Writing in the Disciplines and Student Pre-professional Identity: An Exploratory Study[1]

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Abstract: This study examines student perceptions about (i) whether writing in undergraduate disciplines contributes to the development of student pre-professional identity (PPI) and (ii) how writing in such disciplines affects PPI relative to other classroom activities. The study was conducted at St. John's University in New York, which has a very diverse student population, and involved four different undergraduate disciplines—First-Year History, Chemistry (STEM), Legal Studies, and Speech Pathology. Data was derived primarily from student survey responses. Our findings suggest that writing in undergraduate courses can affect student PPI. Further, the extent to which writing contributes to PPI relative to other course activities appears to be related to four things: whether the course was in the student's major; how professionally authentic the students perceived the writing in the course to be relative to other course activities; the extent to which the instructor works through the disciplinary writing process with the students; and the extent to which the student already has a PPI.

Higher education institutions are under growing pressure to prepare students for professional employment and the world of work (Jackson & Wilton, 2017; Trede, Macklin, & Bridges, 2012). Billett (2009) argues that one of the responsibilities of higher education is to help socialize students to the roles and cultures of their intended professions. Higher education can support this important socialization process by adopting pedagogical practices that help students develop a pre-professional identity (Pittman & Foubert, 2016). Pre-professional identity (PPI) is defined as "an understanding of and connection with the skills, qualities, conduct, culture, and ideology of a student's intended profession" (Jackson, 2016, p. 926). Research finds PPI enhances both professional and academic success (Nadelson, Warner, & Brown, 2015; Jackson, 2016; Jackson, 2017). PPI is associated with persistence in the STEM disciplines (Chang, Eagan, Lin, & Hurtado, 2011; Graham, Frederick, Byars-Winston, Hunter, & Handelsman, 2013), employability (Jackson, 2016; Tomlinson, 2012), job satisfaction (Holland, 1985), and lower job attrition once students are in the workforce (Renn & Jessup-Anger, 2008).

Research on the development of PPI has focused primarily on students' transition from graduate programs to entry level positions in the field (e.g., Pittman & Foubert, 2016; also see Trede et al.,

2012 for review), but the development of PPI can also begin during the undergraduate years (e.g., Jackson & Wilton, 2017). Undergraduate students, for example, can be encouraged to join pre-professional clubs and communities, participate in mentoring programs with professionals practicing in the field (Pittman & Foubert, 2016), and engage in experiential learning, academic service-learning, internships, and practica (Jackson, 2016). For the most part, activities that focus on PPI development take place outside the classroom. Very little research has been conducted to evaluate how typical classroom experiences, such as writing, might contribute to PPI. Given the importance of PPI, and the ubiquity of writing in higher education, this study explores how, or whether, in-class discipline-specific writing instruction contributes to the development of undergraduate students' PPI.

Like PPI, writing in the disciplines is often viewed as an activity of socialization. As Heidi Estrem put it in *Naming What We Know*, "Approaching disciplinary writing as an act of identity and affiliation illuminates how writing in new contexts is not only about learning abstract conventions but also about learning how to be within a group with social conventions, norms and expectations" (Adler-Kassner & Wardle, 2015, p. 56). Students also find writing activities to be more meaningful and consequential if such activities help them imagine their future selves (Eodice, Geller, & Lerner, 2016a).

Present Study

Over the past four years, we have been examining the connections between student writing and student identity in our four disciplines—History, Legal Studies, Chemistry and Speech-Language Pathology. When we first started investigating this relationship, we were surprised to find that many of our students did not identify in a manner that we would have expected. For example, we found that some of our first-year students did not self-identify as college students because they "did not live on campus." Additionally, many of our third-year chemistry students did not self-identify as scientists, though some of our pre-medical students already identified as health services providers.

We then became particularly interested in exploring the question of how to develop student identity, through writing, as a means of fostering student success in the context of our particular student population. St. John's University is one of the most diverse universities in the United States. Over forty percent of the student population identifies as Black, Hispanic, Asian, native Hawaiian/Pacific Islander, American Indian, Alaska Native, or of two or more races. Students come from forty-seven states, the District of Columbia, Puerto Rico, the US Virgin Islands, and over 120 countries. Reflecting the mission of St. John's to serve those in need, over forty percent of St. John's students are Pell Grant eligible. Many of our students are the first in their families to attend college, and research has suggested that first-generation college students are less likely to obtain a degree than continuing-education college students (Redford & Hoyer, 2017).

In the context of our particular student population, we were specifically interested in exploring whether discipline-specific undergraduate writing experiences might help students begin imagining themselves as professionals in a related field. Socialization into the professions includes honing a set of skills that align with those of other members of the same profession and are different from those outside the profession (Trede et al., 2012). Since discipline-specific writing is differentiated in process, style, or format from writing outside the discipline, we viewed discipline-specific writing as a means of professional socialization (Eodice, Geller, & Lerner, 2016a). However, we recognize that, as Mary Lea and Brian Street and others have concluded, developing an identity

through academic socialization is not usually a "straight line" process. Pre-professional identity development among college students is also complicated by issues of personal identity development, the institutional context, and larger social issues (Lea & Street, 1998).

We hypothesized that students would also view discipline-specific writing practice as contributing directly to the development of their pre-professional identities. Given the direct relationship of discipline-specific writing to the profession, we also predicted that discipline-specific writing might be perceived as contributing more to PPI development compared to other types of classroom-based learning experiences, such as class discussions, lectures, readings, and exams. Finally, we predicted that a perceived connection between discipline-specific writing and PPI might strengthen as a function of the student's proximity to graduation. That is, we anticipated finding a stronger connection between discipline-specific writing and PPI in fourth-year compared to first-year undergraduates.

Methods

We approached our exploratory cross-disciplinary study of undergraduate writing from an action research perspective. Action research is an iterative method of inquiry whereby problems are identified, actions are implemented, and outcomes are formally assessed (Bradbury-Huang, 2010). Based on these outcomes, additional needs are identified and targeted following the same process. This cyclic approach differs from hypothesis driven research in that, while both are informed by theory, action research does not set out to test a hypothesis. Rather, action research approaches both problems and solutions from the perspective of the primary stakeholders—in this case, the faculty and the students.

Participants

A total of 90 undergraduate students participated during the spring 2016 semester. All students were enrolled in one of the following four courses: a first-year history-focused seminar in the core curriculum; a first/second-year introductory legal writing course; a third-year chemistry course and laboratory; and a fourth-year senior seminar course in speech language pathology and audiology.

Measures

In order to assess the impact of different instructional methods on students' PPI, we evaluated data derived from student surveys. We also informally examined student writing.

Student Surveys

Previous research on professional identity has used surveys (see, for example, Jackson & Wilton, 2017), but, to our knowledge, no survey has been designed to assess the effects of classroom instruction on undergraduate students' perceived PPI. Therefore, in collaboration with our university's Office of Institutional Research, we developed a bespoke survey ("PPI Survey," hereafter) designed specifically for our purposes. This end-of-the-semester common outcomes assessment survey was distributed to our students at the end of the spring 2016 semester. This survey assessed the students' perception of the impact of our course writing and non-writing activities on PPI. Across our courses, there were slight modifications between the surveys as necessitated by the subject material; however, all of the surveys had the same general features to

facilitate comparison across courses. All PPI Surveys included both open-ended questions and questions using a Likert-type scale. The open-ended survey questions asked the students to reflect on their relationship to the discipline and how their thoughts about that relationship had changed over the course of the semester. The Likert-type scale questions asked students to rate how effective each of our course-specific activities were in helping the development of their PPI. The Likert scale questions solicited responses ranging from "Strongly Agree" to "Strongly Disagree." The responses for each Likert category are provided for each course. The surveys were not performed anonymously in order to connect the survey results with student performance for future investigations (Chan & Bauer, 2014; Bauer 2008; Adams, Wieman, Perkins & Barbera, 2008). (See Appendix for a sample survey.)

Student Writing

In our individual courses, student writing was examined through a variety of approaches, specific to each discipline. Table 1 below briefly summarizes the various writing processes that were used in each course related to PPI, and Table 2 below briefly summarizes the writing products that our students produced in each course. The processes were used to introduce the students to disciplinary conventions and to provide an opportunity for students to reflect as "writing makes thinking visible, allowing learners to reflect on their ideas" as mentioned in the WAC Clearinghouse statement of Principles and Practices. The writing products were a mix of high and low stakes assignments that were submitted for feedback, assessment, and/or comments. These assignments situated the student writing in the disciplinary genre.

Detailed comparisons across our courses are not directly addressed here because of the differences between our disciplines, courses, course-levels, materials, and assignments. However, targeted discussions among the researchers provided insight into issues such as how the students engage in meaning-making in the disciplines and why the students think they are or are not a member of the disciplinary community (McKee, 2003). Though this was an informal evaluation process, this level of engagement with student writing led to deep and significant insights into the student experience for each particular course and across courses. In the following section, we discuss how we approached each of our courses, in turn.

Table 1: Examples of Writing Processes used in Each Course

	Discover New York (First-Year Students)	Legal Writing (First- and Second-Year Students)	Macroscopic Physical Chemistry and Experimental Physical Chemistry (Third-Year Students)	Senior Seminar in Communications Sciences and Disorders (Fourth-Year Students)
Guided reflecting about writing	X	X		X
Scaffolded semester-long		X		X

projects				
Reflections on identity	X	X	X	X
Essays on exams	X			X
Reflections on content	X	X	X	
Discipline-specific citation usage	X	X	X	X
Literature-based writing	X	X	X	X
Revising work products	X	X		X
Collective note-taking		X		
Peer editing/review	X	X		

Table 2: Examples of Writing Assignments Completed in Each Course

Discover New York (First-Year Students)	Legal Writing (First- and Second-Year Students)	Macroscopic Physical Chemistry and Experimental Physical Chemistry (Third-Year Students)	Senior Seminar in Communications Sciences and Disorders (Fourth-Year Students)
Creative non-fiction Worksheets Reflections on writing, content, identity, and service learning	Case Briefs A Legal Memorandum Drafts of that memorandum Student reflections on their writing	Lab reports, Non-technical communication Reflections on profession, reflections on course concepts	SOAP notes Annotated Bibliography Research Paper Research paper edits

Results and Discussion

Pre-professional Identity as College Student Identity—Mr. Benjamin and Dr. Conn

Students at St. John's typically enroll in two or three courses in the core curriculum in each semester of their first college year. One of these courses, Discover New York, follows a first-year seminar model where topics reflect the discipline of the faculty member. The first-year seminar model allows for faculty teaching the course to approach topics in the course from within their own field of expertise. For example, sections are taught reflecting the disciplines of art, literature, music, or political science, and how these specific disciplines each connect with New York City. Conn, a historian, taught the course through the discipline of history, and focused on the history of immigration in New York City with an emphasis on the use of historical methods. As with most core courses, this section was open to students in all majors.

For purposes of this study, Conn and Benjamin focused first on students' identities as historians as measured by their use of evidence in their writing, and second on their identities as college students, a first step in the transition toward college-level study and the development of PPI. This intersection of students' identities – identity as a college student and identity as someone learning the professional practices of a core curriculum discipline, along with other aspects of identity – emerged as a focus of Conn's and Benjamin's work. The appropriate use of evidence, a foundational skill in a liberal arts education, was defined as: i) including citations when paraphrasing; ii) using quotation marks when appropriate; and iii) using and analyzing primary and secondary sources to support arguments. Students' self-identification as college students was measured through surveys and in-class reflections. Developing identities as college students is particularly relevant in this course for two reasons: first, as noted above, the student population at St. John's includes a significant number of first-generation college students; and second, this first-year seminar is designed in part as a transition to college course. As students develop their identities as college students during their first year of study, they prepare themselves to engage more deeply in a discourse community, both within the university and within their chosen disciplines.

In higher education literature, researchers have examined several aspects of students' identities as college students. Some of these aspects overlap with students' developing identities as pre-professionals. For example, Jensen and Jetten (2015) describe "academic identity" as "the extent to which students feel they belong to the greater academic community, students' experience of personal academic worth and their visibility in the academic environment" (Jensen & Jetten, 2015). Marshall, Zhou, Gervan, and Wiebe (2012) discuss a "sense of belonging" for college students defined as a "fundamental human need for individuals to belong, and to be respected and valued members of a group or community of people." Lounsbury, Huffstetler, Leong, and Gibson (2005) place their work on identity and college achievement within the context of psychological research on identity development, defining a sense of identity in general as a person having "a firm sense of who one is, a purpose in life, a clear set of personal values, knowing what one wants out of life and where one is headed, and having personal goals for the future." The references in these definitions to connection, community, shared values, and personal direction reflect aspects of pre-professional identity as well.

This class benefitted immensely from the involvement of an Undergraduate Writing Fellow, Michael Benjamin. Benjamin was embedded in the course, attending all class meetings, reading class assignments along with students, and meeting weekly with Conn (the faculty member) to plan

assignments and review student work. Benjamin met individually with students throughout the semester. Among other reasons for Benjamin's presence in the classroom, a primary goal was to employ peer learning to help students engage with the course, the professor, the Writing Center, and the university. The spring 2016 semester was the third semester that Conn and Benjamin worked together.

For this course, Conn and Benjamin created three major creative non-fiction writing assignments that combined students' lived experiences with content and narratives found in course materials. This approach was informed by findings from The Meaningful Writing Project (Eodice, Geller, & Lerner 2016b; Eodice, Geller, & Lerner 2017) and by our review of reflections from previous students about their connections to New York City. The learning goals of these assignments included i) identifying and using appropriate evidence; ii) connecting classroom readings with personal narratives and experiences; and iii) demonstrating understanding of central course themes. The three major assignments asked students to examine their relationship to New York and migration, then compare their experiences to migration patterns and larger developments in New York City history.

During preparation for the first major assignment, the class discussed appropriate use of citations and Conn demonstrated how to use a primary source to support a written statement. Students were asked to apply this skill, a foundational skill in history and other disciplines, during in-class practice, and nearly all students were able to do this successfully. However, on the formal assignment, only half of the class used primary sources appropriately (as defined above). Before the second major assignment, Conn and Benjamin conducted a second class discussion about how to use evidence, adding explicit instruction about the reasons for using evidence in history writing and in related disciplines, encouraging students to discuss how evidence is used in their major courses. Again, students demonstrated near mastery of this skill during in-class practice. However, once again the in-class discussion and practice did not transfer to significant improvement for those students who had demonstrated problems with those citation skills in the first essay assignment.

Before the third major assignment, Conn and Benjamin conducted focused interventions by meeting with individual students who had not used evidence appropriately in the first or second assignments. They reviewed these students' writing, talked with the students about using evidence, and listened to these students talk through their work. Those interventions revealed some misconceptions about using evidence (for example, that no citations are needed when paraphrasing, or that papers written for history consist of only citations without analysis). One student said that she had been taught that no citation was necessary if she could find the relevant information in six places on the Internet (meaning that it would be considered common knowledge). Two students reported that their meetings with Conn were their first meetings with a college faculty member, an important step for students finding their place in the university community. After these individual meetings, Conn and Benjamin found that approximately one-half of students who had experienced difficulties in using evidence and citations in previous assignments demonstrated improvement in the third assignment.

To capture students' perceptions of their identities as college students, the PPI Survey at the end of the semester included questions about to what extent they viewed themselves as college students. Twenty of the twenty-four students enrolled in the course completed these surveys. Percentages in the figure below were calculated based on the number of students responding to the question. Responses were then analyzed for common themes and grouped as shown in Figure 1 below.

In response to an open-ended question in the PPI Survey, eight out of twenty students did not fully view themselves as college students. It should be noted that these surveys were conducted at the end of the students' second semester in college. This result was somewhat surprising, as students by this point are preparing to focus more intently on their major courses. Comments from those who did not completely identify as college students included reasons related to their living arrangements (such as commuting rather than living on campus), lack of involvement on campus, and questioning their own levels of maturity and independence. As one student wrote, "*I feel like I'm just here for school like I was in high school because I am a commuter.*" Comments from those who viewed themselves to a large extent as college students included reasons such as moving away from home, focusing on schoolwork, and feeling a sense of independence. As one student wrote, "*I came 3000 miles for it. I better be a college student.*"

These responses may reflect the class demographics. Nineteen students came from the New York City metropolitan area (where St. John's is located), with some commuting to campus from home – a typical distribution for a first-year course at St. John's. In addition, this course consisted of first-year students who were generally enrolled in liberal arts core courses more than courses in their majors. No matter where students fell on the spectrum of their self-identities as college students, academic considerations (e.g., homework, college-level coursework) were noted far less consistently than other aspects of students' lives (e.g., where they live) in contributing to identity. These results reflect the conclusions drawn by Jensen and Jetten (2015) about the critical importance of "bonding social capital" for first-year students—what they characterize as "strong social ties, high social support and loyalty toward other members." Students who do not see themselves as connected to campus by virtue of their residence or their lack of involvement on campus are less likely to develop bonding social capital.

Figure 1: Frequency of Key Themes in Student Responses to the Question: "To What Extent Do You See Yourself as a College Student?"
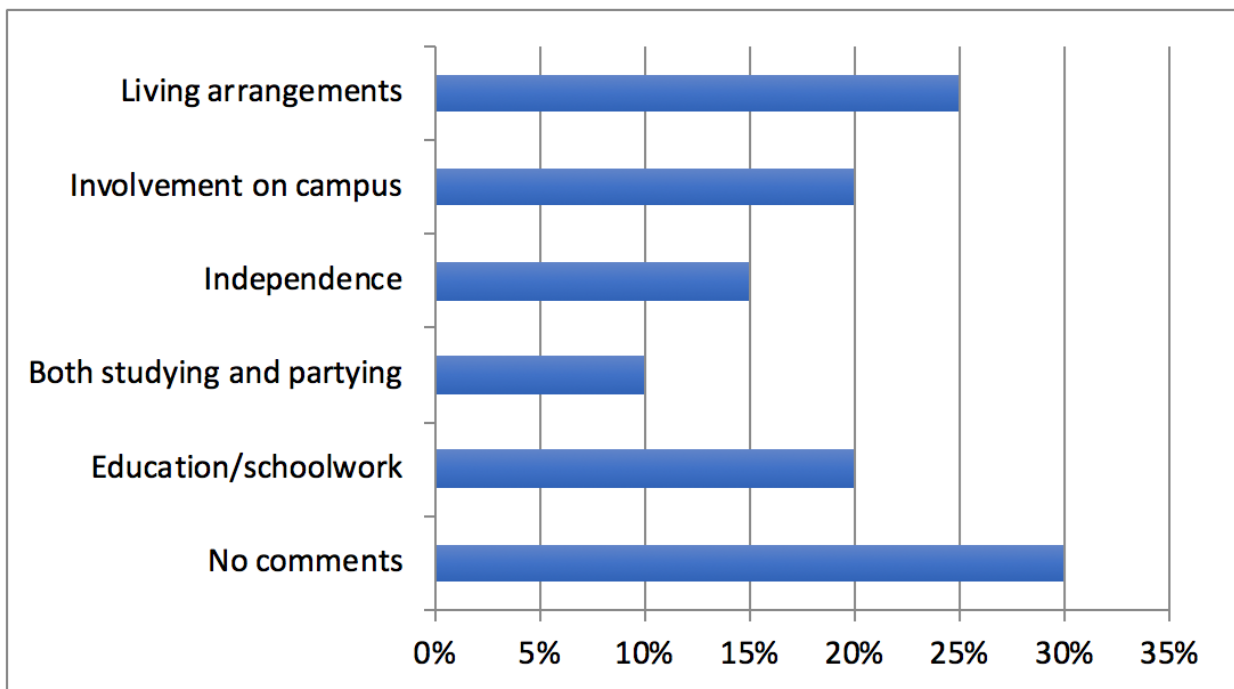
Using Authentic Resources in Legal Writing Assignments to Promote PPI—Prof. Croft

Legal Writing is a required course in the undergraduate Legal Studies Program at St. John's. The Legal Studies Program is externally approved by the American Bar Association and primarily draws students who are interested in either pursuing entry-level work in law-related fields or attending law school. This research included two sections of this course. Together, forty students were enrolled in these two sections of the course. Over three quarters of the students were first- or second-year students, and, when asked at the beginning of the semester where they aspired to be in five years, 91% of the students expressly mentioned the possibility of law school or otherwise working in the legal profession.

Students take this class after taking an introductory class on legal analysis. The purpose of the Legal Writing class is to teach students to effectively communicate a legal analysis in writing. In this course, relative to a concrete problem, legal analysis is: (i) identifying the relevant facts; (ii) identifying the relevant law; (iii) applying the law to the facts; and (iv) coming to an appropriate conclusion (Glaser, 2002). Traits that are valued in legal writing as a genre of writing include: the substantiation of claims; the application of law to facts; concision; focus; organization; and clarity (Hart & Breland, 1994; Kosse & ButleRitchie, 2003).

To teach this course, Croft worked through one semester-long, scaffolded, legal research memorandum with the students. Conceptually, his aim was to bring the students through his research, analysis and writing processes for the purpose of teaching those processes to the students.

The ability to work with evidence is crucial in legal writing, and, the "evidence" that the class worked with included the facts of the semester-long hypothetical and relevant statutes and judicial opinions. The class worked with the statutes and judicial opinions that professionals work with in practice, not edited textbook versions.

The semester-long project was based on a hypothetical felony murder with three discrete research issues. Class time was spent (i) discussing the basic statutory analysis of the problem, (ii) identifying research issues, (iii) discussing each of the statutes and judicial opinions that the students would use, (iv) taking appropriate notes together, (v) outlining the analysis together, (vi) drafting sections of the memorandum together, (vii) editing sections of the memorandum together and (viii) working on the legal citation formats that would be used in the project together.

To complete the project, students were required to read each of the statutes and judicial opinions that would be used in the memo and to brief (summarize) some of these opinions. For each research issue discussed in the memo, students wrote a draft of that section of the memo, and, after receiving professor and student feed-back, students rewrote that section of the draft. After receiving comments, students also submitted informal journal entries reflecting on what they did well in the draft, what they did poorly in the draft and how they planned to improve in the areas that they performed poorly in. Ultimately, the students pulled together their three drafts into one large memorandum, which Croft also assessed, evaluated and commented on.
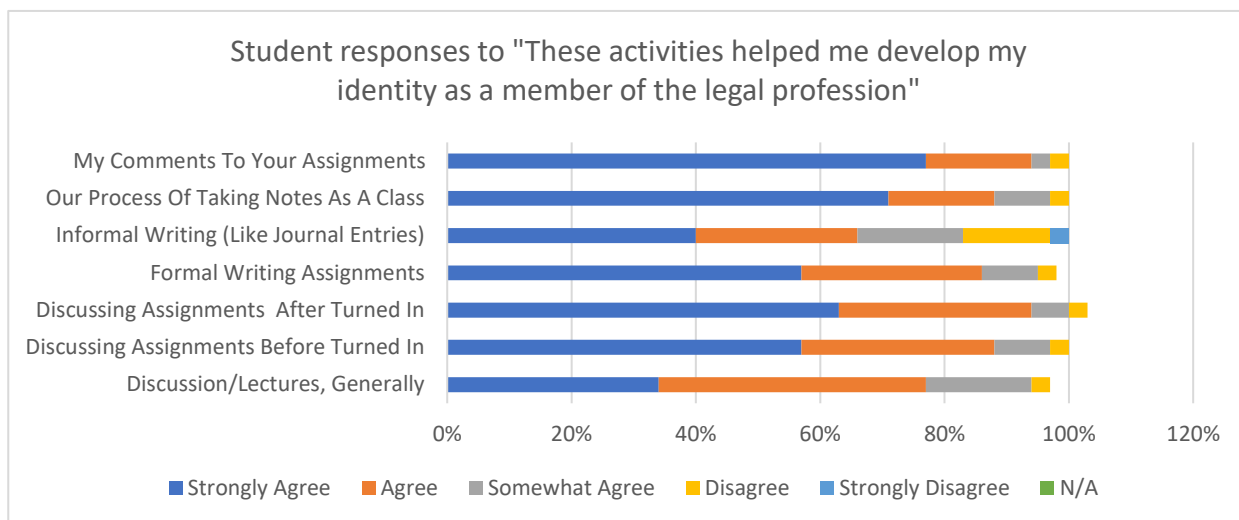
As mentioned above, at the end of the semester, students completed the PPI Survey. In particular, students were surveyed about (i) whether their relationship to the legal profession changed over

the course of the semester and (ii) how the activities in the course affected their identity as a member of the legal profession.

A majority of the students thought that their relationship to the legal profession changed over the course of the semester. When asked "How have your thoughts about your relationship to the legal profession changed over the course of the semester?," 38% of the students responded "Not at All," 26% of the students responded "To some extent" and 35% of the students responded "To a large extent." In open-ended comments to this question, ten students highlighted the fact that working hands-on with legal sources in class increased their perceived connection to the profession. Others mentioned that they wanted to pursue a career in the legal profession before taking the class and still do. This is consistent with a recent AALS survey that suggests that a majority of law students first considered law school before attending college (AALS, 2018). And others mentioned that they had always wanted to pursue a career in the legal profession, but that this class made them think otherwise.

Figure 2 reports the data that was collected with respect to how the activities in the course affected the students' identities as members of the legal profession. Please note that: every student did not answer every question; the percentages given in the figures were calculated using thirty-five as a denominator, even though thirty-five students didn't answer every question; and that the percentages reported in the figures are rounded to the nearest percentage point. Please also note that some of the questions reported in Figure 2 have been shortened to fit into that Figure.

This data shows that the course affected the students' PPI. This data also confirms Croft's suspicion that students value working with the sources that professionals work with in the field and that students value the process of working through concrete problems together as a group, including the process of taking notes together. To Croft, the most surprising result of these surveys was how connected the students perceived their learning in the course to be to the development of their PPI. Students specifically mentioned that doing hands-on work with the sources that professionals use in the field increased their connection to the profession and increased their confidence that they could one day join the profession. For example, in response to an open-ended question about their connection to the legal profession, one student wrote: "*I think that actually working on this case in class brought out more of a liking to it because we were finally doing something other than being explained how to do something in the profession. This time we actually got to see visually how to do these things and not look in a textbook all semester.*" In response to a similar open-ended question, another student wrote: "*The hands-on experience of reading cases, understanding them properly and learning how to cite them makes me feel connected a lot more to this profession.*" In response to a similar open-ended question, another student wrote: "*I think that being in a legal profession is something that I can do now.*"

Figure 2: Pre-professional Identity in Legal Writing

Student responses to "These activities helped me develop my identity as a member of the legal profession"

My Comments To Your Assignments	
Our Process Of Taking Notes As A Class	
Informal Writing (Like Journal Entries)	
Formal Writing Assignments	
Discussing Assignments After Turned In	
Discussing Assignments Before Turned In	
Discussion/Lectures, Generally	

Legend: ■ Strongly Agree ■ Agree ■ Somewhat Agree ■ Disagree ■ Strongly Disagree ■ N/A

(x-axis: 0%, 20%, 40%, 60%, 80%, 100%, 120%)

Using Technical Presentations to Promote PPI for Third-Year Chemistry Majors— Dr. Serafin

Both Physical Chemistry (lecture) and Experimental Physical Chemistry (laboratory) are required third-year courses in the Chemistry Program, which is externally accredited by the American Chemical Society. The lecture and laboratory courses are independent, but are closely related in content and are taken simultaneously.

The intentional goal was to both develop and use the student's PPI to facilitate student success in these courses which are often perceived as challenging by the student (Nicoll & Francisco, 2001; Sözbilir, 2004). As such, students enter the course with significant anxiety about their performance, and addressing this anxiety is an important component of student success in this course. In part, Serafin attempted to use student reflective writing in this course to help students manage this anxiety by helping them feel connected to the discipline, thereby increasing their motivation and persistence. A recent examination of persistence in STEM students identified learning and professional identity as determinants of persistence (Byars-Winston et al., 2016; Graham et al., 2013).

Reflective writing assignments were used for two main purposes: to develop metacognitive capabilities in the students and to motivate the students for success by developing their PPI. A sample task was writing a letter to the editor as a scientist in response to an article about the issues of reproducibility in science to help the student reflect on the role of scientists in society and their responsibility as scientists. Student letters to the editor contained rather strong words indicating that the students were beginning to develop a more critical view of the professional scientific community. The student response letters to the editor had wording like: *shocked, crazy, unsettling, and alarming.*

When designing these reflective writing activities, Serafin considered what challenges students face in the course and what motivates students in the course. Reviewing the students' responses to

these assignments often led to interesting insights into the students, for example, the pre-medical students did not view themselves as scientists, but rather as health professionals. An awareness that the class has multiple different PPIs is critical if one seeks to facilitate a deeper connection to a professional identity.

Experimental Physical Chemistry is a chemistry laboratory where the students are writing their first formal reports as authentic disciplinary writing. This course provides an opportunity for a student to approach a scientific question through the actual acquisition of evidence (data), critically analyze that evidence, and then present their analysis to the community. By examining and discussing what they actually measure in the laboratory (the evidence or experimental data), the students begin to engage in the scientific scholarly or professional activity of constructing knowledge based on evidence. This shift marks a transition for the students, from someone who acquires knowledge from a text (student) to someone who constructs knowledge from evidence (scientific professional). Over the course of the semester, the students learn to place their results in context with existing knowledge (citations), clearly explain how the data was obtained, correctly interpret the data, and offer an audience of skeptical or critical peers possible reasons to believe their conclusions.

The laboratory reports generated by the students provide a rich opportunity to explore the progression of important professional skills. Using evidence to support a claim is a central skill in any discipline, and it was explicitly and quantitatively examined in the student formal writing. Sample reports from early and later in the semester were analyzed for such items as: (i) the number of literature citations, (ii) the number of data citations (how their experimental results were used to support their claim), (iii) whether a claim was made in the report (why are they writing this report and to whom?), and (iv) whether their claim was supported by their evidence (appropriate logical reasoning from their data). For example, by contrasting the first and the ninth laboratory reports, insights can be gained into whether the student is developing appropriate evidence usage or technical communication skills.

Figure 3 reports student responses to the PPI Survey questions "These activities helped me develop my identity as a member of the scientific or medical community."
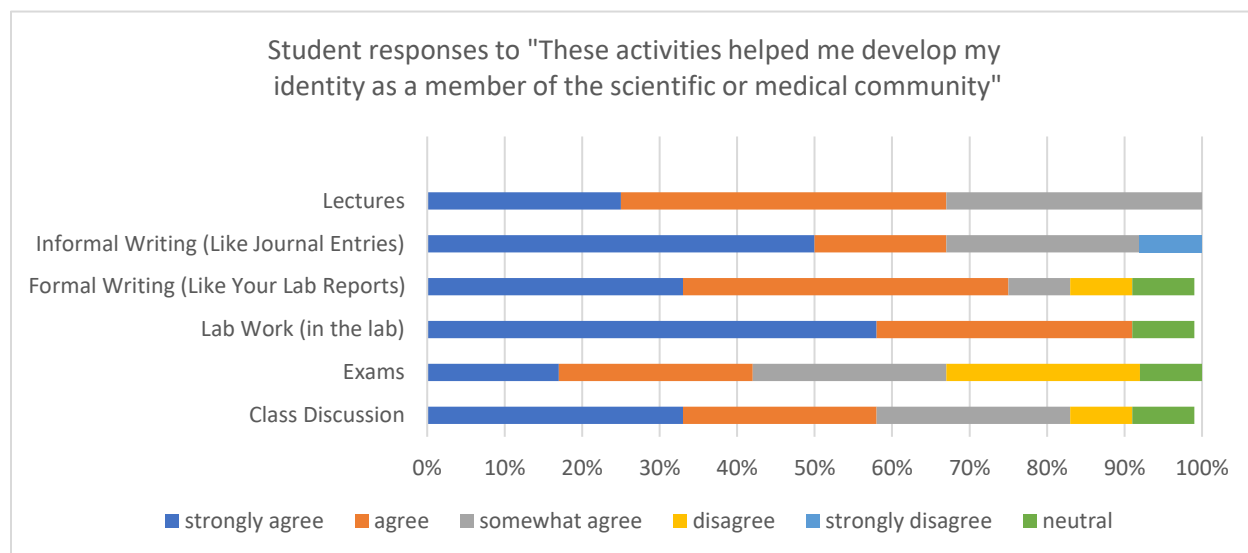
The laboratory work was determined to be the most effective for connecting the students to a profession. This is perhaps not a surprising result, as this would most closely mimic the authentic disciplinary activity that they would engage in as professionals. Curiously, the formal writing which involves the discussion of that same lab work is rated as significantly less effective. This might suggest that the student does not yet have a sophisticated understanding of how authentic disciplinary communication occurs. Perhaps a discussion of topics such as peer review, and a close reading of a "scientific" journal article will help the student better understand the authentic process they are approximating in the classroom.

The informal, reflective writing is the second most effective practice. Exams are the least effective, which is an unsurprising result given that no effort was taken by the instructor to connect the exams with professional identity.

The PPI Survey also gave students the opportunity to provide open-ended feedback on the course and how it affected their identity. When asked "Have your thoughts about your professional identity changed over the course of the semester?," for example, 17% of the students responded "Not at All," 67% of the students responded "To some extent" and 17% of the students responded "To a large extent." As these are third-year students in a course that is almost entirely chemistry

majors it is perhaps not surprising that this course would not affect their perceived PPI significantly.

Figure 3: Pre-professional Identity in Chemistry

Student responses to "These activities helped me develop my identity as a member of the scientific or medical community"

	strongly agree	agree	somewhat agree	disagree	strongly disagree	neutral

While using the PPI Survey in this course suggested that this course did not advance PPI, future research could use a more nuanced instrument to measure the impact of these activities, an instrument that explores the nuances of the students' relationship with professional affinity, professional identity and professional community. This more nuanced approach is needed because the third-year students in this major course already appear to have developed a base line PPI through their course work.

A study examining research experiences with the Baxter Magolda self-authorship framework as a measure of the student professional identity is edifying. This model says that as students advance, they move beyond external cues such as course grades towards increased self-authorship and use more internal standards such as a desire to talk about their findings or their ability to take responsibility for a project (Nadelson, Warner, & Brown, 2015). This framework appears to lend itself well to Serafin's experiences and could be a useful lens for future studies when constructing activities to promote PPI development.

In an additional anonymous survey, the laboratory students were asked what they thought that the most beneficial part of the course was. One student responded, "*This is, out of all the labs I have done, the most work intensive. It also is the most rewarding. This is the closest to real science that I have done at St. John's, and it was rather empowering to do the experiments and get results that mean something. Instead of just making up a conclusion to fit, this class, and the chemistry program, gives you enough information that you can make conclusions based on the experiments you did and the theories you know. That is something I find very exciting.*" Another student responded, "*Learning how to format lab reports, putting an importance on ethical issues and citation. I like the pre-lab quizzes, they force me to know what I'm doing prior to coming into lab.*"

Clinical Notes and Academic Research Promote PPI in CSD—Dr. Wiseheart

The final class was Senior Seminar, a required course in the Department of Communications Sciences and Disorders (CSD). Students were ten undergraduates (9 female; 1 male) in the final semester of their senior year. Because entry into CSD professions (speech-language pathology or audiology) requires a graduate degree, almost all students in the major apply to graduate school.

Senior seminar is a capstone course in the major. Its goal is to introduce students to research in preparation for graduate study and clinical practice. Understanding the role of evidence in scientific research and communication was an explicit learning objective. In the first instructional unit, lectures and learning activities focused on information literacy and the difficulties and importance of communicating scientific findings to different audiences. In the second unit, the primary learning objective was for students to understand the role of external scientific evidence in the CSD profession. As an introduction to scholarly activity in the profession, students were introduced to the structure of a research paper and to the peer review process. As a class, students created a shared annotated bibliography summarizing pertinent information from 10 published research articles focused on the topic of morphological awareness, reading comprehension, and second-language learning. Using their shared annotated bibliography as the basis of a literature review, students wrote an introduction and documented the results of each of their five cases (as discussed below) in the form of a multiple baseline single-subject design research study. Standard APA formatting is used in this discipline and was also addressed throughout this "guide on the side" interactive writing process as this writing was developed. APA formatting was also explicitly practiced through the use of worksheets.

In the final unit, students participated in an academic service-learning (AS-L) research project in which they provided morphological awareness training (a type of reading tutoring) to volunteers from our university's English language institute who were learning to read English as a second language and wanted additional help. Volunteers signed an IRB approved informed consent to participate in the program and then met with the students twice a week for 6 weeks. After each meeting, students summarized the session and charted progress in the form of a clinical SOAP note. SOAP is an acronym that stands for "subjective, objective, assessment, plan." This format is the standard method of documentation used in clinical practice across the health-related professions.

Students produced three major writing products: an annotated bibliography, SOAP notes, and a research paper. These scaffolded products were not graded but were edited collectively throughout the semester. To assess mastery of APA style, the graded final exam also included a task in which students were asked to edit a research paper for proper formatting of in-text citations and a full end-of-text references section. All of the students completed this portion of the exam with at least 90% accuracy.

Figure 4 shows students' responses to the PPI Survey. Informal writing was defined as anything written with little to no editing. This included in-class reflections and SOAP notes (clinical writing). Formal writing was defined as anything that was typed and written with time for editing. This included their research paper (APA-style professional writing). With regard to activities that contributed to students' PPI, average Likert scale scores (5= strongly agree, 1 = strongly disagree) for informal professional writing (4.62) were higher than formal academic writing (4.5) and also higher than meeting with AS-L partners (4.12).

As might be expected, all students either strongly agreed or agreed that "writing SOAP notes" contributed to the development of their PPI. What was somewhat surprising was that students

rated "reading research articles" just as favorably. One interpretation of this finding is that undergraduate students perceive professionals in the field as consumers of research. Alternatively, it could also reflect their understanding that to learn about their chosen careers, research articles provide insight into how professionals or experts think it should be done. Another surprising finding was that more students only "somewhat agreed" that "meeting with AS-L partners" contributed to PPI. This was unexpected since "meeting with clients" is generally thought of as the primary responsibility of a CSD professional.

Figure 4: Pre-professional Identity in Communication Sciences and Disorders
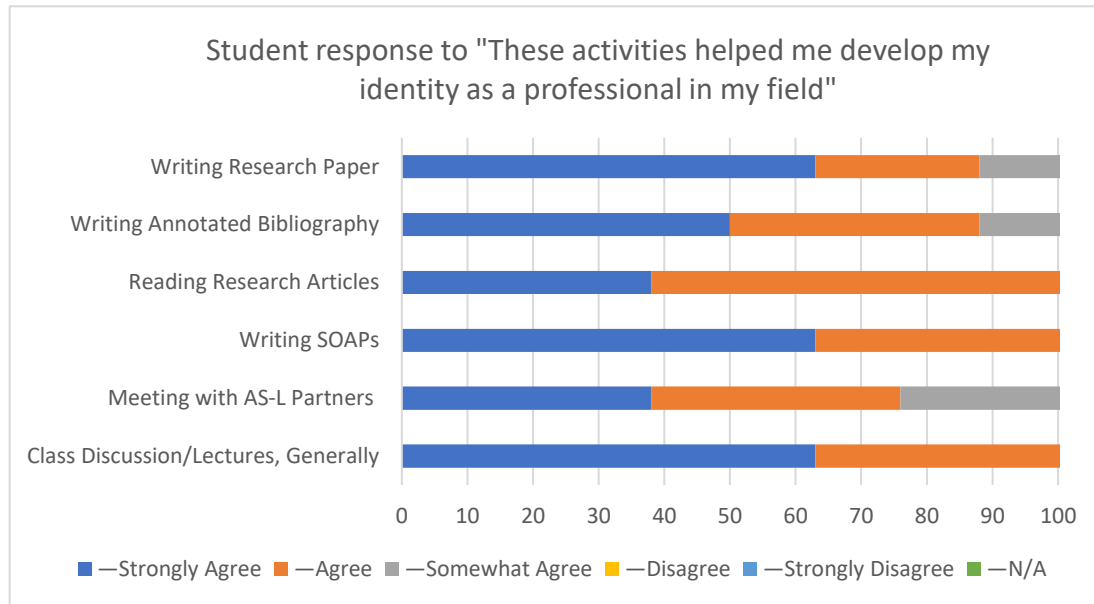
Open ended responses to the PPI Survey reiterated the fact that students valued instruction in professional writing. "*I wish we didn't have so much writing in our English courses I would have rather had more specialized instruction pertaining to the field.*" All but one student mentioned a desire for more undergraduate writing instruction related to their professional field. Students mentioned both clinical and research writing in CSD: "*I would have liked to have a little more writing relevant to speech path. This class was amazing for learning practical speech path writing such as SOAP notes. But I wish as an undergrad I would have had more classes that like this—that way I'd be a pro by grad school*" and "*… I just wished that I had more instruction on how to write and analyze research papers pertaining to my major.*"

Collective Observations

While most of the research done on PPI to date focuses on the development of PPI at the graduate level or through experiential learning activities outside of the classroom, we found that writing in undergraduate courses can contribute to student PPI as indicated in the results of the PPI Surveys of each course, discussed above.

Our findings are consistent with what Lea and Street (1998) and others have concluded: developing an identity through academic socialization is not usually a "straight line" process, and, in fact, as

with other aspects of identity development, is a complex process, dependent on factors both inside and outside of the classroom. In our courses, the extent to which writing contributes to PPI, relative to other course activities, appears to us to be related to four factors: whether the course was in the student's major; how professionally authentic the students perceived the writing in the course to be relative to other course activities; the extent to which the instructor works through the disciplinary writing process with the students; and the extent to which the student already has a PPI (which may reflect how early the course is in their major sequence and the extent to which the student already identifies with the profession). In Legal Writing and CSD, courses in the majors where student engaged in authentic disciplinary writing, such writing contributed to the development of student identity more than other classroom activities. In Chemistry, students reported that lab work affected their PPI more than writing. Apparently, the students perceive lab work as most closely mimicking the disciplinary activity that the students will engage in as professionals. In DNY, a first-year course with mostly non-majors, while writing clearly affected students' PPI, according to the PPI Survey, writing did not contribute to PPI in a way that was materially stronger than other course activities. In at least one of our courses, students rated the writing in the course as having a greater effect on PPI than outside the class experiential learning. As Wiseheart noted above, students felt that writing SOAP notes and a research paper connected them with their profession more than other course activities, including face-to-face meetings with academic service-learning partners. Reflecting on the change in student PPI in our courses, we noted that earlier courses (Croft) appeared to affect PPI more than later courses in a major sequence (Serafin and Wiseheart) and that our courses had less of an effect on the PPI of students who identified with the professions before coming into our courses (see for example, Croft and Serafin, above).

While our study does support the observation that writing in undergraduate courses can contribute to student PPI, we think that future research will require the use of a more nuanced instrument than our PPI Survey to measure the impact of course activities on PPI—an instrument that explores the nuances of the students' relationship with professional affinity, professional identity and professional community.   For example, a better instrument could better measure the effect of course activities on students who had PPIs before taking our courses and could unpack the extent to which the course affects different aspects of PPI—student understanding of the profession, student affinity with the profession and student professional foundational skills. It would also be of great interest to better understand what other identities the students bring into our courses so that we can both leverage that experience and help anticipate possible points of tension that our students may experience (Kells, 2007). One way to approach measuring students' professional foundational skills in the future may be to measure the students' abilities to effectively work with evidence (possibly by measuring the number of citations that students use in their work and the efficacy with which they use such citations). As we were conducting this research, we all found ourselves focusing on the extent to which students were able to effectively use disciplinary evidence and citations.

We found that working through the writing process with our students was an effective use of class time and materially contributed to the development of student PPI. With the exception of Legal Writing (where the purpose of the class is to teach the disciplinary writing process), in each class, the researchers and students devoted significantly more time and attention to focusing on, thinking about, discussing, and working through the writing process than in previous iterations of these courses. And, in each course, those additional efforts appeared to pay off through increased awareness and/or development of PPI. As Benjamin and Conn, Wiseheart and Serafin noted above,

their students' abilities to understand evidence and to effectively use citations increased after repeated class discussions and interventions on the process of using citations. And, as Croft noted above, his students reported that working through the research and writing process together— using the sources that professionals use to analyze the kinds of problems that professionals analyze and the process of taking notes together as a class—increased the students' connection to the legal profession. In fact, at least 85% of students in three courses—DNY, Legal Writing and CSD—agreed or strongly agreed that instruction and class discussion of the writing process (and in Legal Writing and CSD collaborative writing of scaffolded assignments) contributed to PPI.

As students engage in a variety of writing practices through their college years, they can be supported by faculty who recognize the complex and contested nature of PPI development, especially as students are confronting other issues of developing personal identity. While PPI does not happen on its own without intentional instruction, undergraduate writing in the disciplines can be approached in a way that is calculated to affect PPI. Instructors can use writing in the disciplines to affect student PPI by (i) requiring the students to engage in authentic disciplinary writing, (ii) effectively communicating to the students how authentic to the discipline that writing is, and (iii) engaging in intentional pedagogical practices that are likely to affect PPI—like working through the disciplinary writing process with the students. We will certainly keep these insights in mind as we work to more effectively teach our students in our courses.

Appendix

Macroscopic Physical Chemistry
End of Semester Survey, Spring 2016
Prof. Joseph M. Serafin

Name : _____

1. This course is designed to introduce you to content and also to introduce you to the field as a whole. How do you view your relationship to the profession and/or how do you see your place in the field (i.e., your identity as a professional)?

2. How have your thoughts about this question changed over the semester?

        □ Not at all   □ To some extent   □ To a large extent

    Comments:

3. Describe what you have experienced that makes you feel most like a scientist or medical professional.

4. Which writing projects/assignments/reflections that you did in this course did you like the most? Why?

5. Where do you think that you will be professionally in five years?

Please rate your level of agreement with:

These activities helped me develop my identity as a member of the scientific or medical community.

These activities helped me with what I was learning in this course.

	6. Develop my identity						7. Learning in the course					
	Strongly Agree	Agree	Somewhat Agree	Disagree	Strongly Disagree	N/A	Strongly Agree	Agree	Somewhat Agree	Disagree	Strongly Disagree	N/A
Class Discussion	□	□	□	□	□	□	□	□	□	□	□	□
Exams	□	□	□	□	□	□	□	□	□	□	□	□
Lectures	□	□	□	□	□	□	□	□	□	□	□	□
Lab work (in the lab)	□	□	□	□	□	□	□	□	□	□	□	□
Informal Writing (Like Journal Entries)	□	□	□	□	□	□	□	□	□	□	□	□
Formal writing (lab reports)	□	□	□	□	□	□	□	□	□	□	□	□

8. The writing assignments and reflections in this course increased my ability to think independently and critically.

□ Strongly Agree   □ Agree   □ Somewhat Agree   □ Disagree   □ Strongly Disagree   □ N/A

9. The writing assignments and reflections in this course increased my understanding of the subject matter.

□ Strongly Agree   □ Agree   □ Somewhat Agree   □ Disagree   □ Strongly Disagree   □ N/A

10. The writing assignments and reflections in this course increased my connection to the scientific or medical profession.

□ Strongly Agree   □ Agree   □ Somewhat Agree   □ Disagree   □ Strongly Disagree   □ N/A

11. Do you think this course helped you develop more effective study habits in addition to covering content? Why or why not? Would you have liked to do more or less of something?

12. How is John Wheeler's First Moral Principle related to metacognition? [This is just to see if I need to spend more time on these topics next year. No pressure]

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Notes

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