Board 323: Investigating Engineering Undergraduates' Writing Transfer from Two First-Year Writing-Intensive Sites to Introductory Engineering Labs

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Work-in-progress: An Investigation of Engineering Undergraduates' Writing Transfer from Two First-Year Writing-Intensive Sites to Introductory Engineering Labs

Abstract

Transfer of learning theory explains how learners can apply their previously acquired knowledge and skills in a new situation or context. In the context of writing transfer and lab report writing, first-year writing courses can act as one kind of previous learning experience or as a transfer source, and lower-division engineering labs can be the new situation or the transfer target. This preliminary study investigates how engineering students' prior writing experience affects their lab report writing in lower-division introductory engineering labs. This study uses two distinct sites of first-year writing-intensive courses: one rhetorically-focused and one literature/philosophy-focused. We collected student samples (n = 9) from three universities offering these two distinct sites and approaches. We compared the content, outcomes, and writing expectations of the first-year writing-intensive courses offered by the three schools. Next, we conducted a rhetorical analysis of research papers collected from the writing-intensive course samples to identify each site's writing knowledge and skills. The same analysis was applied to the student's first lab reports collected from the introductory engineering lab courses. We then compared the writing knowledge and skills between the first-year writing-intensive course samples and the engineering lab report samples to investigate how learning transfer occurred in the student writing at these three different sites. The criteria used to conduct the rhetorical analysis of writing samples focuses on writing outcomes most relevant to engineering lab report writing (relating to audience awareness, organizational structures, presentation/analysis/interpretation of lab data, use of primary and secondary sources, and document style design). We identify the prior writing knowledge and skills of the two distinct first-year writing-intensive course sites by investigating obvious points of productive transfer. This study provides a better understanding of how undergraduates use writing knowledge and skills earned from varying first-year writing-intensive contexts when writing their engineering labs.

1. Introduction

Many engineering programs require students to take writing-intensive courses such as first-year composition (FYC) to establish fundamental academic writing knowledge and skills at the beginning of their programs of study [1]. Although engineering students learn how to write in academic settings from FYC, they struggle to write lab reports in their lower-division introductory engineering lab courses [2]. Indeed, writing experience between FYC and introductory engineering labs must be distinct due to their disciplinary knowledge and conventions. However, it cannot be said that they are not completely unrelated [3]. According to the transfer of learning theories [4], the knowledge and skills gained in one learning situation can be effectively applied to new, different situations. Students possess a broad range of prior

knowledge and skills, which influence their learning on in-coming topics. Therefore, engineering students' knowledge and skill earned from general education writing courses might influence their writing in the disciplines [3]. Our previous studies investigate that a transfer-focused writing pedagogy made positive impacts on engineering undergraduates' learning in lab report writing by reinforcing and expanding on students' learning from FYC [5-8].

Scholars in writing disciplines have studied "writing transfer," which is defined as "a writer's ability to repurpose or transform prior knowledge about writing for a new audience, purpose, and context [9]." Yancey et al. [11] established three writing transfer modes: remix, assemblage, and critical incidence. Remix is characterized by the amalgamation and synthesis of fresh insights and existing knowledge, yielding "novel understandings of composing that may evolve over time". In remix scenarios, students showcase their capability to merge new knowledge, such as writing engineering lab reports, into the framework of pre-existing knowledge, here derived from composing research papers in general education writing courses. In our analysis, we consider remix transfer when a student demonstrates successful adaptation of their past writing knowledge from general education writing courses to the engineering lab writing context and genre expectations. The students in the assemblage group can be characterized by their inability to transform previous writing knowledge for new tasks and a limited understanding of lab report writing expectations. Assemblage occurs when students excessively depend on their existing concepts of writing, leading to a strategy where they "graft" fragments of new learning about writing onto their prior knowledge. In this scenario of utilizing prior knowledge, new writing knowledge required for engineering lab reports is appended rather than integrated, merely attached without significantly modifying or enhancing pre-existing notions of writing and writing tasks. A critical incident arises when writing transfer is either minimally successful or completely unsuccessful. Described as a process, a critical incident is characterized by a mismatch between prior knowledge and new writing tasks, leading to an immediate failure in effectively adjusting to the new writing context and expectations.

In the context of engineering education, students' learning about writing in general education writing courses is considered to be a transfer source. Their writing in introductory engineering lab courses is a transfer target. Writing transfer between general writing courses to writing in engineering lab courses can be considered as far transfer due to their disciplinary distinctions [11]. Although FYC instructors and administrators in writing programs established the WPA 3.0 outcomes [12] to standardize the student outcomes of their FYC or general education writing courses in the lower division, a wide range of variations exist across schools and programs. Considering a range of transfer source contexts, it is largely unknown how engineering students transfer their writing knowledge from FYC to introductory engineering labs. This preliminary study aims to investigate engineering students' writing transfer of their prior writing knowledge to introductory engineering lab writing in three distinct sites. The general education writing structures vary among the three sites: one communication-focused, one rhetorically-focused, and one literature-focused. We will collect and analyze qualitative data to inform empirical evidence of engineering students' writing transfer under the three sites.

2. Methods of Approach

2.1 Institutional context

This study was conducted across engineering programs at three universities: a polytechnic university offering ABET-accredited programs in civil, electrical, mechanical, and renewable energy; a liberal arts-anchored private university with ABET-accredited programs in civil, electrical, and mechanical; and a branch campus of a research-one (R1) land grant university offering ABET-accredited programs in electrical and mechanical engineering. Engineering students at two of the participating schools, namely the Polytechnic University and a branch campus of an R1 university, are required to complete First-Year Composition (FYC) courses. These FYC courses are centered on rhetoric and specifically crafted to further support students' compositional skills aligned with the WPA 3.0 outcomes [12]. At the Polytechnic University, a mandatory technical writing course (taught by Communication faculty) is offered each quarter during the sophomore year. Consequently, most students undertake an introductory technical writing course, focusing on technical report genres, either before or concurrently with early engineering lab courses. In contrast, the private university does not incorporate an FYC course or a technical writing course into its engineering curriculum. Instead, their general education writing-embedded course (ENG 112: Thinking Through Literature) is literature-oriented and designed to introduce literary genres and criticism through writing about literature.

2.2 Student lab report sample collection

We recruited student volunteers (*n=3 for each site*) in the three sophomore-level civil and electrical engineering courses at three different universities in the academic years of 2020-2021 and 2021-2022. The course delivery modes were a mix of in-person and online. The student volunteers signed their consent, which was approved by each institution’s internal review board (IRB). We collected students’ final papers for general education writing courses, including FYC, and lab reports of the first lab from the three participating engineering lab courses. We compared the general education writing course samples and the first lab reports to identify the prior writing knowledge of each site by investigating obvious points of productive transfer.

2.2 Student writing sample evaluation process and instrument

All the sample lab reports were assessed using the attached rubric with three criteria: engineering convention, genre awareness within results and discussion, and use of external sources for technical information to interpret data. Indicators of each criterion are also introduced in Table 1. The level of productive transfer was evaluated based on Yancey et al.’s three transfer modes [11]. Remix is defined as happening when prior writing knowledge is shown to be successfully adapted and integrated from one writing context into a new writing context; assemblage occurs when students' transfer of previous writing knowledge into a new writing context is uneven; Critical incident occurs when prior knowledge is over-relied upon and inappropriately applied to a new writing context.

Table 1. Student writing sample evaluation instrument

Criteria	Indicators of each Criterion	Level of productive transfer
Engineering Conventions	• Construction of Introduction Move (cf. Swales, 1990 [13]) • Construction of Methods Move (cf. Swales, 1990 [13]) • Construction of non-text elements • Discussion of non-text elements	• Remix: a successful adaptation of their past writing knowledge to the engineering lab writing context and genre expectations. • Assemblage: an attachment without significantly modifying or enhancing pre-existing notions of writing and writing tasks for lab writing. • Critical incident: a mismatch between prior knowledge and new writing tasks, leading to an immediate failure in effectively adjusting to the new writing context and expectations
Genre Awareness w/in Results and Discussion	• Explanation of Quantitative Data • Identifying Action Based on Quantitative Data • Explanation of Other Data • Identifying Action Based on Other Data	
Use of External Resources or Technical Information to Interpret Data	• Appropriateness of External Information • Citations	

3. Case Study Results and Discussion

3.1 A polytechnic university

The polytechnic university in our sample requires 18 credits of "Communication General Education." Historically, this included two three-credit composition courses, a three-credit public speaking course, and nine credits of additional courses, typically involving one or two technical writing courses and a small group communication course. In the Fall term of 2021, this institution transitioned to a model where students were required to take one four-credit composition class, and either a second four-credit composition class or a four-credit technical report writing class. Because of this change, students in our sample were on the bubble and could choose to graduate under either the old or new requirements. This may be a confounding factor in analyzing transfer among the students in our sample; however, all students take both communication studies and writing no matter what. While the writing courses at this institution are administered under the heading of Communication General Education and the Communication Department, they are taught by faculty from the discipline of Rhetoric and Writing.

We collected lab report samples from the first lab of a sophomore-level civil engineering lab course. The following section provides a rhetorical analysis of three students, coded as EF, SM, and HB.

Student EF's sample includes a researched argumentative essay from FYC and a lab report memo. Student EF clearly demonstrates remix in the transfer process. Their work shows strong genre awareness of both humanistic researched essays and memos, but confidently uses similar rhetorical features in both.

EF's research essay and lab memo both show reader-centered choices that are appropriate to each of their genres. For instance, their essay introduction previews the entire paper's argument using sequential language to walk the reader through what to expect. Similarly, their lab report's introduction contains a preview of all the sections the memo will contain. The following table depicts portions from the two samples, and we underlined the evidence of productive transfer.

EF Research Essay	EF Lab Report Memo
In order to illustrate the connection between sports and happiness, I will first describe the three most common ways people achieve happiness in their lives, in order to give context to what it means to live a happy life. Next I will describe in more detail the gap in the course conversation about happiness, and how sports play a role in happiness throughout a person's life. Then I will directly answer my research question by explicitly connecting athletic participation with long term happiness in a person's life, more specifically, how each of the three approaches to happiness can be achieved through sports. Finally, I will conclude with a brief summary of the conversation, and how sports can have lasting impacts on a person's happiness.	This lab memo outlines the entire lab, starting with the methods of the lab. Results and analysis of the results are also included, and a conclusion summarizes up our findings. References and an appendix are included to wrap up the memo.

Even though essays aren't technical writing, persuasive writing can demonstrate many features that productively transfer to a technical context. Both kinds of writing need to use evidence to support claims, and both kinds of writing need to make their point clear and easy to find for the reader. One way EF does this in both samples is by making organization explicit. Both of EF's samples use appropriate headings to guide the reader through the document. The essay used the headings Introduction, State of the Debate, Identifying the Gap, Effect of Sports on Happiness, Counter Argument, Conclusion, and References. The lab memo used Introduction, Methods, Results and Analysis, Discussion, Conclusion, References, and Appendix. The student did not borrow any inappropriately specific labels from the essay context, but did productively transfer this knowledge by remembering to use headings and choosing good ones.

Student SM's sample includes a researched technical report in a technical communication course and a lab report memo. The lab report is only three pages and less than 700 words long, which gives fewer opportunities to see transfer happening, but some areas of interest are identifiable in the document.

SM's sample is confounding as the researched report contains many features that could be directly transferred for use in an engineering lab report, but aren't demonstrated in this sample. For instance, their report thoroughly introduces the task at hand and previews the conclusions, but their lab report introduction is extremely brief. While it was expected that direct instruction in technical communication would produce clear remix transfer, this was not evident in SM's sample to show assemblage transfer.

SM Technical Report	SM Lab Report
This paper is divided into three sections, one for detailing each type of ABC. Each section contains how the technique is performed, how it compares to conventional construction alternatives, and how the ABC technique improves sustainability. Based off this research, it was concluded that accelerated bridge construction should be implemented more because it will lead to reduced traffic impacts and is more sustainable than conventional construction.	I have completed the creep testing assigned in Lab 1 for Strength of Materials. The methods, results, and discussion of the findings are provided in this memo.

However, SM's analysis section remixes prior knowledge about appropriate use of figures and tables. Their non-text elements are successful in presenting data appropriately, labeling axes, and applying a trend line.

SM Technical Report	SM Lab Report
Figure 3. Comparison of user costs for passenger cars and trucks for SIBC and CC. Data from (Yavuz Attanyake, and Aktan 2017)	Figure 1. Displacement and time for a simply supported 7-foot 1x6 timber beam loaded at mid-span with 40 lbs. A logarithmic trend line is applied and an equation and R^2 values are displayed.

Thus, student SM shows some elements of assemblage transfer and some elements of remix transfer. A longer sample from the student might have more locations to identify transfer learning.

Student HB's samples include an argumentative essay from FYC and a lab report memo from the sophomore-level civil engineering lab course. This lab report sample was the shortest of all three analyzed here, at only two pages under 400 words. This alone might suggest a critical incident where the student's understanding of what constitutes a fully developed piece of writing (engineering writing or otherwise) was not applied to this context.

Similar features between genres fail to appear with significance in HB's samples. This could indicate a critical incident when enough prior knowledge was not present or activated regarding document structure, rhetorical awareness, or interpretation of data. For instance, the following table shows the thesis of the student's essay compared to a statement of purpose from their lab report. The lab report does not elaborate on why the beam is being tested (contrary to EF's

sample, which notes that students have been asked to predict the creep of the material for the next 100 years).

HB Argumentative Essay	HB Lab Report Memo
In order to uphold its value in the nation's changing economy, universities must reform their educational systems to be centered around life skills required to be a contributing citizen of the nation. This requires universities to rethink the way that their system is structured to create employees-- and make sure that they can ensure to develop students to be more than just employees.	This memo contains the methods, results, and discussions for the creep testing of a wood beam.

On the other hand, neither HB's lab report nor essay exhibited the use of headings, previewing, or other reader-centered rhetorical moves that prepare or guide the audience through the text. This again suggests a critical incident in learning requiring an intervention with the student to prevent future misalignments.

3.2 A branch campus of a research-one land grant university

Part of a multi-campus public research institution, the engineering program at a branch campus of a research-one land grant university offers degrees in electrical and mechanical engineering. As part of the general education curriculum, both programs require six written communication credits and six writing-in-the-major credits. The written communication credits are fulfilled by a FYC course taken during the first year and a technical and professional writing course, taken in the third year. The upper-division writing-in-the-major courses are generally fulfilled during the third and fourth years. For the purposes of this study, the artifacts for this analysis come from students enrolled in the electrical engineering program, including research papers from their first-year composition courses and introductory lab reports from a 200-level course (Design of Logic Circuits). For each of the three student samples discussed, the first-year composition course was taken prior to the electrical engineeringlab course. We collected first-year research papers from the FYC courses and the first lab reports from the lab course. Coded as SA, JN, and MS, the pair of artifacts for each student is discussed below.

Overall, the writing samples from student SA illustrate critical incident in the transfer process. While they both demonstrate an awareness of genre, both are underdeveloped. As such, genre awareness is somewhat superficial, and there is inconsistency when it comes to audience awareness. For example, the introductions for both the research essay and lab demonstrate awareness of introductions as structural and rhetorical, posing a question to introduce the research essay and identifying the focus of the lab report upfront:

SA Research Essay	SA Lab Report
Are electric cars better for the environment compared to their gas-powered rivals? In the hybrid category itself there are normal hybrid vehicle and plug in hybrid vehicle. Hybrid vehicles encompass the technology of both internal combustion engines and electric motors and battery. The key difference between an hybrid vehicle's and an plug in hybrid vehicle's is the usage of the electric motors and size of the battery. The plug in hybrid vehicle's are designed to drive with the use of the internal combustion engine. The range of plug in hybrid vehicle's are not comparable to electric vehicles. Hybrid vehicle's are designed to support the gas engine from start, and stops allowing for increased city miles per gallon (Witzenburg). Internal combustion engine produce pollutants and damage the environment from the moment the resources are mined to production of the vehicle and to when the vehicle is no longer is in use. For electric cars, the source of pollution and environmental damage is at the production of the vehicle and the production of electricity that is used to charge the battery.	The goal of this lab was to understand binary addition and subtraction. This would be done using a breadboard with switches and integrated chips. This would create a circuit that would display the output onto a led light strip. The key difference between addition and subtraction is that when circuit has to do subtraction the circuit first has to do 2's complement to the binary input.

At the same time, the introduction for the research essay goes on to list information about hybrid vehicles, but the purpose of this information is not made clear for the audience. The purpose of the paper is not established for the audience via an identifiable thesis in the introduction, an expected convention of the first-year research essay. We see this unevenness in the lab report introduction, too, where the goal of the lab is identified ("to understand binary addition and subtraction"), but the purpose of the lab report is not captured (the "why?" behind this understanding in the contest of electrical engineering.

Another indication of critical incident happening is demonstrated in the interpretation of quantitative data. Both the FYC research essay and the ECE lab report include quantitative data, but the interpretation of this data in the lab report is minimal to nonexistent in the Discussion section of the lab report:

SA Research Essay	SA Lab Report
The source of electricity to power electric cars has an impact on the amount of pollution electric cars produce as well. In The United States the U.S Energy Information Administration states that 60.6% of the energy in the US in created from fossil fuels (EIA). The main two sources for fossil fuels are natural gas which is at 40.5% and coal which is at 19.3%. These two sources make up the majority of the power sources in the US. Nuclear power comes behind at 19.7% and renewables coming in at 19.8% (EIA). With this data, this shows that the average	Before inputting the numbers into the binary adder and subtractor a prediction was made on what the binary output would be given the decimal numbers. After the prediction was made the binary digits were inputted into the adder and subtractor and the outputs were recorded on the table above. Comparing the predicted to the actual binary output shows that in both

electric car is powered by power stations that run on fossil fuels in the US.	addition and subtraction the binary calculator was correct.

While the data above from the research paper is explained and somewhat contextualized (comparing percentages of fossil fuels types, for example), there is no reference or explanation of the specific data generated from the lab experiment in the Discussion section of the lab report. The Methods section of the lab report includes two tables with data, but that data is not referenced in the Discussion section, as illustrated above.

The artifacts from Student JN provide a representative example of assemblage occurring in the transfer process. Here, the introduction functions both structurally and rhetorically in both samples, adapting to an engineering audience for the lab report. The table below includes an excerpt from the research essay's introduction, which ends with an identifiable thesis statement, and the full introduction from the lab report:

JN Research Essay	JN Lab Report
…If this implementation of electric vehicles occurs on a large scale in the next several years than possible damage to the environment caused by greenhouse gases can be significantly reduced as currently gas- and diesel-powered cars and trucks create the largest percentage of CO2 emissions compared to other polluting factors in the world. The transition to electric vehicles for most people will provide many benefits beyond just zero emissions travel but this will not come without many challenges and compromises that come along with driving an electric vehicle 2021. I believe that the transition to EV's for commercial and personal transportation will be a positive change for the environment in the long term however, it will not come without setbacks and limitations for many regarding the usability of their EV's.	This lab has two main objectives, the first objective is to construct a four-bit binary adder circuit using the 74LS283 chip to perform the calculations and switches to perform binary inputs. The second objective is to use inverters to turn the adder circuit into a subtraction circuit by taking the two's complement of the subtrahend before adding it back to the minuend. For both these objectives, tables with be created to record the values put out by the circuit and to verify that the circuits are working correctly.

This comparison illustrates successful transfer in that the student writer is able to adapt from the genre expectations of a research paper, including establishing the issue and providing a thesis (claim) to adapting to the expectations of an engineering introduction by identifying the lab's purpose by articulating multiple objectives (both the "what?" and the "why?) of the lab report. Another example of successful transfer adaptation is illustrated in the Methods section, which includes two subsections: "Materials," which is presented as a list, and Procedures, which is organized according to instructional steps. At the sametime, we see some inappropriate use of first-person "I" carried over from the research essay into the lab report, as evidenced in the table below:

JN Research Essay	JN Lab Report:
from Introduction: I believe that the transition to EV's for commercial and personal transportation will be a positive change for the environment in the long term; however, it will not come without setbacks and limitations for many regarding the usability of their EV's. *from Conclusion:* I believe that once the high purchase price for EV's and the lack of infrastructure are solved, electric cars and trucks will be wildly popular on the roads of the U.S. and across the world which will furthermore highlight the added environmental benefits as with every gas car replaced by an EV will reduce emissions and help reduce the possible effects of climate change.	*from Discussion:* After going through the data collection process and circuit collection process of this lab I found that my partner and I were successful in completing the construction of both the 4-bit binary adder circuit and the 4-bit binary subtraction circuit that implemented two's complement. *from Conclusion:* After completing parts A and B I found that my predictions were correct when it came to the predicted vs. recorded binary values of both tables.

More unevenness of prior knowledge transfer is demonstrated in the interpretation of quantitative data. The research essay includes data appropriately with signal phrases and quoted material; in the lab report, however, data is included in tables, which is appropriate, but there is minimal explanation or interpretation of the data within the Discussion sections:

LN: Research Essay	LN: Lab Report
Data from a 2018 Harris polling firm found in Joseph's article found that "58 percent of respondents named "running out of power" as their top reason for not purchasing and EV, and 49 percent named "low availability of charging stations". This data featured in Joseph's article suggests that a significant amount people may be turned off to buying an EV just due to the lack of charging infrastructure.	After going through the data collection process and circuit collection process of this lab I found that my partner and I were successful in completing the construction of both the 4-bit binary adder circuit and the 4-bit binary subtraction circuit that implemented two's complement. And once construction was complete of the two circuits, we were able to verify that the circuits were in fact correctly constructed by looking at the results of both Part A and Part B tables.

In this comparison, the student appears to struggle with the adaptation to engineering conventions: the use of primary data and how to analyze that data in the Discussion section beyond presenting it in a table in the Results section. Consequently, the Discussion section provides general claims but no specific evidence to shore up those claims.

Overall, the artifacts from student SM illustrate an example of remix, wherein the student demonstrates the ability to integrate and adapt prior knowledge from the FYC writing context into the engineering writing context. Adaptation to genre awareness is illustrated throughout both artifacts. The research essay provides a traditional academic introduction that moves from broad to specific to present the problem and identify a thesis (see below). Though the lab report introduction does include a 1st person reference ("we"), it demonstrates both structural and rhetorical features in that it identifies both the focus and purpose of the lab report:

SM Research Paper	SM Lab Report
How and in what ways does obesity affect the human population? This affects nations worldwide and poses a constant health threat to civilizations itself…. Obesity is affecting children in the country and around the world whether they live in rural or urban areas and some reasons for obesity are the lack of healthy fresh foods, and huge food producers. People need to recognize the problem at hand and need to actually try to make an effort to help reduce the obesity rate.	For this lab we explored how binary addition and subtraction works and how to set this up. We were able to see and display how one and two's complement is applied in a real world setting with the use of an LED strip. If the LED was lit it would be interpreted as 1 and if a part of the LED was off it would be represented as 0.

Additional examples of adapting from the research essay to the lab report genre include the use of engineering appropriate subheadings (IMRD) and tables, a detailed explanation of purpose and process in the Methods section, and a discussion of the broader significance of the lab experiment in the Conclusion ("After reviewing our results we were able to compare our predictions to what we observed in the field. Our goal was achieved and our data can prove that to be true").

3.3 A liberal arts-focused private university

Our third site of analysis is a religiously-affiliated private liberal arts university. This institution has a "Core Curriculum" emphasizing the "intrinsic value of knowledge" as opposed to the applied focus of our first two sites. They do not require first-year composition courses of any kind: students take six credits of either English or Philosophy under the heading of "Literacy, Dialogue, and Expression," followed by two Writing in the Disciplines tagged courses in their degree program.

The participating lab course was a civil engineering laboratory course in the lower division, and the rhetorical analysis of three students' samples follows.

Student EF's sample included a philosophy essay from a writing-intensive Philosophy course and an environmental engineering lab report. Their sample showed evidence of using out-of-place essayistic moves in their lab report, which places them in the category of "critical incident". For example, this includes the following wordy comparison and contrast move in the introduction of both samples:

EF Essay	EF Lab Report
When it came to where human knowledge came from, there were two main categoriessomeone fell in. They were either a rationalist or an empiricist.	When dealing with wastewater, there are two main types of reactors to treat the polluted water. One is a continuously stirred tank reactor (cstr) and the other is a plug flow reactor (pfr).

Student EF's statement of purpose was positioned at the beginning of the second paragraph and describes what the experiment "focuses on" (more essay-oriented language) rather than a direct statement of the objective of what they were trying to measure. The lab report was formatted in paragraphs as if it were an essay even in places that benefit from different formatting, and looked visually very similar to the essay sample that was written in a thesis-antithesis-synthesis structure. The methods section was one paragraph long and written consistently with the auxiliary verb "should." The student's graphics were present and referenced appropriately in the text, but diagrams were labeled in a way that was difficult to read. This student showed evidence of transferring knowledge from previous writing experiences, but it came through in inadequate or inappropriate ways for the rhetorical situation and genre of the lab report.

Student MB's sample again included a philosophy essay and an environmental engineering lab report. Their lab sample showed some similar rhetorical moves, such as a reverse-pyramid formatted introduction, quotations to cite an authority, and the use of explicit comparison language to draw conclusions. This transfer is patchwork but seems functional, and thus they are an example of assemblage.

The introduction to both of MB's documents includes a citation to an authority about a central fact of the document. The quotations are also referenced in a citations section at the end, though the formatting is inconsistent.

MB Essay	MB Lab Report
In Plato's Apology, Socrates claims that "the unexamined life is not worth living for a human being" (Plato 38a).	The ideal CSTR consist of "the concentration, C, within the CSTR container is uniform throughout" (Masters and Ela).

It is reasonable to assume the student is drawing on prior knowledge that an introduction is an important place to cite an authority. Direct quotations are much less used in lab reports and technical writing, however. On the other hand, this is the only time the student references a source at all in the lab report sample. MB's central essay claim and statement of purpose of the lab report both come at the end of the first paragraph. While their essay's claim stretches across several sentences, the lab report purpose is quite clear: "The objective of this experiment is to analyze the performance of continuous flow reactors using a tracer." However it would benefit from coming even sooner. MB reasons from evidence effectively throughout both documents. While the lab report retains some essay-like formatting, the conclusions are bullet-pointed for efficiency. Overall this student is still learning which aspects of essay writing are appropriate in

engineering (introductions, reasoning moves) and which may be left behind (claim-last structures). This suggests they are remixing prior knowledge.

Finally, student JK's sample included a literature analysis essay and an environmental engineering lab report. Their sample lab report was the least essay-like and read more like a report. This student's work falls into the remix category because it most smoothly integrates prior and new knowledge about writing in the disciplines. Similar to student MB, JK also uses a quotation from a source early in their documents. However, in their lab report, it comes later and only after the purpose of the report has been stated. In both cases they use the quote, attribute it, and then afterward unpack what it means.

JK Essay	JK Lab Report
Page 123 in Nella Larson's Quicksand reads "Helga felt like a veritable savage… This feeling was intensified by the many pedestrians who stopped to stare at the queer dark creature,". This passage demonstrates the uncomfortableness many black people feel when tokenized.	"PFRs are impossible to attain because… mixing will occur due to molecular diffusion, turbulent dispersion, and fluid shear". (EELR 2018) This means that it is impossible to get an ideal version of a PFR which the baffled reactor is trying to replicate.

Unlike the previous two samples, JK began the introduction of their lab report with a direct statement of purpose: "The purpose of this lab is to look at how different reactors mix contaminants based on the design of the reactor." They show evidence in their sample of knowing what an introduction needs to accomplish in general and being able to see that it should be formatted differently in different contexts. Also, unlike the previous two lab reports examined, JK's has a much more extensive methods section using "we" language to report directly on what is team accomplished. The section also includes a list of apparatus used (supplementing a diagram) as well as a bulleted list of lab roles. Overall this shows good and growing knowledge of engineering conventions. Finally, while JK's essay is a literary analysis, there is evidence of remix transfer related to claims and reasoning.

JK Essay	JK Lab Report
Burnout has played its part in burdening Helga's life through every step, which are shown in her drive to change her environment. She has moved from teaching, to Harlem, from Copenhagen, and is now secluded in a church community in Alabama, and she has never been able to find help anywhere she goes. Burnout is causing Helga to try to find the best way out of every situation, just to find a place to live and feel comfortable in her own skin.	The results of the data show that neither of the reactors exhibited ideal behavior. The baffled reactor is supposed to mimic the Theoretical CSTR because of the mixing capabilities of the baffled tank. The results show that it did not mix as well as the Theoretical CSTR, but it mixes more quickly than the unbaffled reactor, resulting in a shallower slope of the curve.

Overall, all three students from this liberal arts institution showed evidence of transfer of knowledge, although they seemed to lack familiarity with engineering conventions to varying degrees.

4. Conclusion

This preliminary study investigates how prior writing experience in first-year writing courses impacts lab report writing in lower-division engineering labs. Samples from three universities are analyzed for writing knowledge and skills in the context of writing transfer. Criteria include audience awareness, organization, data presentation/analysis, source usage, and document style. we could assess each student volunteer's productivity in writing transfer according to Yancey et al.'s three modes of writing transfer: remix, assemblage, and critical incident. All FYC student samples in the rhetorically-focused site showed audience-centered choices in organization, data presentation, data analysis (claim-evidence-warrant), and document style, which are appropriate to the research paper genre. Multiple students demonstrated a high level of negotiation in audience awareness for engineering lab writing, for example, a direct statement of the objective and well-organized IMRDC structure. They could adapt their past writing knowledge shown in writing course samples to the engineering lab writing context and genre expectations productively. However, multiple students on this site marginally transferred or failed to transfer their prior writing knowledge to engineering lab writing. Some lab report samples show essay-like formatting, a lack of lab data analysis, or direct quotes in engineering lab writing. Their samples from the two courses have shown an underdeveloped understanding of the lab report genre. In contrast, the engineering lab course samples in the literature/philosophy-focused site show out-of-place essayistic moves, a thesis-antithesis-synthesis structure, and essay-oriented language, which were shown in their philosophy essay samples. Students from the liberal arts institution exhibited differing levels of familiarity with engineering conventions. This preliminary case study confirms that diverse first-year writing contexts can impact engineering students' writing transfer for their introductory engineering labs.

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