

High Expectations – Transforming First Year Students into Ethical Scientists

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Biography

Tanya Noel graduated with her PhD in Biology from The University of Calgary in 1998, and is an Assistant Lecturer in the Department of Biology at York University in Toronto, Canada. Currently, she serves as Undergraduate Program Director of Biology, and a Centre for the Support of Teaching Scholar. She has taught introductory biology, botany and microbiology, and coordinated laboratories for various courses. Her research interests include student engagement, inquiry, and quality of learning in introductory science courses.

Jennifer Petruniak received her BSc in Biology from the University of Waterloo in 2002 and is currently pursuing a MSc in Biology at York University. Working primarily in the field of invasion ecology, Jennifer's research interests include zooplankton spatial dynamics, secondary invasion pathways and finding novel approaches to scientific problems through interdisciplinary collaboration. She has been involved in curriculum development for English as a second language students, and is interested in teaching science as a process.

Introduction

BIOL 1010 6.0 (Biological Science) is a wide-ranging introductory survey course with associated laboratory exercises. Traditionally, the lab component had been intended to reinforce students' understanding of biological concepts and to teach practical laboratory skills required for subsequent courses. Overall, more than 1200 students per year take this course, as it is required for all students in Biology programs and is a popular choice for students in other science programs and as a General Education course for non-science students. Because the number of students per lab section is limited, we recognized that the labs provide an ideal environment for innovations in developing higher-level learning and critical thinking skills. Recent laboratory curriculum revisions were made with the objective of giving students opportunities to develop and practice fundamental scientific skills in the context of Biology. Early in the course, students explored and used scientific literature, and continued to be expected to consult relevant scientific literature in later assignments. Academic integrity concepts were integrated into the laboratory activities to provide students with a good understanding of plagiarism and how to use and cite sources appropriately. Although the objectives were ambitious, the preliminary results were largely positive, and we are looking forward to building on these efforts in future years. In the first year running the new laboratory exercises, we encountered some challenges that will need consideration in ongoing curriculum development.

'Science information and ethics' laboratory exercise

The described laboratory exercise was developed to help students begin to gain skills that they would need throughout the rest of the course, and in most cases, throughout their future studies. All of the BIOL 1010 laboratories were designed to reinforce science as a method and to promote effective communication. This laboratory was performed early in the course.

This specific exercise was designed to give students hands-on experience searching the scientific literature, explore aspects of plagiarism via the "Turnitin" system (©iParadigms, LLC.), and format reference citations appropriately. In the lab, students set up accounts on turnitin.com, and submit material that is not original for part of the exercise on plagiarism. On their own time, they rework and resubmit the paragraph in their own words to TurnItIn.com for an originality report. Additionally, during the lab time, students perform a series of activities relating to searching for scientific literature in different ways, and will prepare a small set of References in the format used in this course.

Student Outline

Objectives of the laboratory exercise

Following this lab, students should be able to:

- Use library resources to find scientific literature.
- Find resources in the York University library system, and know where to go for library assistance.
- Cite reference sources correctly.
- Prepare a "Literature Cited" section of a lab report.
- Demonstrate understanding of various aspects of ethics as relating to scientific topics and practices.

- Explain plagiarism, and know when to put information in their own words.
- Use the Turnitin.com system, and understand an originality report.

The lab manual (Noel et al., 2007) includes information about the importance of scientific literature, some general background regarding ethics in science, and detailed information regarding plagiarism, paraphrasing, and citing sources appropriately. Several examples are included to show how sources should be cited in the body of a piece of writing, and how to list these sources according to the reference format used in the course. In addition to the textbook, a writing guide (Pechenik, 2007) is required, and serves an additional resource for this laboratory exercise (as well as others).

Activities in this laboratory exercise

All BIOL 1010 laboratory exercises require students to prepare in advance for the session, perform work during the session and usually perform a reflective exercise on their own time after the session. Before this particular laboratory exercise, students were expected to set up an account for the academic computer labs (if not already done), and complete York University's Academic Integrity tutorial (http://www.yorku.ca/tutorial/academic_integrity/). Students had also been encouraged to attend a large BIOL 1010 library tutorial session that introduced library tools, and demonstrated how to search scientific literature.

During the lab session, the teaching assistant (TA) guides students through a set of exercises, to be carried out individually (although students are encouraged to ask questions of their lab mates). The laboratory takes place in a computer lab, equipped with workstations for each student. The computers have access to institutional network resources and the internet. Initially, students will set up Turnitin accounts and join the BIOL 1010 class. In the lab time, students are directed to web sources from which they are asked to copy and submit to Turnitin as Assignment #1. This allows students to see how the system shows submissions with high similarity to other sources. (Assignment #2 involves students writing a paragraph on the same subject as the copied material in their own words, also submitted to Turnitin, before the next class.) The rest of the lab session is devoted to 'The Amazing Library Race' - a series of challenges using library resources to find scientific literature and create appropriately formatted reference list based on the challenge results. Each student in a lab section is given a different set of challenges from a challenge bank. (See Table 1 for an example of challenges that could be provided to a student.)

Table 1. Amazing Library Race – Example “challenges” provided to a student during the laboratory session. While the challenges are similar for all students, topics and text quotes vary for each person.

<p>Challenge 1: Using the provided topic, find a relevant article in a peer-reviewed scientific journal. Show the paper – i.e. the open PDF or the full text HTML version (if available) - to your TA, and record the citation in your Word document.</p> <p>Topic: Anti-cancer products produced by fungi</p>
<p>Challenge 2: View the references from the paper you have found in Challenge 1. Choose a paper from the list, and find it. Show the TA the reference in the Challenge 1 paper, and the open PDF or the full text HTML version (if available) of the one from the reference. Enter the full citation in your Word document.</p>
<p>Challenge 3: Find a book related to your topic from Challenge #1. Show your TA the information about the book (title, authors, which library/libraries, call #). Enter the full citation in your Word document.</p>
<p>Challenge 4: Find the article (based on provided text quote). You can show the TA the open PDF or the full text HTML version (if available). Enter the full citation in your Word document.</p>
<p><i>An excerpt from a recent scientific paper, in quotes, would be listed here.</i></p>
<p>Challenge 5: Prepare a reference list of all papers and books from the previous challenges. This list should be in the NRC Publishing style (e.g. Canadian Journal of Botany, Canadian Journal of Zoology, etc.)</p>

Before the next lab session, students are asked to visit the science library (i.e. the Steacie Library at York University) and sign in on a BIOL 1010 signature sheet at the circulation desk for one mark towards the evaluation for the laboratory (out of a total of 10 marks).

Student instructions (from lab manual):

- *Using Turnitin*

Following the instructions in the Appendix of the lab manual, set up an account at Turnitin.com. Your TA will provide the enrollment code and password. Your TA will review the Turnitin system briefly in the lab session. As part of your assignment, (which you may be able to begin working on in the lab period, but will likely need to finish outside of the lab) you will use the system in two very different ways. First, to see how the system analyzes and reports text similarity, you will find, copy and paste text from a website or journal article (as directed by your TA) and submit it to the system. (This should be very quick ... and this occasion is probably the only time in your university career that you can actually submit material that is not your own work!)

You will also prepare a short paragraph in your own words, describing the assigned website/article. Prior to submitting the paragraph to Turnitin, be sure to take your own notes (in your own terms and phrases), and prepare drafts and revisions, to reduce the likelihood that you will be tempted to use the original author’s words/phrasing. The paragraph should be less than a single page in length, double-spaced. This paragraph will also be submitted to Turnitin.com. Your goal is to write a clear, concise, accurate description with very little similarity to other sources (i.e. avoiding plagiarism).

- *Finding scientific literature*

You will be participating in “The Amazing Library Race”! Scientists often need to find scientific literature in different situations, and often searching is required. This exercise will give you some practice doing various types of literature searches, and keeping track of your reference citations.

In today’s lab, your TA will provide a brief overview of York University library resources. You will work through a series of challenges relating to use of the library, searching for scientific literature, and keeping track of reference sources. Once you have finished your current challenge, bring the result to your TA; if you’ve successfully completed the item, the TA will record completion, and you can move to your next challenge.

Assignment / marking scheme

Before and during the lab period:

- Completing pre-lab activities before lab. [1 mark]
(Bring proof of academic integrity quiz completion to lab!)
- “Amazing Library Race” challenge results. [5 marks]

Before next lab period:

- Both originality reports for the Turnitin assignment to be handed in to TA at the beginning of the next lab period. [1 mark for completing task as directed; 2 marks for quality of the paragraph prepared in your own words.]
- Visit Steacie Library and sign in (on 1010 list) prior to next lab section. [1 mark]

Notes for Instructor

Outcomes of the laboratory

The majority of students who completed an end-of-course survey indicated (answered “Agree” or “Strongly Agree”) that they were comfortable finding relevant scientific information, understand what plagiarism is, and think that they will use the skills they gained in BIOL 1010 labs in future lab courses.

We noticed in subsequent lab assignments that students took finding appropriate scientific literature seriously, and often included more than the minimum number of required reference sources, which contrasts markedly with what has been observed in the laboratory reports in this course from previous years, before introduction of a laboratory involving scientific literature and library resources.

Use of Turnitin as an educative tool

As York University subscribes to the online plagiarism prevention system Turnitin, we employed this tool to help our students in understanding plagiarism. (There are a few plagiarism prevention/detection systems, and it may be worthwhile for an instructor to check to see if their institution subscribes to any of these services.) As with most such systems, Turnitin can be customized by instructors to be used solely for instructor detection of plagiarism (i.e. in a punitive role), or can be set up to allow students to view the similarity of their submissions, and resubmit their work after revision. As our objectives were to help students understand plagiarism and academic integrity, we used the system to allow students to use the system in a way that would illustrate concepts that can seem abstract to a first year student.

We observed a few things that may be of interest to instructors planning to use this system. The system needed more setup time needed than we had anticipated. Each TA requires their own account and must be designated as a TA in the course. (Many graduate students already had student accounts.) We had to set up a master class with individual sections, as BIOL 1010 has over 50 laboratory sections. Each submission needs to be set up as an assignment in the system with due dates. (In the described lab exercises, two assignments were created.) Each section must have the same preferences (e.g. to allow students to view their own originality reports, allow resubmissions up until the deadline).

We observed occasional delays in originality report generation. There is also an automatic 24-hour delay for originality reports on resubmitted work, so students were advised to submit early if they had any concerns about how well they had paraphrased from the original source.

It is important to note that similarity scores can change over time. If Student A submits a report that is very similar to the report of Student B, this will only be revealed once both submissions are in the system.

It must be remembered that Turnitin does not catch all forms of plagiarism. We asked TAs to mention that although high similarity in an originality report is usually indicative of a problem, a low similarity score does NOT necessarily mean that no plagiarism has occurred. Also, if a student does not submit their own paper (or all of their own paper), they may be able to circumvent the system. However, the goal of this laboratory exercise was to help BIOL 1010 students understand academic integrity and plagiarism, so we asked the TAs to focus on helping students in comprehending why academic honesty is important in university and in scientific communication.

TA support and preparation

Graduate student TAs prepare for each laboratory exercise in the course by attending a lab meeting, and consulting TA notes. TAs are always given the option to perform the exercises themselves, in the wet lab or computer lab. For this particular exercise, TAs were also required to ensure that they had active Turnitin accounts before their labs. We had set up a “master class” in the system, which included all of the different lab sections, assigned to the appropriate TAs. As our TAs differed in familiarity with the York University library systems, and in searching scientific literature in general, some additional support was required in some cases. Our subject librarian kindly agreed to run short library tutorials for any TAs interested in a hands-on review of the scientific library resources available at this institution. Many of the TAs provided very positive feedback about this optional session, having perceived the value of these tools in carrying out their own research.

This short exercise also taught the TAs who weren't familiar with the system how to use it in regards to marking. For those TAs who were new and lacked confidence/experience with marking assignments, it provided an additional check for plagiarism, alerting them to those papers that may require more attention while marking. We note that plagiarism detection software should never replace responsible and diligent grading, but it can point out to TAs where similarities exist.

TAs must have an answer key and understand the reference format in order to mark the in-lab exercises. (Answer keys, along with challenge items, are available from the authors by request.)

Challenges/issues we encountered

Not surprisingly, the first year we ran the new labs, we did encounter a few problems and challenges, described briefly below:

Computer/system glitches

In addition to the Turnitin considerations described above, we occasionally had minor technical problems. An upgraded computer lab is anticipated to cut down on such problems in future.

Developing and distributing different sets of activity items for different students

Finding activity items was surprisingly fun for us, but time consuming. Each student in the section was given their own items and we made some variations each week.

Formatting references correctly was more time consuming than we had planned

In a busy lab session, we found that the students often had trouble preparing the reference list in the requested format within the available time. In the future, we will have students complete this task outside of the lab for later submission.

“This isn’t Biology!”

While the majority of students were appreciative of what they were learning, a few students were resistant to developing skills (rather than the traditional lab exercises limited to concentrating on biological factual information and carrying out experiments in a cookbook approach). This indicates that we could improve the awareness of students of the goals of the laboratory.

Why did we still have cases of academic dishonesty in the laboratories?

A few cases of suspected plagiarism in lab reports were brought forward as TAs marked the final lab assignments. From discussions with the students involved, it appears that a few students were either overwhelmed by the end-of-year workload and/or had difficulty comprehending the background material for the final formal lab report. In future, we will try to work with the TAs to increase the explicit reinforcement of academic integrity in all lab exercises, and support at-risk students.

Possible modifications

The laboratory exercise could be adapted or expanded upon, depending on the level of the students, and the objectives of the laboratory/course curriculum. Some examples include:

1. Adjustments can be made to increase or decrease focus on use of library tools, citation of references, academic integrity. Time permitting, each of these could be expanded into more extensive exercises. e.g.
 - Additional paraphrasing/plagiarism awareness exercises.
 - More work on in-text citations.
 - Customized library/scientific literature searching, integrating into other laboratory exercises.
 - Discuss evaluating quality of potential reference sources.
2. If your institution does not have a Turnitin subscription, investigate other plagiarism detection tools. Alternatively, alter exercise to have students review one another’s plagiarized vs. original work.
3. Additional or advanced exercises can be assigned for students to complete on their own time.

4. Explore other ethical issues (e.g. bioethics controversies, falsification of data, recognition of author contributions in a scientific paper, etc.).

Future directions

Based on our observations from the first time this laboratory exercise was run, we identified some future directions. Some of these are already in place for the 2008-2009 academic year.

1. Provide additional resources for students and TAs.
2. Consider use of other Turnitin tools (e.g. peer review).
3. Link activity items to additional specific aspects of future lab exercises (i.e. allow students to build on work carried out in this laboratory in subsequent lab assignments).
4. Include RefWorks (or other reference management system) as part of laboratory exercise.
5. Continue with integration/expansion of initiatives in other courses.
6. Track students who took course with revised curriculum, compare to those who completed previous version. Assess for differences in terms of academic honesty and information literacy.
7. Introduction of BIOL 1010 code of conduct. (This has been done, and will also be incorporated into other courses.)

Links

- Additional materials (lab exercise from manual, TA notes): <http://www.yorku.ca/tnoel/ABLE/>
- Turnitin website: <http://www.turnitin.com/>
- York University's Academic Integrity tutorial: http://www.yorku.ca/tutorial/academic_integrity/

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Literature Cited

- Noel, T.C., Petruniak, J., Gardonio, E., and L.W. Donaldson. 2007. SC/BIOL 1010 6.0 Biological Science Lab Manual. Vol. 1. York University, Toronto, ON, 68 pages.
- Pechenik, J.A. 2007. A short guide to writing about Biology. Sixth edition. Addison-Wesley Longman, New York, 26 pages.