IMPLEMENTING REFLECTIVE WRITING IN LARGE NON-TECHNICAL ENGINEERING COURSES

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Abstract – Reflective writing is a strategy used to promote self-regulated skills among students. We describe the implementation of reflective writing assignments in two compulsory undergraduate non-technical engineering courses on the engineering profession and professional practice. We discuss our observations on the content of the student papers and the challenges associated with the implementation of these reflective writing assignments.

Keywords: Reflective writing, self-regulated learning, instructional strategies

1. INTRODUCTION

Research in the field of self-regulated learning (SRL) aims to understand how students become agents of their own learning [2]. SRL, as defined by Winne and Hadwin, is the act of strategically and intentionally adapting learning activities to achieve learning goals [3]. Benefits of SRL include, amongst others, improved student performance and expanded depth of student thinking [1]. Different instructional strategies have been found to promote SRL skills among undergraduate students. A common strategy used in higher education courses is reflective writing. This instructional strategy allows students to think and write about their own learning process in a specific course. In many situations, as shared in this paper, students are invited to respond to a statement at the beginning and at the end of the course. By giving students an opportunity to revisit their initial response to a question posed by the instructor, they become aware of how they may have changed (and by how much) during the semester and self-assess how much they learned. Asking students to reflect and write about their investment in a course also provides an opportunity to look back and self-assess their learning strategies in view of their performance.

In this paper, we describe the implementation of reflective writing assignments in two compulsory non-technical engineering courses. We discuss different aspects of these assignments, including our observations on the content of the student submissions, challenges associated with their implementation, and our reflection on the activity.

2. COURSE DETAILS

Reflective writing assignments were used in two undergraduate non-technical engineering courses offered at McGill University: FACC 100 Introduction to the Engineering Profession and FACC 400 Engineering Professional Practice. Both are compulsory courses and are taken by students from all engineering programs. FACC 100 is taken typically in the first year of studies and provides an overview of the engineering profession and of different engineering disciplines, with a focus on the programs offered at McGill University. FACC 400 is intended to be taken in the final year of studies, i.e., before students graduate and embark on their professional careers. The course reviews aspects of professional practice and project management.

Both courses are offered twice per year (Fall and Winter semesters). In FACC 100, there are approximately 425 students, mostly from out-of-province and designated as U0 students, registered in the Fall semester while 300 students, mostly from Québec (i.e., the CEGEP system and designated as U1 students), take the course in the Winter semester. In FACC 400, there is less distinction in class composition in terms of out-of-province students vs. those from Québec. Approximately 325 students take the course in the Fall semester and 375 students take the course in the Winter semester.

Specific topics covered in FACC 100 include an introduction to engineering practice, professional conduct and ethics, the engineer's duty to society and the environment, sustainable development, and occupational health and safety. The following are the expected learning outcomes of the course and in particular, students should be able to

- formulate an opinion on the necessary skills and competencies to be successful as an engineer,
- understand engineering professional values and ethics; apply knowledge of these values to address issues in professional practice,
- explain how the field of engineering is inter-disciplinary,
- assess critical issues in engineering using concepts related to sustainability and global engineering,

- apply design and management processes to engineering projects, and
- understand basic technical concepts from various engineering disciplines.

Specific topics covered in FACC 400 are laws, regulations, and codes governing professional practice, responsibility and liability, environmental legislation, contracts, client relations, and project management (analysis, design, execution, and operation). By the end of the course, students should be able to

- identify legal and regulatory frameworks governing professional engineering practice, including liability and responsibility,
- acquire the knowledge and critical analysis skills needed to resolve ethical issues that arise in professional engineering practice,
- assess the role of the engineer with respect to society, environment, and sustainability while accounting for ethics and equity issues,
- understand and describe basic concepts associated with intellectual property,
- define the workflow in executing engineering projects,
- differentiate the different types of contracts used in professional engineering practice and understand the rights and obligations of the client and the engineer within a professional working relationship, and
- develop skills for professional communication and life-long learning (including reflection and self-evaluation).

With respect to the graduating student attributes, both FACC 100 and FACC 400 cover *Individual and Team Work* (applied), *Communication Skills* (applied), *Professionalism* (developed or applied), *Impact of Engineering on Society and the Environment* (developed or applied), *Ethics and Equity* (developed or applied), *Economics and Project Management* (developed or applied), and *Life-Long Learning* (developed or applied).

Creating and implementing course activities and assessments that engage the students is very challenging, especially considering the large class sizes. Over the years, activities and assessments have included the use of a student response system (e.g., TurningPoint), group discussions and problem solving, think-pair-share, organized debates, video and poster presentations, written papers involving peer review, and reflective writing assignments.

3. REFLECTIVE WRITING ASSIGNMENTS

The main objective of including reflective writing assignments in both courses is to provide students with an opportunity to engage in self-direction and self-evaluation, two indicators that are associated with *life-long learning*. In both courses, the reflective writing assignments involve a two-step process whereby a paper is written and submitted at the beginning of the semester followed by a reflection and subsequent submission towards the end of

the semester. It is expected that students will draw upon their learning experiences in FACC 100, FACC 400, and in other courses, as well as their other experiences acquired throughout the semester or their studies, e.g., from participation in co-curricular activities, internships, or co-op programs (where applicable), in performing their reflection.

3.1. Reflective Writing Assignment in FACC 100

In this assignment, students are asked to describe their broad career objectives or their first professional experience (e.g., their dream job) upon obtaining their undergraduate engineering degree. They are asked to discuss the skills, both technical and soft, that they think will be necessary to be successful. The assignment is distributed during the first class of the semester (time is even provided in class for the students to start working on the assignment) and is due within two weeks. Towards the end of the semester, the students are asked to review their original submission and then discuss whether or not their career objectives/first professional experience changed and/or whether there are changes to the skills (or their relative importance) that they perceived to be necessary to be successful. The students have to justify clearly the changes or absence of change. The assignment is worth 5% of the final grade.

3.2. Reflective Writing Assignment in FACC 400

In this assignment, students are asked to write a letter of reflection and can choose one of the following two scenarios.

Scenario 1. The students write a letter to themselves. The letter must begin with, 'As an engineer, I will be someone who takes on responsibility for making positive contributions to society and human kind through advances in applied science and technology. Based on my experience as an engineering student to date, I think I can (*or will or should*) participate in the following ways in responding to challenges facing human kind...'

Scenario 2. The students write a letter to a first year student (U0 or U1) taking FACC 100. The letter must begin with, 'As an incoming student, you will likely focus significant efforts throughout your studies on mastering technical concepts associated with your program. However, engineers need to consider many more factors in their professional work, including the impact of engineering on society, sustainability, ethics, and equity to name a few. The reason you are taking FACC 100 Introduction to the Engineering Profession is because ...'

The assignment is distributed in the first class (time is also provided in class for the students to start writing their letter) and is due within two weeks. Students are instructed not to look at their letter after submission. About one week before the end of the semester, students are asked to re-read the letter that they wrote and to reflect on its contents. They have to describe any changes to their thoughts and explain

why there were changes or no changes. The assignment is worth 7.5% of the final grade.

3.3. Implementation Details

In both courses, there is a one page limit for each written paper (either the first or second part of the assignment). Apart from the requirements stipulated above, the students are not provided with explicit instructions for completing the second part of the assignment. The students can write a new paper/letter or re-write certain passages from their first paper or they can also use bullet points to explain their thoughts.

The assignments were submitted via a learning management system (in this case, myCourses); submission of the second part was made conditional upon completion of the first part.

The instructor reviewed all of the submissions and feedback was provided to the students only *after* the second part was completed, i.e., after considering both the initial submission and reflection.

As these are reflective writing assignments, there are no 'correct' nor 'incorrect' responses. As such, in terms of grading, students generally received full marks. Students did not receive full marks if (1) they did not complete both parts of the assignment (in particular, they did not submit their reflection) or (2) their reflection clearly demonstrated a lack of effort, e.g., students simply stated that nothing changed without providing any justification.

4. OBSERVATIONS

4.1. Results

After reviewing more than 1,700 papers from students who completed FACC 100 (~1,400) and FACC 400 (~350) in four separate offerings of the courses (three times for FACC 100 and once for FACC 400), a number of general observations were made.

Initial submission. The following observations pertain to the content of the initial submission.

1. In FACC 100, many students described their dream job and focused on the necessary technical skills. Soft skills, if referred to, were constrained largely to those associated with communication and management.
2. In FACC 400, many students chose to write a letter to themselves in which they described various principles to guide their professional conduct and practice. Many focused on social commitment and 'engineering for humanity.'
3. In FACC 400, fewer students wrote about soft skills, such as team work, leadership, and communication.
4. In FACC 400, many students demonstrated a significantly greater level of awareness for topics such as sustainability and the impact of engineering on the environment and society compared to students in FACC 100.

Reflection. The following observations were made after reviewing the students' reflections.

1. While a few students wrote a new paper/letter for the second part of the assignment, most simply revised certain passages or used bullet points to highlight changes.
2. In FACC 100, a number of students changed their career objectives. New objectives or professional experiences included becoming more engaged in engineering for sustainability and entrepreneurship.
3. In FACC 100, many students wrote about having an increased awareness or a broader appreciation for the engineering profession in terms of non-technical aspects, such as responsibility and social obligation (i.e., duty to society and commitment to sustainability and the environment). They also acknowledged the difficulties in decision making when faced with complex issues involving ethics and equity, or balancing their duties to society and their employer.
4. In FACC 100, many students reduced emphasis on technical skills and highlighted the importance of soft skills in professional practice, e.g., communication—both oral and written—for expressing their ideas, team work—especially with regards to the role of an individual in a group, how to be an effective team member, taking accountability for one's work within a group, etc., and leadership.
5. In FACC 400, many students discussed the complexities in resolving complex issues involving ethics or equity. They also described a greater awareness of the legal and regulatory framework governing engineering practice.
6. In both courses, several students identified weaknesses and areas in which they needed to improve, e.g., team work, communication skills, etc. Some suggested how to address these weaknesses by seeking opportunities associated with co-curricular activities such as participation in design teams or design competitions.

4.2. Challenges

Following our experience in implementing these reflective writing assignments, we have identified the following challenges.

Time. Given the large class sizes, a considerable amount of time is required to review the papers and provide feedback to the students. On average, it takes about five minutes to read through the original submission and the reflection response, and to provide feedback. For 400 students, this is equivalent to nearly a full week of full-time work.

Providing feedback. While every effort is made to provide personalized feedback to the students, the written assignments themselves tend to fall into one of several patterns. As such, the corresponding feedback provided also follows certain patterns, which can reduce its 'meaningfulness'.

Genuineness of the student responses. While there is no reason to doubt the validity of the content in the students' papers, there is a concern that the students' reflection is based on what they believe the instructor 'wants to see'. In other words, they may deliberately write about certain changes or address specific ideas and topics, even if they do not truly believe in them.

5. DISCUSSION AND CONCLUDING REMARKS

In such large classes, we often find it difficult to 'connect' with the students. By reading their papers, we are provided with an opportunity to consider the students' opinions and thoughts, as well as to observe how these are influenced by their on-going learning experiences. Based on the course evaluations, we have observed that a number of students question the purpose of reflective writing (this has also been observed in other technical engineering courses that we have taught that incorporate reflective writing exercises). On the other hand, a number of students valued the opportunity to perform the reflection and appreciated the feedback. Thus, in spite of the challenges associated with implementing reflective writing assignments in these courses, especially in terms of the time commitment required, we believe that they are useful and remain committed to their continued use.

A number of factors might influence the reflective process and moving forward, we have identified a number of questions that can be examined further. Sample questions include the following:

1. Does academic performance, e.g., characterized by a student's grade point average, influence the reflective process and if so, to what extent? In particular, are

students that have higher academic standing more likely to value and conduct self-evaluation and explore opportunities for improvement?

2. Does gender influence the reflective process and self-regulated learning? For example, are female students more likely to perceive personal weaknesses and identify a need for improvement?
3. Does student background influence the reflective process? For example, are domestic students more likely to engage in self-evaluation compared to international students?

Experiences such as the ones shared in this paper, and future studies in this field will provide instructors and educational developers with the tools required to help future generations become lifelong learners

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