulary Reference Tool?	YES 11	NO 1		
How many technical terms did you look up and study using the Vocabulary Reference Tool?	BETWEEN 1 AND 5 4	BETWEEN 5 AND 10 5	BETWEEN 11 AND 20 2	MORE THAN 20 1
In general, how helpful is the Vocabulary Reference Tool for studying and learning technical terms?	NOT VERY HELPFUL 0	A LITTLE HELPFUL 9	VERY HELPFUL 3	
How helpful was the Vocabulary Reference Tool in preparing for your final exam?	NOT VERY HELPFUL 0	A LITTLE HELPFUL 8	VERY HELPFUL 3	
What parts of the Vocabulary Reference Tool do you really like?	<b>LIKE</b>	<b>NOT SURE</b>	<b>DON'T LIKE</b>	
• Alphabetical list of technical terms	9	3	0	
• Simple definitions of technical terms	9	3	0	
• Example sentences that include the technical terms	6	5	1	
• "Pieces of meaning" that describe technical terms, for example: [surface, shape, measurement]	6	5	1	
• Links to the World Wide Web (for some terms)	5	6	1	
• Photographs describing technical terms	9	2	1	
• Drawings and charts describing technical terms	8	4	0	

## Conclusion

### *Summary*

The *Online Technical Vocabulary Reference Tool for Deaf Students* described above was developed to address the critical need for deaf students receiving a technology-oriented education to acquire the technical vocabulary skills required for success in their courses and programs and for success in their future careers. In serving as an educational resource for deaf students, the Reference Tool helps to solve the ongoing struggle that faculty have faced in seeking appropriate and effective methods for teaching technical vocabulary.

As elaborated above, the Vocabulary Reference Tool employs best practices in technical education, instructional technology, and vocabulary teaching. Through the employment of best practices, the Vocabulary Reference has the greatest likelihood of achieving the desired educational outcomes for which it was designed. It is anticipated that students' successful use of this resource will lead to their improvement in knowledge of the language of engineering technologies and in their performance on projects and exams. It is also anticipated that its use will help to infuse English teaching principles across the curriculum, leading to students' overall improvement in English literacy and therefore to improved student retention. It is further anticipated that successful use of the vocabulary resource will facilitate NTID students' options for transferring to technology programs within other colleges of RIT. Finally, it is anticipated that the vocabulary resource will be extended to vocabulary instruction in other NTID programs and will provide a model of effective English teaching/learning strategies for other RIT faculty.

### *Evaluation*

Preliminary evaluation of the Vocabulary Reference Tool has provided promising feedback on the likelihood of successful fuller implementation and use of the resource. The two instructors who implemented use of the resource in their courses in spring 2005 gave it a positive review and suggested specific improvements. For example, it was suggested that the Reference Tool include "topical groupings" into categories such as electrical terms, mechanical terms, and machining terms. It was also suggested that there needs to be more consistency in the descriptions of technical terms. These recommendations will be followed.

Student reactions to the Reference Tool were also positive and promising. The majority indicated that the resource helped them in studying and learning technical terms and in preparing for their final exam. Further, they had positive reactions to all of the current components of the vocabulary resource.

### *Refinement and Expansion*

Based on the preliminary feedback, on currently recognized needs, and on existing best practices that we have not yet been able to include, we plan to refine and expand the Vocabulary Reference Tool to incorporate some or all of the following:

1. expansion of the list of technical terms
2. consistency across page entries for technical terms
3. cross-referencing of terms into topical groupings
4. refinement in the specification of semantic associations
5. cross-referencing of technical terms according to semantic associations
6. illustration of technical terms in larger segments of naturalistic scientific discourse
7. word tables and other schematics illustrating relationships among terms

8. additional links to related material and other resources
9. exercises that provide opportunities to practice the technical terms
10. assessment activities with corrective feedback

Still other refinements will be driven by instructors' and students' continuing experiences with the Vocabulary Reference Tool and the feedback that they provide.

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## Appendix A

**VOCABULARY REFERENCE TOOL**

## Faculty Survey

Please provide us with feedback on your use and your students' use of our "Vocabulary Reference Tool." Even if you used it very little in your courses, your feedback will be very valuable as we try to determine the usefulness of the reference tool and how to improve and expand it. If you did not use the reference tool at all, we would be grateful if you could review its features and then complete the relevant parts of this survey. If you did use the reference tool, please complete the survey after you have assigned course grades to your students this quarter. Thank you very much. – *Ray Grosshans and Jerry Berent*

1. Which course did you teach this quarter?  
Circle your answer:                      PRECISION MEASUREMENT                      AUTOMATED SYSTEMS
2. Did you use the *Vocabulary Reference Tool* at all in teaching or supporting your course(s)?    YES    NO
3. If you used the *Vocabulary Reference Tool* in teaching classes or labs, please explain how you used it with your students and how often:
4. Please explain any other usage of the *Vocabulary Reference Tool* for your course(s)—for example, in association with homework assignments, as a recommended tool for reviewing for the final exam, etc.
5. How did your students learn how to use the "Vocabulary Reference Tool"?
6. From your observations, how receptive were your students to using the *Vocabulary Reference Tool* for studying and learning technical terms?  
  
                         NOT RECEPTIVE AT ALL                      SOMEWHAT RECEPTIVE                      VERY RECEPTIVE
7. Based on your previous experiences teaching this course, is there any indication at all that the *Vocabulary Reference Tool* positively affected your students' performance on specific assignments, on the final exam, or overall? Please explain:
8. What is your assessment of the components (listed below) of the *Vocabulary Reference Tool* with respect to promoting teaching/learning of technical vocabulary, ease of use by students, etc.  
  
                         Alphabetical list of technical terms  
                         Simple definitions of technical terms  
                         Example sentences that include the technical terms  
                         "Pieces of meaning" that describe technical terms, for example: [surface, shape, measurement]  
                         Links to the World Wide Web (for some terms)  
                         Photographs describing technical terms  
                         Drawings and charts describing technical terms
9. In your opinion, would it be easy to expand the use of this *Vocabulary Reference Tool* to other NTID technical courses? Please explain:
10. Provide any additional feedback or suggestions for improving and/or using the *Vocabulary Reference Tool*?

## Appendix B

**VOCABULARY REFERENCE TOOL**

## Student Survey

Please answer the following questions about our "Vocabulary Reference Tool." Your feedback will help us to improve this reference tool. Give your completed survey to your instructor, but do NOT write your name on the survey. Thank you very much. – *Ray Grosshans and Jerry Berent*

1. Which course are you taking?  
Circle your answer:                      PRECISION MEASUREMENT                      AUTOMATED SYSTEMS
  
2. During spring quarter, how often did you use the *Vocabulary Reference Tool*? Circle one answer:  
  
NOT AT ALL              LESS THAN ONE HOUR              ONE OR TWO HOURS              MORE THAN TWO HOURS
  
3. If you answered NOT AT ALL for question #2, explain WHY you did not use the *Vocabulary Reference Tool*:  
  
*If you used the "Vocabulary Reference Tool" this quarter, please answer questions 4 through 10.*
  
4. Did you use the *Vocabulary Reference Tool* in class or out of class? Circle one answer:  
  
BOTH IN CLASS AND OUT OF CLASS              ONLY IN CLASS              ONLY OUT OF CLASS
  
5. Did your instructor show you how to use the "Vocabulary Reference Tool"?              YES              NO
  
6. How many technical terms did you look up and study using the *Vocabulary Reference Tool*?  
  
BETWEEN 1 AND 5              BETWEEN 6 AND 10              BETWEEN 11 AND 20              MORE THAN 20
  
7. In general, how helpful is the *Vocabulary Reference Tool* for studying and learning technical terms?  
  
NOT VERY HELPFUL              A LITTLE HELPFUL              VERY HELPFUL
  
8. How helpful was the *Vocabulary Reference Tool* in preparing for your final exam?  
  
NOT VERY HELPFUL              A LITTLE HELPFUL              VERY HELPFUL
  
9. What parts of the *Vocabulary Reference Tool* do you really like? Circle one answer for each part:  
  

Alphabetical list of technical terms	LIKE	NOT SURE	DON'T LIKE
Simple definitions of technical terms	LIKE	NOT SURE	DON'T LIKE
Example sentences that include the technical terms	LIKE	NOT SURE	DON'T LIKE
"Pieces of meaning" that describe technical terms, for example: [surface, shape, measurement]	LIKE	NOT SURE	DON'T LIKE
Links to the World Wide Web (for some terms)	LIKE	NOT SURE	DON'T LIKE
Photographs describing technical terms	LIKE	NOT SURE	DON'T LIKE
Drawings and charts describing technical terms	LIKE	NOT SURE	DON'T LIKE
  
10. Give us your suggestions. What should we do to improve this *Vocabulary Reference Tool*? Write your suggestions on the back of the sheet.