SCOL 290, 391, 490
Requirements for the Reports

Science College
Concordia University

This document is intended to be a guideline for the student and the supervising faculty member. Students must meet with their supervisor before starting their research and establish how this document will apply to their research project.

The Science College curriculum requires three courses involving independent research: SCOL 290 (3 credits), SCOL 391 (6 credits), and SCOL 490 (6 credits). In 290 students are expected to spend a minimum of 120 hours on this course. In 391 students are expected to spend a minimum of 240 hours on this course. In 490, students are expected to spend at least 240 hours on this course. It is assumed that students will be given papers to read as part of their experience in these courses. The following are guidelines for the faculty directing these projects and the students taking the courses.

Deadlines

SCOL 290: Students must submit via email their reflective paper and final research report to their supervisor and to the principal of the Science College by the last day of classes at the end of the semester in which the student enrolled in the course. The supervisor must submit via email the grade evaluation to the principal of the Science College by the last day of exams.

SCOL 391: Students must submit their reflective paper and final research report via email to their supervisor and to the principal of the Science College by the last day of classes at the end of the second semester from when the student enrolled in the course. The supervisor must submit via email the grade evaluation to the principal of the Science College by the last day of exams.

SCOL 490: Students must submit final research reports via email to their supervisor and to the principal of the Science College by the last day of classes at the end of the semester from when the student enrolled in the course. The supervisor must submit the grade evaluation via email to the principal of the Science College by the last day of exams of the second semester.

Extension: It is acknowledged that the nature of research is such that delays may occur outside the student’s control. Students may request a one semester extension to submit their papers; requests must be made to the principal of the Science College.

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**The Nature of the Projects**

SCOL 290 is intended to give students an introduction to the way a research group operates, as well as the factors that go into the design and execution of a research project. With this in mind, it should include the following:

a) The project should be chosen so as to give the student as much interaction as possible with the activities of the group, who, depending on the level of the course, could play a greater or lesser role in the direction of the student.

b) It may not be necessary that the research be completed, with a final well-defined goal, nor indeed need it be successful. What counts is that the student understands the long-term objectives and the part that his or her research will play.

For SCOL 391 and SCOL 490, projects should be designed with a clear stopping point in mind. We discourage projects that may drag on for more than two semesters.

For SCOL 290 and SCOL 391 there may be some temptation to use the students as unpaid technicians. It is essential that the student have some part of the research activities of the group that is identifiably his or hers, and they should not be considered fair game for any odd jobs that need to be done.

N. B. Students must choose a project outside of the topic of their major for SCOL 290 and SCOL 391. This practice is in the spirit of the multidisciplinary objectives of Science College.

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**Research Reports and Reflective Papers**

A Research Report is required for all courses. In addition, for SCOL 290 and SCOL 391, a Reflective Paper is also required.

**SCOL 290**

In SCOL 290 the reflective paper is a description of the student’s learning experience in the lab. This paper of approximately five pages should include aspects of techniques learned, and could include negative or positive aspects of the research process in that experience. This is an opportunity for the student to synthesize what they have learned from their research experience.

The research report relates to the research/experimentation experience. This portion (approximately 5 pages) should follow introduction, methods, data analysis, and results in the format of a discipline-specific key journal.
SCOL 391

The reflective paper is where students describe and reflect on their learning experience similar to that described in SCOL 290. The research report also mirrors the SCOL290 research report, but should reflect the additional work associated with this elevated course. The typical report will be 15 pages in length, and will follow a key journal in the discipline, including a brief introduction, methods, data analysis, results, and discussion. The SCOL 391 research report is considered like a small honours thesis.

SCOL 490

In SCOL 490 the reflective paper is not required. The major effort should be devoted to the preparation of a submission-ready manuscript. Following the format of a key journal in the discipline, the paper of approximately 25 pages will follow standard research format from abstract to discussion. A SCOL 490 research report is expected to be the same quality and format as an honours thesis.

Detailed requirements of the research reports are listed below. In all cases the length is exclusive of references.

**Presentation of the research.**

Each student is expected to present their research (poster or talk) either at the Science College Research Day in the fall or the BOLD Science conference in the spring, whichever one occurs next after paper submission.

**Grading Guidelines for Supervisors**

The student’s background preparation (knowledge, readings, understanding of the problem).

The student’s contribution to the ideas and details of the study (originality, initiative, openness of ideas, discussions, questions).

The student’s work in the laboratory, (learning of techniques, performance of tasks, presence in the laboratory, interaction with other laboratory members, contribution to other projects, data collection and analysis).

The final report (content, format, clarity of exposition, understanding of the problem, data treatment, discussion etc.).

Please take into account that the students are not graduate students and that SCOL 290 is usually completed at the beginning of their university studies and SCOL 490 is the final capstone demonstration of what they’ve learned.
Style, Format, and Content

Different departments have different style formats. Psychology reports would follow the style of the American Psychological Association. Physics departments that of the Canadian Journal of Physics etc... Students should follow the format of the Department in which they are conducting the research project. The following are basic elements of formatting that should apply to research manuscripts:

1. Specify standard letter size (8½ × 11 in, or 21½ × 28 cm) with all margins set to ¾ in, or 1.9 cm.

2. Number pages consecutively with Arabic numerals beginning with the first page of the introduction and proceeding through without omissions to the end of the last appendix. Pages prior to the first page of the introduction are numbered with lowercase Roman numerals. All page numbers appear within the document header at the right page margin. Suppress the page number for the title page.

3. The font size is 12 point and should use a standard font (the font of this document is 12-point Ariel). Use standard character spacing, that is, do not apply condensed spacing or use a condensed font.

4. Use continuous double spacing throughout the main body of the text of the report, which includes the abstract, introduction, method, results, and discussion. Do not insert extra space between paragraphs. That is, use double line spacing both within and between paragraphs.

5. The text must be left aligned (i.e., ) so that the right hand edge of each paragraph is uneven. Use a single space after each period, question mark, comma, colon, or semicolon.

Title Page

Center the title within the same left-right margins used for the rest of the document; also center the whole page within the top-bottom margins. Use title case, and do not set the title in boldface. Also do not include a running head on the title page. Include your research supervisor's name and lab location. See the example at the end of this document.

Abstract

Use “Abstract” as the heading, and do not set this heading in boldface. Center your name below the heading, and then center the thesis title below your name, all with continuous double spacing between lines. The text of the abstract should not exceed 150 words. Include an explicit statement of the purpose of the research, a concise description of the subjects and procedure, and a statement of the major findings and their interpretation. An abstract that mentions the results only in passing at the end with the empty phrase, “The findings and implications of this study are discussed,” and gives no further detail is incomplete. See the example at the end of this document.
Acknowledgments

You must acknowledge your supervisor’s contribution, other technical assistance or help in recruiting or supplying participants or subjects, and any granting agency (e.g., NSERC, CIHR) that supported the costs of your research. You also may acknowledge any other person whom you feel contributed to your research and thesis. Put your name and the month and year at the end of the acknowledgements as you would see it in the preface to a book.

Introduction

Your supervisor will have suggested papers to read as a background. They are commonly cited in your introduction.

The main purpose of your introduction is to convince the reader that your experiment is important research. You need to logically justify your predictions (i.e., hypotheses) by explaining the theoretical basis for them. Remember that any idea that is not your own should have a reference citation following it. Even if you have paraphrased someone else's ideas, you still need to use a citation. Also, never cite a source that you have not actually read yourself.

Your predictions should be logically derived from past theories and research. Therefore, you should summarize previous research and make your main research question clear. Although it is important that some relevant experiments be reviewed in detail, make sure that your introduction does not simply read like a sequence of short summaries. It is vital that the links between the past research you have reviewed and your hypotheses are straightforward and logical. When describing past research, be sure to address any important theoretical controversies in the literature. You might also comment on the strengths and weaknesses of the past research. At the end of the introduction, you should explicitly state your hypotheses.

Method

Participants/Subjects. Characteristics of the participants in human studies or subjects in animal studies must be described in full detail in this section. Specifically, do not wait until the results section to describe participants or subjects as their characteristics are not generally considered part of study results. For humans, state the mean, range, and standard deviation of their age; report the same basic statistics for other relevant continuous variables that describe the sample. Also report on gender composition, ethnicity, or other categorical variables relevant to the study. For animal studies, describe the species (e.g., Sprague-Dawley female rats), the source of those animals, and any other relevant characteristic. Also needed is a statement about how the participants or subjects were treated in accordance with ethical standards. In human studies with a single, undifferentiated group of participants, it is usually possible to describe the group with just text and no tables. If there are multiple groups that differ on several key demographic or other variables, however, then it may be better to report group descriptive statistics in a table and summarize those results in the text. Also clearly explain how the participants were selected, which helps readers to understand possible limits to the generalizability of the results. Likewise, interpretation of the results should not go beyond what the sample warrants.

Other subsections in the method section may be needed depending on the study. Some possibilities with instructions for subsection content are considered next, but the goal for the whole method section is to give instructions for someone to replicate each and every aspect of the study.
**Apparatus.** This subsection, which is sometimes labeled as “Materials,” is needed for studies in which special equipment is used to control experimental conditions or record data, among other possibilities essential for carrying out the study. Give enough information about a physical apparatus, such as the brand and model number for a device purchased from a commercial supplier, to permit replication. If an apparatus is bespoke (custom-made), then consider including an illustration, drawing, photograph, or whatever is necessary to allow replication. Note that psychological tests are not considered as “apparatus” and should be described in their own subsection.

**Procedure.** Give details about how each step of the investigation was carried out. These details should include instructions given to participants and information about specific experimental manipulations, such as randomization or counterbalancing, or about any other special feature of the design. Describe any sources of anticipated attrition of cases due to factors such as dropout or noncompliance, and indicate how such attrition could affect the generalizability of the results. Also describe ways used to deal with experimenter bias, especially if the data were collected by a sole author.

**Analysis.** This subsection is generally needed only if a special technique is used that is not standard or widely known in a particular area. For instance, there is no need to describe general characteristics of multiple regression (MR) or the analysis of variance (ANOVA) because these are standard techniques in the behavioral sciences. If there is something special about the application of these techniques that readers must know in order to understand the results, however, then provide those details. Consult with your supervisor or thesis course instruction about the need for an analysis subsection.

**Results**

Besides reporting about the substantive analyses, the results section of every report should address the two issues discussed next:

**Data Integrity.** A complete research report offers reassurance to readers that the results are trustworthy. Specifically, this means that any special complication, protocol violation, or other unexpected problem in data collection must be mentioned. A frequent complication is missing data due to participant dropout, failure of some participants to complete questionnaire items, or equipment failure, among other possibilities. Clearly inform readers about both the extent of missing data and how this problem was dealt with in the analysis. Also describe evidence that statistical assumptions, such as normality, were met and also about any corrective steps taken, such as transformations or deletion of extreme scores (i.e., outliers). In regression analyses, describe the distributional characteristics of the residuals, which should be uniform across the whole range of the criterion (homoscedastic) and approximately normally in shape. In all applications of ANOVA, provide information about whether the distributions of scores on the dependent variables are approximately normal, and in repeated-measures ANOVA provide evidence that either the assumption of sphericity is tenable or describe corrective measures if this assumption is not plausible.

**Summary Statistics.** It is now common to report sufficient summary statistics so that the main analyses can be replicated by another researcher who has no access to the student’s raw data file. In regression analyses conducted within a single sample, sufficient descriptive statistics include the correlation matrix for all variables and their means and standard deviations. For applications of ANOVA in purely between-subject designs, report the size (n), mean, and standard deviation for

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each cell on every dependent variable. When there are repeated measures (i.e., there is a within-subject factor), then also report the correlation matrix for each group. Study summary statistics are ordinarily reported in an appendix (i.e., include a callout to the appropriate appendix in the text).

**Discussion**

The discussion section should accomplish 3 major goals: (1) Close the circle of the report that began in the introduction. This statement means to interpret the results in relation to previous work in the area. If necessary, attempt to explain inconsistencies among the results of the report and those of previous studies. Just as in the results section, use cautious, careful language that sticks close to the data when interpreting the findings. (2) Outline possible limitations to the generalizability, credibility, or robustness of the results. Common limitations include the nature of the sample (e.g., relatively small, unrepresentative), an unforeseen confound, and missing data, among other possibilities. The good scientific writer openly acknowledges possible shortcomings and tries to explain how they may have affected the results. (3) Do not conclude the discussion section with a variation on the typically banal, clichéd call for future research on the topic. Instead, offer specific suggestions about how to improve research in the area or articulate new hypotheses (questions for future studies).
Sample title page:

“The title of your paper goes about here”

Your Name
(Student ID#)

A research report submitted in fulfillment of the requirements for SCOL 290 /391/ or 490

Conducted in the lab of

Research Supervisor’s Name
Supervisor’s Lab location (e.g. Dept. Chemistry, Concordia University)

Date
Concordia University