HOW WORKPLACE AND ACADEMIC ENGINEERING WRITTEN COMMUNICATION ABILITIES DIFFER: A FOUNDATION FOR COMMUNICATION ASSESSMENT

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Abstract ? Because of expectations that engineering and engineering technology faculty members assess students' abilities to "communicate effectively," it becomes necessary to understand what effective communication might look like in varying contexts. This piece discusses differences between engineering workplace and academic written communication conventions. Contextual differences include: readers, purpose, authorship, duration/ dissemination, processes of creation, and politics. Textual differences include: patterns of organization, and content. Knowledge of these differences can lead to more useful assessments of students' technical writing abilities.

COMMUNICATION EFFECTIVENESS IN CONTEXT

ABET's recent emphasis on outcomes assessment has caused Schools of Engineering and Technology to plan assessment of students' abilities to "communicate effectively" [1]. Many engineering and engineering technology (E&T) faculty who are not well versed in workplace communication and assessment may be uncertain about what to consider when assessing students' written communication abilities.

Evaluations of effectiveness are determined by the situation in which the communication occurs. Because people tend to communicate in ways appropriate to their contexts, many E&T academics may have lost touch or may have never reflected on how engineering communication in academic settings differs from that in workplace or public settings. A student (or faculty member) who can communicate well in an academic setting, however, is not necessarily going to be successful in workplace engineering communication [2].

Although ABET has not specified whether they want E&T faculty members to assess workplace or academic communication abilities as an outcome of students' educations, at the Purdue School of Engineering and Technology Indianapolis, faculty members have decided to assess students' workplace communication abilities. Doing so has led to reflection on the differences between workplace and academic written communication practices and conventions. Although the two overlap, understanding the differences can aid in assessment – and in E&T communication pedagogy.

Many people assume that when a person communicates effectively in one context, that person will automatically communicate well in all contexts. However, studies of recent graduates moving into workplace settings indicate that novices face a challenging transition as they move into the world of work [3]-[4].

Although no one can expect that E&T graduates will be prepared for every workplace challenge they face, faculty members can focus on the differences between writing they do in school and writing that they will do in the workplace. (E&T faculty, however, should not teach only workplace communication abilities; academic communication practices are appropriate and necessary for academic settings, just as workplace practices are appropriate and necessary for their settings.)

WAYS IN WHICH WORKPLACE WRITING DIFFERS FROM ACADEMIC WRITING

Much advice on technical communication given to engineers in academic settings, such as that given by Li [5], deals with how to communicate in academic contexts, but many E&T students will not continue in academic careers. Therefore, E&T faculty members at IUPUI designed a communication assessment program to take into account that most of the students will need competence in workplace communication abilities. (For more details of this communication assessment approach, see [6]-[8]).

In order to train faculty members to assess student written communication abilities that would be appropriate for the workplace, it is important to describe the differences explicitly. Research has indicated differences between workplace and academic communication in relation to:
Contextual Variables
?   Readers
?   Purposes
?   Authorship
?   Duration/distribution
?   Processes of creating
?   Politics surrounding the writing
These contextual variables lead to differences in documents:
Textual Variations
?   Patterns of organization
?   Content

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In addition to the more detailed discussion of these variables below, readers may wish to gain additional insights by consulting [9]-[15]. For purposes of simplicity, this discussion focuses on written communication; additional work needs to be completed on the differences between oral communication conventions in these two situations.

Contextual Variables

The effectiveness of written communication is dependent on the variables inherent in the context surrounding the written text. Effective communication comes from an appropriate adaptation to the variables found within the communication situation. In assessing student documents, it is useful to consider these variable features as much as possible.

Readers In academic settings, professors probably already know the information that students write about but will often read the entire document for purposes of grading. Therefore, student writers often need not be concerned with providing the professor with new or useful information, but rather to demonstrate their competence as fledging engineers or engineering technologists. In addition, much undergraduate academic writing is read only by the professor and no one else. In a way, this narrowness simplifies the students' task in writing. They only have to meet the expectations of one reader.

Professors who are themselves writing academic pieces for colleagues also have a sense of what those colleagues expect and why they might be reading that article. Academics read each other's papers to keep current with research developments and sometimes to judge the competence of the researcher. These purposes of the readers influence how academics write their articles.

Workplace readers, however, are typically more numerous and play a variety of roles. Engineers' co-workers, clients, politicians, and lawyers probably do not already know what the writers are going to tell them and may not read an entire document. In addition to a mixture of roles, these readers have varying interests and levels of technical knowledge.

Workplace writers usually need to discern which group of readers will be the primary audience for the document and which will be secondary. Upon that determination, the writers need to shape the document to accommodate as many groups of readers as possible. In addition, different groups of readers may read only specific parts of the document – managers may read the overview, the budget, and the timeline while technicians may read only the overview and the appendices.

An additional complicating factor arises when workplace writers consider that people who are not part of the originally intended group of readers may also read the document. Writers need to decide how much they wish to adapt their document for that group.

Getting to know one's readers is essential for professional technical writing. Paul notes that engineers and politicians not only have different sets of terminology, but also different ways of thinking. For instance, politicians often make a decision based on perceptions, facts, and political factors, [16] elements that technical experts may not always take into account. Engineering and technology students who are likely to be effective in workplace communication need to demonstrate that they can adapt their thinking to the typical and complex habits of their readers.

Purposes Generally, students write in courses to prove to their professors that they have mastered the content and skills required by the course. Faculty members may also employ to help students learn and retain central concepts in the course. Professors themselves write articles for colleagues to communicate general principles that apply in many situations in order to advance knowledge in the field.

Outside of academia, technical experts often write in order to accomplish a task within an organization such as persuading someone to make a decision, informing someone, or teaching someone how to perform a task. These purposes are very different from demonstrating competence or writing to learn. If a document fulfills the intended purpose for its intended readers, then it can be said to be "effective." In addition, many workplace documents are not intended to provide general principles, but they are intended to provide a solution to a local, immediate problem. Taking these workplace purposes into account when assessing student writing can help us determine what might be effective workplace writing.

Authorship In a school course, students usually write as individuals. At times, professors may provide for students to receive peer reviews of the document, but the final product is largely the responsibility of one person. Students are expected to give appropriate credit to all of their sources of information in order to avoid plagiarism. Professors may write research findings more collaboratively than students do, but as authors they take ultimate responsibility for their work.

In the workplace, on the other hand, documents are often collaboratively written. If a document is intended for an external readership, the authors can often be seen to be writing as the "voice" of the organization. Hence, even if one person is largely responsible for creating a particular document, it often undergoes extensive internal review cycles and revisions before it is released to external readers.

In addition, because the document is perceived to be the voice of the organization, writers can borrow heavily from "boilerplate" text that the company wishes to employ for anyone in the organization writing about a given topic. (One of the advantages of the "corporate authorship" is that if the document causes an event that provokes a lawsuit, the individual author is not held responsible; the corporation is.) Assessing the abilities of E&T students to carry out these collaborative projects may be difficult, but collaborative

writing is an essential skill in effective workplace communication.

Duration/ distribution of the document After a student writes a paper and the professor has graded it and returned it, typically no one else will see or have access to that paper. Students realize that the paper's only effect will be on the course grade. Students may not even keep their graded papers. Professors' articles will be filed and indexed for the retrieval of other researchers.

In the workplace, most documents are kept for a long time. Readers may be able to access them for many years afterward for information about on-going or past projects. In addition, the document may be copied and distributed to many people inside and/or outside the organization, often without the writer knowing that this has happened. Furthermore, all corporation documents, including preliminary notes, project logs, and internal e-mail messages may be subpoenaed in a lawsuit. Knowing that their words may have long durability and wide distribution may make workplace writers more cautious about what they write than about what they say.

Additionally, a single workplace document may be part of a set of larger documents in an on-going project. For instance, a progress report every two weeks will supplement the final report at the end of a project. Or, a report for an internal reader may be a companion piece to a report sent to an external reader. In software user documentation, a set of manuals intended for different readers may be included with the package of software. One can not assess the effectiveness of that single document without some awareness of how the document fits into a larger set of documents.

Process of creation In addition to the factors mentioned above, student writers often do not conceive of working beyond the boundaries that professors set for an assignment. They make their decisions based on their perceptions of what the professor expects. At times, this approach can lead to documents that might not be effective in other situations or that have unusual textual features.

In the workplace, writers may define the tasks, content, and approach needed to create the document. Some organizations have specific expectations for how documents should be formatted and organized, but even in those situations, writers need to decide on the scope and content of the document. These decisions, based on what the writers know about the readers, purposes, duration/distribution, and authorship of the document influence the final shape of a document. In assessing the effectiveness of student writing, E&T faculty members may also need to determine if the scope and approach is appropriate for an organizational setting.

Politics surrounding the writing Professors, in addition to playing the role of evaluators of student writing, also have the power to make assignments, give a course grade, and write letters of recommendation that may affect students' careers. Awareness of the professor's power may incline students to write in ways that please the professors.

In workplaces, readers may not know the writer and/or make pre-judgments against the writers' work, departments, or roles. Writers often need to establish the credibility and significance of the content and purpose in order to achieve the goals of the document for intended readers. They need to consider the power structure that will influence how their texts are received.

Textual Variations

In light of the contextual variables discussed above, the written products often take on the following features, depending on the situation of their production.

Pattern of organization Because academic writing often focuses on demonstrating the soundness of a concept and the ability of the writers, written reports often follow the order of investigation with conclusions appearing last. In this way, readers can follow the writers' thinking process more easily. Because readers are often likely to read all parts of the paper, a great deal of redundancy may not be needed.

Given that busy workplace readers – or those with special interests – may pick and choose only sections of the document, conclusions and recommendations often appear first in workplace writing. Usually effective workplace writers place general information first and detailed information later. The order of investigation is usually not of interest to the readers and their purposes, so writers seldom use that pattern to organize their content if they wish to be effective. Parts of the report may be read alone, so redundancy may need to be used selectively. In assessing effective workplace communication, an awareness of these typical patterns can prove useful.

Content As discussed above, people in academic situations often write about general technical or scientific principles that will apply in many situations. Specific applications of these principles may not be included in their writing. In addition, the content may be dealing with one "correct" answer. One may be coming up with a formula or routine that will always yield the same results. Finally, writers in academic settings may present facts without interpretations or recommendations.

Workplace writers are usually addressing a specific need for the corporation – a problem that needs to be solved in a specific place and time and with given resources and constraints. These writers generally are not concerned with whether or not their recommendations can be transferred to other situations.

In workplace writing, they frequently combine business concerns with technical concerns. Because of their less specialized readership, effective workplace documents may have less technical detail and terminology and more

interpretation than academic pieces. Finally, the document may address a problem that has many options for a solution, and the writers may have to argue for the "best" solution, not necessarily the only "right" one.

APPLICATION OF THESE PRINCIPLES TO COMMUNICATION ASSESSMENT

Understanding the differences between academic and workplace writing conventions and expectations can help E&T faculty members to focus their assessment of students' communication abilities. Because "effective communication" can be an ambiguous term, articulating expectations for each sphere of communication can help to clarify typically tacit assumptions and can lead to more appropriate assessments.

If readers assess an academic paper with workplace criteria or if they assess a workplace piece with academic criteria, the results will be less useful and reliable than had appropriate criteria been used.

At IUPUI, E&T faculty assessors have not only chosen to assess students' workplace communication abilities, but they are trained to understand the differences discussed above. This training has helped them to provide reliable and relatively consistent assessments of student writing. In addition, the artifacts that faculty membersassess typically include the students' brief explanation of the workplace context in which their communication is situated. This explanation typically facilitates assessment; when such explanations are missing, faculty members often ask for them.

Naturally, some of the variables discussed above may not be immediately obvious from looking only at a text, but a general understanding of the contextual and textual variables can be useful for assessors in the complex process of assessing students' written communication abilities.

CONCLUSION

Specific academic and workplace settings may provide principles different from those summarized in Table I. However, knowing these typical differences can guide E&T faculty members as they conduct communication assessment. If they are not aware of these differences, they may assume incorrectly that the standards for academic communication can predict how well students may communicate in the workplace.

Although E&T faculty may be aware on some level that academic and workplace communication practices differ, articulating those differences can make assessors more aware of their expectations and thus the standards they apply as they assign and assess student writing.

TABLE I
OVERVIEW OF DIFFERENCES BETWEEN ACADEMIC AND WORKPLACE WRITING

	Academic Writing	**Workplace Writing**
Readers	Professors, other academics	Multiple roles, may be greater in quantity
Purposes	To prove competence, to arrive at general principles	To solve an immediate problem or meet a specific need. To move someone to action, to teach.
Authorship	Generally individual or a group of individuals	Collaborative, usually representing the organization with whom ultimate responsibility lies.
Duration/ distribution	Relatively limited	May be preserved for many years and widely distributed
Process of creating	Students may not go beyond professors' expectations	Writers may be able to determine the scope of their documents.
Politics	Professors have some power over students, but generally they play the role of evaluators.	Readers may have biases and political agendas of which the writers are unaware.
Patterns of Organization	Often organized in the order of discovery, with conclusions last.	Best organized with conclusions and recommendations first. Redundancy essential.
Content	General principles and routines.	Responses to immediate situations and needs.

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