

article:2280**Teaching Communication in Capstone Design: The Role of the Instructor in Situated Learning**

Background and theoretical framework: This study grows out of two key strands in writing research: situated learning and rhetorical genre theory. **Situated learning**, which has its roots in the work of Wenger and Lave as well as Vygotsky, emphasizes the importance of social contexts in learning and describes the way learners develop as they participate in authentic tasks. Research on the development of student writers emphasizes the ways in which writers develop in response to particular social and academic contexts, and the resulting difficulty in transferring learning not only from school to work but from one course to another. Writing emerges not as a mechanical skill but as a contextualized practice. **Activity theory**, growing out of developments in genre theory, emphasizes the work documents do in mediating information exchange and professional activity. Consequently, the form, structure, and content of a document do not follow a fixed abstract template but rather emerge from the particular audiences and purposes the document is designed to support. As a result, learning to write is not simply a process of learning specific formats, grammatical structures, or sentence patterns. Rather, much like engineering design, it involves learning to first identify the users and functions of a given document and then to apply rhetorical principles to design and develop something that enables users to achieve their goals.

Prior writing research includes multiple qualitative studies that examine the development of writers in different contexts, including graduate students moving through their programs, undergraduates in writing courses, students in co-op experiences, and recent graduates transitioning to the workplace. These studies consistently point to the situated nature of learning and the importance of understanding meta-level skills associated with analyzing each communication situation and adapting all elements of the document or presentation to fit the specific demands of that situation.

Research Questions: While a number of studies tracing student development exist, few have focused on the role of student-faculty interactions in this development. Yet both situated learning and genre theory suggest that these interactions are critical. Moreover, these studies suggest that while dedicated writing courses such as first-year composition and technical writing have an important role to play in student development, writing within students' disciplinary courses is also a powerful force. In engineering, the ability to communicate effectively is a central student outcome, yet little of the engineering education research on this issue draws on the deep body of writing research to identify specific pedagogical strategies engineering faculty can employ. As a result, this study addressed the question, "How do instructors interactions with students around communication assignments influence learning with respect to effective communication practices?"

Methodology: Because the literature within engineering education research lacked a strong tie to the extensive body of writing research that addresses student development, the article provides a substantial literature review to help ground the audience and establish the key theoretical and empirical frameworks. This literature review is followed by a case study that examines the student-faculty interactions around progress reports in a capstone design course. The case is used to illustrate the key theoretical constructs within a specific engineering context and to extend our understanding of the role faculty play in this learning environment. Data collection included observations of a series of meetings between the faculty member and each of the student design teams, surveys of the students regarding communication knowledge and practice, and interviews with selected teams. The data was analyzed thematically using open-coding.

Major Findings: The literature review provided the theoretical framework for interpreting the data and describing the student-faculty interactions. Using this lens, the case study illustrates the critical role these interactions play in student learning. Even with assignments patterned after workplace expectations, students can still experience a sharp bifurcation between classroom and workplace contexts, and as a result may not necessarily develop transferable communication skills. The meeting observations pointed to multiple instances in which the course instructor relied on “requirements” as the rationale for what students needed to include in their reports, rather than emphasizing the functionality and value of the information to the intended users. The student interviews revealed a relatively high level of frustration with requirements that seemed to lack a clear function, and these frustrations represented lost opportunities for targeted situated learning to occur.

Recommendations: The paper concludes with a series of recommendations for integrating communication into engineering courses in ways that support student learning:

- Design assignments that reflect real needs for information exchange between students and faculty, and make those needs explicit both in the assignment and the evaluation process
- Explicitly verbalize the differences between school and workplace documents to help students understand that they are learning a communication process, not a rigid set of formats or stylistic rules.
- Explain the functionality of classroom documents and clearly link assignment requirements (e.g. required content or organizational) to information use (e.g. tracking a project or evaluating design decision-making) to help students understand the relationship between design and function.

- Use documents to mediate critical exchanges of information within the engineering design process to help students see and experience the complexities of information exchange in practice.
- Emphasize the need to continually adapt communication practices to situational exigencies to help students develop the flexibility needed to transfer skills learned in the classroom to skills needed in the workplace.

In addition, the study highlights multiple future research projects, including the following:

- What communication assignments provide the best opportunities for situated learning in design courses?
- How do communication practices in design courses support students' technical development?
- What variations occur across design settings – from one discipline to another as well as from freshman to senior projects, and how do those variations influence communication learning?
- What opportunities for situated learning occur in other components of the engineering curriculum? How might instructors in other courses actively support the development of communication skills?

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