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Article

Writing in Practice: A workshop to address genre-specific conventions of the first-year Engineering Notebook.

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To prepare students to write in discipline-specific contexts, writing programs have sought to equip students with a broad set of skills transferrable to their academic community. However, due to variation in academic discursive practices and the increasingly diverse tasks and genres across the disciplines, disciplinary literacy is necessary for students to be able to fully participate in their respective academic community. Novice writers at the university have to grapple with the complex nature of academic discourse and specific disciplinary writing tasks. Thus, raising student's awareness of genres specific to their disciplines can increase their appreciation for discursive practices in their field. The Engineering Notebook used in professional engineering is an example of a specific genre of writing common in engineering (Bergsman, 2018). First-year engineers are not only unfamiliar with this new genre, but the task of documenting relevant content can represent a challenge. As an important pedagogical tool that requires adherence to specific discursive standards and practices, the engineering notebook represents a professional genre that engineering students have to repeatedly engage in while preparing for their future career.

Although various engineering disciplines might determine how an engineering notebook is used, the notebook is commonly utilized to record observations, capture details, document meetings, problems and solutions, and graphically represent plans and sketches. Specifically, from a pedagogical standpoint, when students engage in the design process, the notebook can serve to record decision-making processes. Bergsman (2018) posits that the notebook serves as a support tool for students to learn and think about design. She notes that "for a student engaging in the complex work of design for the first time, knowing how to plan and carry out a design project specific to their discipline, how to document the process, and how to make their invisible design thinking processes visible in a blank book can be a challenging task" (Bergsman, 2018 p.4). Therefore, the notebook functions as resource that not only scaffolds the design thinking process, but also supports

the discursive practice of documenting information. From a professional standpoint, the notebook functions as a living document which professional engineers can reference while working on a project or it may function as a "product-based document" to be used as a source of evidence in court (Berland, McKenna & Peacock, 2012). Some engineering notebooks may also be referred to as field books, for example, in Civil Engineering, because of the more pronounced split between work that is done at one's desk and work that is done in "the field" or "on site" or as a log or journal in other engineering fields. In many ways, it is used as part of the self-regulation of the practice (P.Kinnear, personal communication, 2018).

The Engineering Notebook Workshop

The first-year engineering foundational design course at a large Canadian University introduces the design process to students through project-based teamwork. To maintain focus on the design process, the projects assigned tend to represent a broad range of engineering disciplines; for example, some teams might be assigned projects relating to civil engineering topics, while other projects might represent electrical and computer engineering fields. Consistent with the design process are the exploratory approaches of identifying a problem and developing creative solutions (Bergsman, 2018). Within this context, the sources of documentation in the notebook could range from site observations to design details, teamwork and decision-making processes. In this specific course, students were responsible for documenting the design process and any relevant content in their notebook, which was then evaluated against a rubric. They were encouraged to use their notebook spontaneously and systematically and instructions on how to use the notebook were provided in the course materials. In support of this large first-year engineering design course, I offered a one-hour engineering notebook workshop. The aim of the workshop was to inform novice engineering students of the engineering notebook genre and give them an opportunity to experience the process of documenting their observations first-hand. While workshops such as these may present an artificial learning environment, the practice of engaging in communication strategies to record information and making informed decisions is at the heart of the process.

Due to the specific nature of the engineering notebook genre and conventions associated with it, the workshop commenced with a description of the engineering notebook formatting characteristics, which were put up on the white board. Each characteristic was then described in terms of its relevance and purpose. Students were reminded that the notebook functioned as an evidence of responsibility and therefore, any information entered required legibility, clarity and consistency. For

example, they were advised to record information in ink, note the date, location and title and clearly indicate a purpose for the observation/notes at the top of the entry. Students were also encouraged to sketch their observations and capture details accurately leaving space in the margins for additional notes that may stem from the reflection process. These organizational characteristics represent basic genre conventions associated with the engineering notebook (Berland, McKenna & Peacock, 2012).

Next, I presented a holistic view of the generic processes involved in documenting notes in the engineering notebook. A graphical representation such as the one below was put up on the board:

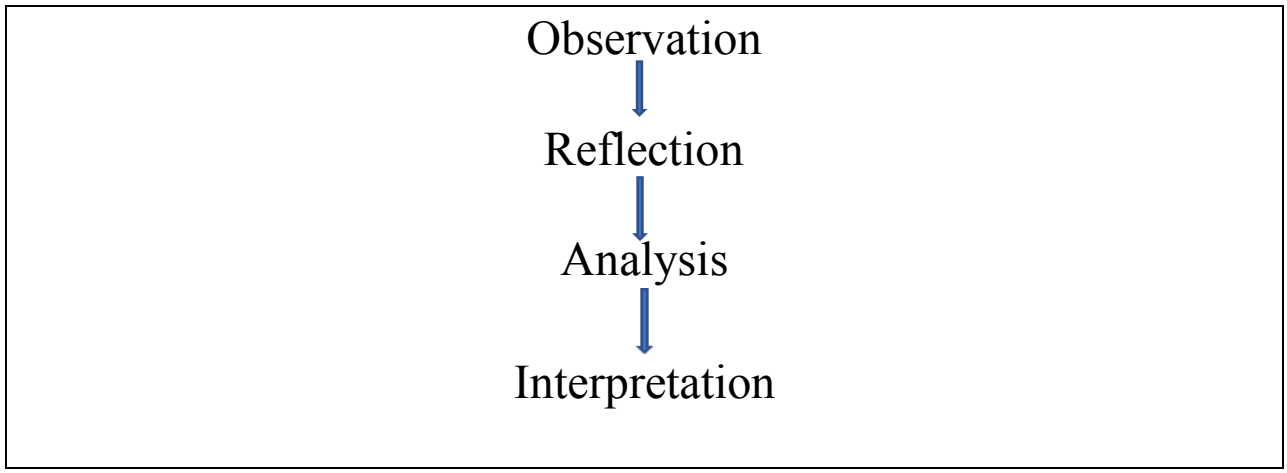

Figure 1. Graphical representation of the documentation process

As can be seen in Figure 1, students were informed that the first step included observation, in which they would study the activity and document the natural situation. This observation could occur at a team meeting online or at an actual physical site. The next step included reflection in which they would revisit their notes followed by analysis, in which they would systematically start to examine their content. This process could take place soon after they capture their observations or at a later time. Finally, interpretation would allow them to assign meaning to their analysis. This step would occur once the previous two steps were completed. Nonetheless, they were advised that each of the steps occurred gradually and iteratively.

Observation

The next stage in the workshop involved observing and documenting. The purpose of the observation was to provide students with an opportunity to spontaneously conduct a first-hand documentation

of any ongoing activity. For instance, in our workshop, the group of students were directed to a construction site just outside the campus building. We were lucky to have ongoing construction on campus which facilitated our site visit. In addition to the construction site, the pit on campus or a nearby crosswalk were also considered as potential options. Sites selected could be indoors as well. The goal is to find a place with ongoing activity to enable students to return back to the site in order to capture further details for clarification. The group in my workshop was given 20-25 minutes to document and record their observations of the site, paying attention to the role played by various individuals on site in addition to the surroundings. Taking into account discursive expectations of the reader, in this case, their Teaching Assistant, they were advised to capture details in way that would create a mental representation of their observations; for example, by using the active voice.

The experience of documenting information in the engineering notebook can be compared to a field researcher who collects data in natural settings to explore human behaviours. Through this type of immersion in the field, student engineers get to become familiar with the unknown, thereby learning to understand which information may be relevant and important to record using written discourse. They learn to carefully observe and record activity, the surroundings, the noise, the smells, people and any impacting factor that might play a potential role in the site observed. Student engineers must also learn to see the world through their engineering lenses (which may be different based on their specific disciplines). The experience of both seeing and documenting what they see acts as one activity to help develop students' engineering eyes (P. Kinnear, personal communication, 2018). In this workshop, students were reminded to focus on safety concerns, numbers for potential calculations, processes, systems, machines, traffic and roles of people they observe. Their perceptions captured through their observations may be represented through words, drawings, sketches, numbers and flowcharts, all of which characterize the multimodal element of recording data.

Reflection

Following the observation, the next step involved reflecting. The purpose of reflection was to provide students with an opportunity to revisit their documented content. Upon returning from their field observation, students in the workshop were given time to read and reflect on the information collected. Additionally, in order to employ a reader responsible approach to writing, they were encouraged to adopt a reader perspective and function as a target audience reading their notebook. One purpose for this strategy is to allow novice writers to carefully think about other potential readers such as project managers or assessors who might need to access their engineering

notebooks. This process encourages students to convey information in a manner that facilitates comprehension. As soon as writing is conceived as a social interaction, writers can reorient themselves towards the composing process and understand the social implications of their writing (Trimble, 2000).

To iterate the reader perspective in the process of documentation, students were asked to briefly switch notebooks with their peers in the workshop to read their notes. The goal here was to transform the solitary experience of documenting and recording information into a peer activity. This allowed students to recognize that although everyone in the group observed the same site, perceptions and beliefs about what to include might vary. How students perceived the utility of their engineering notebooks could impact their use (Berland, McKenna and Peacock, 2012). Adding a social dimension to the workshop entailed giving engineering students an opportunity to collaborate and gain perspective into their peer's representation of information. Through this experience, "writers presumably learn that their reader is a "constructive participant" in communication, actively construing and misconstruing a text" (Kroll, 1984 p.181). This activity lasted for no more than 10 minutes. Finally, they were advised to engage in a deeper reflection process at the end of the day.

Analysis

The next step entailed the process of analysis. The purpose of the analysis phase in the workshop was to allow students to examine their documented notes and organize it. Through the exploration of data, students can initiate the process of analysis. In the workshop, they were encouraged to sort through their content and categorize it as a further aid to organizing and determining the relevant from the irrelevant. Students were encouraged to colour code and categorize information based on concepts learned in the course. For example, they could label categories as built environment, or natural environment or safety issues, to name a few. Similar to qualitative research methods of systematic data analysis, categorizing data can be "aggregated together to form a major idea" (Creswell, 2007, p.271). Through examining various categories over the course of their project, students can detect links that may reflect a pattern or potential design idea or even recognize the changes in the design process that occurred throughout the project. When students connect links in their data and assign labels, they are able to move from analysis to interpretation.

Interpretation

The next stage in the notebook documentation process involved interpretation. The purpose of engaging students in the interpretation process was to give them practice in assigning meanings to their labeled categories. In the workshop, students were encouraged to interpret their categories from the perspective of the design challenge they were working with. They were also reminded that the process of interpretation might lead them to construct and re-construct meaning, which highlights the subjective nature of the process (Creswell, 2007). In the workshop, students were informed that initial observations may not necessarily provide sufficient information and therefore, several interactions with the site or activity could yield more useful content. Similar to ethnographic research, repeated visits to the observation site may be necessary to gather data iteratively (Creswell 2007). Considering that the interpretations are grounded in the observation, more evidence might be needed as the next step, which would warrant future visits to the site or further research. Students were also reminded that their engineering notebooks would be used throughout their design project; therefore, they should expect to see changes in their observations and notes as they become more focused and practiced. Nonetheless, the process of engaging in reflection and interpretation allows students to consider which next steps to take, what questions to ask, and to develop their knowledge by researching unfamiliar topics. Ultimately, the experience of analyzing and interpreting content gathered in their engineering notebook is useful in problem-solving, a skill which engineers engage in throughout their career.

This workshop was specifically designed for first-year engineering students in the aforementioned first-year design course. Despite the one-hour time frame, the workshop set up allows students to not only experience and record first-hand observations, but it also enables students to understand the subjectivity involved in the documentation process. While not all real-life observations may have limited time constraints, this experience prepares students to record information spontaneously. Through the peer collaborative activity of reading each other's notebook entries, novice engineering students were given an opportunity to adopt a reader perspective which could likely influence the construction of future texts. The latter activity will also serve to remind students that the notebook entry process must consider target audiences. While 20-25 minutes for observation may seem insufficient, students could gain familiarity with the complexities involved in writing simultaneously while observing; that is, they have to make important decisions of what to

document and how to represent it in writing. Thus, through this experience, students could develop awareness about one genre-specific literacy practice common in the field of engineering.

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