

Graduate Program in Exercise & Sport Sciences

Thesis Preparation Guidelines

The purpose of this document is to provide specific information to the student to guide the final format detailing of the thesis document. The Graduate Program in Exercise & Sport Sciences uses the American Psychological Association Publication Manual (APA) for writing style reference; however, the APA manual recognizes the special nature of a thesis manuscript and encourages academic departments to provide local guidelines to supplement that APA text (APR 2001, p. 321-322). Accordingly, this document provides guidance that complements and, when necessary, supersedes the APA Manual.

This Guideline document achieves its goal by using numerous examples as appendices. That is, for most topics addressed an example or sample of "how to do it" is provided in an appendix. When writing, do not plan to deviate from the format of the sample provided, however, a thesis advisor will provide advice on specific questions.

The topics addressed in these Guidelines are as follows: Sample Timelines; Selecting a Topic and a Thesis Advisor; General Format: Traditional v. Proposal/Manuscript; Writing the Proposal, Preliminary Thesis Pages; Introduction; Review of Literature; Methods; Results (including preparation of Tables and Figures); Discussion; Summary; Conclusions and Recommendations; References; Appendices and Defending and Preparing the Final Edition of the Thesis. A Checklist for Completion of a Thesis and a list of Thesis Do's and Don'ts are also included. The student should consult the Checklist when deciding to do a thesis as it provides a simple yet fairly comprehensive list of the steps that will be encountered in the thesis process.

Sample Timelines

To be on a one-year timeline it is fairly crucial to present a proposal and get Human Subjects Review Committee (HSRC) approval in the first semester of matriculation. Failure to accomplish these subgoals generally results in the thesis requiring at least 18 months for completion. Planning for a thesis project should always involve a one - two year timeline. The student should be registered for Thesis I (665-620) while writing the proposal and Thesis II (665-621) while working on the subsequent aspects of the project.

Here are a few sample timelines with appropriate task subgoals:

Task	One-year plan	18-month plan	Two-year plan
Review literature, talk to professors, develop research question	Sept-Oct	Sept-Nov	Sep-Dec
Choose thesis advisor and second reader (the committee)	Sept-Oct	Sept-Nov	Dec-Jan
Write Introduction, Review of Literature, and Methods: decide Traditional or Manuscript format	Oct-Nov	Nov-Jan	Jan-Feb
Present proposal to Graduate Faculty	Nov-Dec	Jan-Feb	Feb-Mar
*Prepare and submit HSRC proposal; pilot work and equipment familiarization	Nov-Jan	Feb-Mar	Mar-Apr
Refine Introduction, Review of Literature and Methods as needed	Dec-Jan	Mar-Apr	May-Jul
Collect data	Jan-Mar	Apr-Jul	Aug-Nov
Analyze and interpret data	Apr-May	Jul-Sep	Nov-Dec
Prepare Results, Discussion; ch 6 if needed #	May-Jun	Sep-Oct	Dec-Jan
Refine thesis as needed for committee approval	Jun-Jul	Oct-Nov	Jan-Feb
Present and defend thesis	July	Nov	Feb-Mar
Present to Graduate Chair and Dean (refine thesis accordingly)	August	Dec	Mar-Apr

- *guidelines for the HSRC proposal can be found in the Office of the Provost or the Office of the Graduate Chair
- #ch 6 required for Tradition format

Selecting a Topic and a Thesis Advisor

Finding a thesis topic can be accomplished in a variety of acceptable ways. First and foremost, journal (and conference proceedings) readings can provide a window displaying current topics of research interest. Attending classes, conferences, and workshops are additional ways to be exposed to stimulating information that might uncover a potential thesis topic. Topics identified can be brought to faculty for discussions of suitability, interest, and feasibility. Alternatively the student can simply ask faculty for research topics that the faculty are interested in pursuing. If the student is mutually interested, a thesis project can be arranged using the faculty member's research idea. Research topics are the intellectual property of the faculty member who shares them with the student and cannot be transferred away from that faculty without expressed permission. The faculty member who shares an original research project idea with a student should be the thesis advisor on that project unless that faculty chooses to yield this responsibility.

The thesis advisor is a graduate faculty member whose interests and expertise best align with the student's research topic. The Graduate Chair advises students in their search for a thesis advisor and committee members. One method to identify a thesis advisor is to speak with graduate faculty in your concentration area to gauge interest and

suitability. Once the thesis advisor is selected, a second reader should be chosen shortly thereafter (within days) in consultation with the thesis advisor. Up to one other member may be added to the thesis committee at the discretion of the student, thesis advisor, and second reader (as early in the project as possible). The thesis proposal form (appendix A) must be completed and signed by the student, thesis advisor, and other committee members once the thesis proposal is successfully presented. This form is then submitted to the Graduate Chair. The composition of the thesis committee should not be altered after the proposal and cannot be altered without the permission of the Graduate Chair acting in consultation with the thesis advisor.

General Format: Traditional v. Proposal/Manuscript

The choice of Traditional or Proposal/Manuscript format is one that resides with the student but should be made in consultation with the thesis advisor. A traditionally prepared thesis has six chapters (1. Introduction, 2. Review of Literature, 3. Methods, 4. Results, 5. Discussion, 6. Summary, Conclusions, and Recommendations), each of which will be described in this document. The traditional thesis is written in the past tense, as it is a report describing a project that has happened. The advantage of writing a traditional thesis is that the format is well established and only need be applied to a specific topic. The disadvantage of the traditional format is the student must still prepare a proposal that has the elements of ch 1, 2, & 3 but is written in the future tense because the proposal describes an experiment that is yet to happen. Therefore the student using the traditional format must return to ch 1, 2, & 3 and recast these chapters in the past tense in order to complete the thesis.

The proposal/manuscript style has two major sections (Proposal-containing an Introduction, Review of Literature, Methods; and Research Manuscript-containing an Introduction, Methods, Results, and Discussion). The Proposal is written in the future tense and the elements contained within are essentially the same as ch 1, 2, & 3 of the traditional format. The Research manuscript section is prepared in accordance: with author guidelines provided by an appropriate journal (or APA Manual if desired) as selected by the student in conjunction with the thesis advisor. The advantage of this format is the final document is potentially ready for journal submission and the proposal is written in the future tense may be acceptable for simply transferring into the first section of the thesis document without having to change tense. The disadvantages to the Proposal/Manuscript format are that writing each manuscript section may be an original effort providing less structure for the student than the traditional format. Furthermore, there is inherent redundancy in the two sections of the Proposal/Manuscript format as both require Introduction, Methods, and References be included.

When using either thesis format remember the most important rule of research- to be as clear, concise, and logical as possible. This applies to every sentence, paragraph subtopic, chapter, and section written. Good writing takes time and even the best enters proofread repeatedly and redraft their work frequently. Don't expect thesis writing to be any different.

Attention to detail is critical for high quality document preparation; here are a few examples of details to be addressed: 1) subtitle hierarchy as presented in the Table of Contents should match text exactly; 2) lists of table, figure, and reference titles should match exactly with appearance in text; 3) all tables, figures, references and appendices

must be clearly identified in the text; and 4) graphics that must appear in landscape orientation should be avoided but if required should be bound with their top edge at the left margin. Spacing throughout the text should be double-spaced (including tables, figures, appendices, and references) except when presenting direct quotations, which may be single-spaced. Single spacing may be used judiciously in long appendices if agreed to by the theses committee.

Writing the Proposal

A thesis proposal is written in conjunction with a thesis advisor and committee on topic mutually agreed on by all parties. This work is done as a function of enrollment in Thesis I (665-620) under the name and section number of the thesis advisor. The proposal (and the course) concludes successfully when a presentation to the Program's graduate committee is done, ch 1, 2, and 3 and a related 1-2 page abstract are substantially completed, and the proposal is deemed acceptable by the thesis advisor. Acceptance of the proposal is formalized when the Thesis Proposal Approval Page is signed by the student, advisor committee members, and submitted with a 1-2 page(s) abstract to the graduate chair. The advisor should also submit a grade for the course at this time. A Thesis Proposal Approval Page form is available from the graduate chair.

Preliminary Pages

Preliminary pages are those that precede the first page of numbered text (i.e., the Introduction). These pages are numbered sequentially with lower case Roman numerals centered at the bottom of the page starting with (ii) on the Approval page that follows the unnumbered thesis title page. The order of preliminary pages is as follows with optional pages identified with as needed.

- a. Thesis title page (sample found in Appendix B)
- b. Approval page (sample found in Appendix C)
- c. Abstract (sample found in Appendix D)
-preferably less than 250 words and always less than two pages
- d. Acknowledgments (as needed)
- e. Dedication (as needed)
- f. Table of Contents (sample found in Appendix E for Traditional and Appendix F for Proposal/Manuscript)
- g. List of Tables (required if tables appear in text; sample found in Appendix G for Traditional and Appendix H for Proposal/Manuscript)
- h. List of Figures (required if figures appear in text; sample found in Appendix I for Traditional and Appendix J for Proposal/Manuscript)

The preliminary pages are followed by the text prepared in Traditional or Proposal/Manuscript format. The text, or body of the thesis, ends on the last page of chapter six or at the end of the Discussion for the Proposal/Manuscript format. The References immediately follow the text and are subsequently followed by Appendices to the thesis. References in the Proposal/Manuscript format follow the proposal and also follow the Research Manuscript; each list of references is specific to the section that precedes it. Appendices, in either thesis format, are all added at the end of the document and appear lettered sequentially in the order they appeared in the text. Pagination of the

thesis begins with page 1 on the first page of the Introducing and continues sequentially with Arabic numerals through the last page of the Appendices. Page numbers appear right justified one inch from the top of the page with no pages left unnumbered. Exceptions are the first page of each chapter (Traditional) or section (Proposal/Manuscript), first page of each Appendix, and the preliminary pages (using Roman numerals) which are all center numbered at the bottom of the page.

Introduction

The Introduction is intended to present the topic to the reader and gain their appreciation for the relevance and importance of the research. To best get the reader interested in the thesis topic avoid a long, technical preamble but instead be clear, concise, logical, factual, and to the point. The Introducing of a Traditional (Chapter 1) or a Proposal (first section in Proposal/Manuscript) contains a preamble followed by subunits titled: Statement of Purpose; Hypotheses, Research Question(s) Scope of the Problem; Assumptions of Study, Definition of Terms, Delimitations, and limitations. While all of these subunits pertain to most theses it is conceivable that a student and thesis advisor might mutually agree to omit a subunit for a given thesis. The objectives for each of these subunits are as follows:

Preamble - tell readers about the study by explaining the logic used to arrive at the purpose of the research. Describe highly pertinent previous literature that logically leads to the description of the new problem and underlies the importance of the research. The preamble should be 2-4 pages of text and lead directly to the Purpose subunit.

Scope of the Problem (optional) - clearly identifies the factors to be studied and the tools used. The audience to whom findings are relevant is often identified. Well written preamble, purpose statement, and hypotheses subunits can often be substituted for Scope of the Problem

Statement of Purpose - statement of the problem in general form the details of which will later be presented in the hypothesis.

Research Question(s) (optional) - the recasting of the purpose statement into question form.

Hypotheses - research hypotheses detail the purpose statement by telling the reader how the problem will be addressed. Hypotheses identify the variables (e.g. independent and dependent) to be measured and often briefly state how they will be measured. A hypothesis can be directional or non-directional which are both predictive in nature (i.e., the author predicts how variables will differ or at least that they will differ). When using such hypotheses the author must be willing to predict the outcome of the research. A null hypothesis can also be used and predicts there will be no difference between conditions studied. A thesis may present more than one hypothesis depending on the number of research questions to be addressed. Data analyses, qualitative or quantitative, should be directly related to and driven by the stated hypotheses of the research. In other words, each hypothesis should be specifically addressed by data analysis.

Assumptions of Study - underlying facts or premises that are required to be correct for data to be of acceptable quality. If an assumption is incorrect than related data are likely invalid and the study may become meaningless. Good assumptions expose important issues that often must form the theoretical basis for a research project (e.g.

endurance-trained individuals in this study had a greater sympathetic response during the exercise test than untrained subjects) whereas obvious assumptions (e.g., the subjects told the truth when answering the questionnaire) are not terribly valuable to understanding the nature of the problem.

Definition of Terms - provides clear, operational definitions for critical terms. Constructs, variables, and terms that may have multiple definitions but are being applied in a specific manner for the thesis should be identified and their precise usage described.

Delimitations - describe important choices or decisions made by when defining the parameters of the study. These are options exercised in a specific way that open lead to a limitation in the generalizability of the study's results. An example of a delimitation is when it is decided (a delimitation) to collect data on a particular subject population, (e.g., a sample of elementary schools girls). This will limit the generalizability of data as explained in the next section.

Limitations - description of the degree of generalizability of data that often is caused by a decision made by the investigator. Limitations can also result when an assumption is known to fail or an extraneous/influential variable goes unmeasured or uncontrolled. An example of a limitation is when it is decided (a delimitation) to collect data on a sample of elementary school girls, generalization of the results is probably limited to girls of a similar age. These data cannot likely be generalized to boys of high school age. Another example of a limitation is if one makes the assumption that questionnaires are answered honestly or diets are followed faithfully but finds unidentified subject(s) may have cheated.

Conceptual examples and written explained above are found in the once presentation format style for the subunits of your advisor and of the graduate chair. Appendix K offers an example of the Introducing and subunits of the proposal (i.e., ch 1). These examples must be conceptually applied and expanded by the student to meet the needs of their particular thesis. The student should benefit from the thesis advisor's direction when preparing these subunits for the proposal presentation. As we strive to improve document consistency in the future, please use the subtitles offered above in the order suggested unless unusual circumstances prevail.

Review of Literature

The Review of Literature follows the Introduction in the thesis but, in fact, the literature review is the first step in planning a successful research project. The Review should contain a thorough presentation of previously recognized literature/knowledge on all topics important to developing the research hypotheses/questions and discussing the results of the thesis. Several topics and related keywords may need to be searched on several databases for an acceptable Review of Literature to be written. The Review should not extend into marginally relevant areas and should generally be 15 - 30 pages. A good Review is carefully organized using a conceptual framework. The Review of Literature begins with a brief preamble that tells the reader what to expect from the Review and outlines the subtopics to be addressed. A partial example of a Review of Literature can be found in Appendix L. For more complete examples of Reviews examine previous theses that should be available from your committee members and the graduate chair. Please maintain format consistency in the Review of Literature as is expected

throughout the thesis. The Review of Literature is concluded with a brief summary that reiterates the highlights of the Review in less than one page.

Methods

A careful, precise, and complete description of the details involved with all thesis data collection. The broad aim of the Methods is to allow another investigator to pick up the document and repeat the research project exactly as it was originally conducted. The subunits of the Methods are typically subjects, design/measurement/procedures/tests/protocols/instrumentation, data analyses, and summary. According to the specific methods of the study the subunit for design/measurements/procedures/tests/ protocols/instrumentation may be split into separate subunits for emphasis when necessary or truncated to do-emphasize a process unimportant to the description of the research. If fact, the subtitle never reads as "design/measurements/procedures/ tests/protocols/instrumentation" A partial example of Methods can be found in Appendix M. For more complete examples of Methods examine previous theses that are available from your committee members and the graduate chair. Please maintain format consistency in Methods as is expected throughout the thesis. If any tables or figures are to appear in the Methods please follow the guidelines provided below. The Methods is concluded with a brief summary that reiterates the highlights of the Methods in less than one page

Results (including preparation of Tables and Figures)

The Results provides a concise representation of what was found by the research. Here the data are presented and statistical analyses are reported. The chapter is typically organized by variable or by hypothesis tested. The text is primarily a series of brief factual statements that highlight relevant information that can be found detailed in tabular or graphic form. A partial example of Results can be found in Appendix N. For more complete examples of Results examine previous theses that should be available from your committee members and the Graduate Chair. Please maintain format consistency in Results as is expected throughout the thesis. In Traditional format, the Results is concluded with a brief summary (less than one page) that reiterate: the highlights of the Results.

Tables in the Results (and throughout the text and Appendices) should be consistent in presentation. Tables should stand alone, appear on pages independent of text and must be referred to in the text prior to their appearance. Tables should appear on the page immediately following their introducing in the text. Tables are generally double-spaced as are the notes that follow. It is acceptable to combine two or more short tables on one page provided they are each referred to on the previous page, each table can be doubled spaced, and at least two double-spaces are to be maintained between tables. It is common for a Notes paragraph to immediately follow the table. Notes explain any abbreviations or symbols used in the table and provide any other information the reader requires for the table to stand alone (i.e.? be understood without needing to refer to the text or any other page). In general, the Information in the APA Manual (p.147 - 176) should be consulted when preparing tables. Also use the examples found in Appendix O for guidance on table construction and Note preparation.

Figures, like tables, should stand alone, appear on pages independent of text and

must be referred to in the text prior to their appearance on the subsequent page. Most information above regarding tables applies to figures. Figures, however, have no title above but instead a caption below. Symbols are explained in a legend that is imbedded within the body of the figure. Much of the information in the APA Manual (p.176 - 201) related to figures applies to journal publication and not to thesis preparation, however, some of the Information may be instructive. The examples found in Appendix P should provide ample guidance on figure construction and caption preparation.

Before adding, always ask, “Does a table or figure add clarity to the document?”. Moreover if tables or figures become too numerous it should be asked if some would be better positioned as appendices. Tables, particularly statistical tables, are typically put into appendices when using a Proposal/Manuscript format.

Discussion

The Discussion addresses the results of the thesis in light of hypotheses and previously published literature. Without repeating the Review of Literature, the Discussion addresses questions related to previous work and compares similarities/dissimilarities of present results with previous research results. Applications of the findings for use by practitioners (e.g., coaches, clinicians) should also be addressed here. The Discussion should also describe any shortcoming of the study, explain the significance and reasons for these events, and potentially relate these issues to future research. The organization of topics within the Discussion should be carefully and logically considered but cannot be prescribed in any generic outline. Remember that discussion is for explaining results but not for presenting data a second time-that's why the Results were written. Do not use statistical terminology or jargon too freely in the Discussion. Talk about concepts-not numbers and statistical significance. This is the place to explain the importance of the findings, describe: their meaning and application. Always end the Discussion with a final paragraph that drives home the main findings of the study. In Traditional formats the Discussion is concluded with a brief summary that reiterates the highlights of the Discussion in less than one page

Summary, Conclusions, and Recommendations

This chapter is only found in the Traditional thesis. The summary is an expanded abstract that provides highlights from the previous five chapters with emphasis on the methods, results, and discussion. The conclusions are typically enumerated statements that address the findings of the study and often directly parallel the hypotheses. The Recommendations for future study are also enumerated and identify important extensions of the thesis that would enhance the existing knowledge base. An example of Summary, Conclusions, and Recommendations can be found in Appendix Q.

References

The APA Manual (2001, p. 215-281) is the rule here. It is critical that references appearing in the text agree EXACTLY with those in the reference list. The APA Manual (2001, p.207-214) also covers rules for citing authors within the text. Always carefully double check that all citations appear in both the text and reference list and that all authors are properly listed. Rules of careful citation and plagiarism are established by the Ithaca College Student Conduct Manual and always apply in thesis writing. A sample

(partial) Reference list appears in Appendix R.

Appendices

The last part of the thesis is the appendices (hurray!). Appendices should contain any information that is vital to fully understanding a point in the thesis or replicating a method of the study, but the information is not vital to the flow of the text. That is, a reader may not be interested in checking the information in an appendix but would still appreciate the importance of the point that referred the reader to the appendix.

Proposal/Manuscript style theses typically place detailed statistical tables and figures in appendices. All appendices must be addressed in the text of the thesis. Examples of appendices appear in Appendix S. The APA (2001, p. 205-207) provides useful guidelines for constructor of appendices. If a reference is used in an Appendix it must be cited at the end of the appendix unless that citation can be found in the References.

Defending and Preparing the Final Edition of the Thesis

Upon completion of the thesis, prepare a presentation (15-20 min) for thesis defense. The theses defense should only occur when the thesis advisor and committee members agree that the thesis is in the final stage of approval and the candidate is fully prepared for defense. The thesis defense generally involves lengthy discussion of the theses and will also include discussion of topics generically related to the candidate's degree.

After a successful defense the candidate will submit any needed revisions to the thesis advisor and committee members for final approval and signatures. Be sure to submit at least five original copies of your Certificate of Approval Page with your original signature since each copy of thesis must have original signatures. Following approval and signature by the committee, submit the thesis to the graduate chair for approval and signature. The graduate chair must have at least six weeks prior to the desired degree posting date to allow time for remarks from the chair and approval by the Dean of Graduate Studies before the degree posting date. Although these dates vary from year-to-year, March 15 (for May graduations; July 15 (for September graduations; and November 1 (for December graduation) are reasonable submission dates to allow for all needed approvals. Following approval and signature of the graduate chair, submit the thesis to the Dean of Graduate Studies for signature and approval at least 30 days in advance of the degree posting date: April 15 (for May graduations; August 15 (for September graduation) and December 1 (for December graduation). Note that it is the candidate's responsibility to check specific dates and deadlines. A thesis turned in after deadline cannot be guaranteed a proper review or approval for the degree posting date.

The final thesis document should be prepared on 8.5 x 11-inch white paper with margins set at 1 inch except for the left margin set at 1.5 inches. Font should be 12 pitch and of standard nature (e.g., Times News Roman). At least four bound copies of the thesis are required with two on 20-lb paper (one for the thesis advisor and one for the graduate chair) and two on archival paper (25% rag content) for the library. Additional bound copies (on 20 lb paper) should be considered for other committee members and any personal copies the new author desires. The thesis should be bound in black and the cover imprinted in gold lettering, consistent with previous theses. An example follows:

Thesis Cover Printing example:

THESIS

Career Termination and Transition from
Intercollegiate Athletics: Experience of
Former Division 111 Female Athletes

Beth Howland

2001

Thesis Advisor: Dr. Greg A. Shelley

The upper half of the thesis spine should be printed in the same style gold letters containing the student's name, degree, and year of completion, for example:

Beth Howland

M.S.

2001

Checklist for Completion of a Thesis

**CHECKLIST FOR COMPLETION OF A THESIS
(19 EASY STEPS)**

These guidelines were developed to familiarize you with the process of proposing, writing, and completing a thesis project. Listed below are the steps necessary to guide you through this process. This is intended to increase your understanding of each phase of the thesis, and will enable you to plan realistically for the completion of your project.

- _____ 1. Familiarize yourself with the current research literature on your topic of interest. Be sure to look at published (books and periodicals) and unpublished materials (theses and dissertations) and carefully read the future recommendations sections of these works. If you are stuck on selecting a topic of interest, talk to the faculty. They are usually ready to provide you with good project "seed" ideas.
- _____ 2. Discuss potential thesis topic(s) with appropriate faculty advisor (faculty member with expertise in selected topic areas) and possibly a second reader (faculty member with expertise in topic or related area). Once an advisor, second reader, and you agree on a topic it is thesis material and you are ready to prepare a proposal.
- _____ 3. Work with your thesis advisor to develop a thesis proposal for the graduate program and one for the Human Subjects Review Committee (HSRC). Your

advisor will be able to give you examples and input on how to prepare a good graduate program proposal. For the hard proposal, obtain a current copy of the guidelines for Proposals' from the Provost's Office. The graduate program proposal should precede submission of the HSRC proposal.

- _____4. Work with your thesis advisor and second reader to review and finalize the proposal and choose a proposal date. Be sure that you are prepared to provide all relevant information as outlined in your first three chapters (i.e., introduction, review of literature, and methods) prior to your thesis proposal. Also, be aware of deadlines for the HSRC and how your overall timeline is affected by selector of proposal submission dates.

- _____5. Give a presentation of your thesis proposal to the Graduate Program (interested faculty and students) prior to submission to the HSRC. The purpose of this presentation is to solicit constructive criticism regarding the content and/or methodology of the proposed project. This proposal presentation should be about 15-20 minutes in length and include an overview of the first three chapters of your thesis (i.e., introducing, review of literature, methods and procedures). This presentation should include the following:
 - A complete title.
 - An introduction of the proposed topic and project.
 - A clear and concise purpose statement,
 - A significant statement outlining why the proposed project is significant to the existing body of knowledge and the furthering of knowledge in the field.
 - Specific research questions or hypotheses statements.
 - Definitions of important terms, names, etc.
 - A review of the important and supporting literature,
 - A detailed description of the research design to be followed and the methods to be conducted: selection of participants, measured materials, instrumentation, procedures, role of pilot study, data analyses, etc.

You should provide a 1-2 page outline of your proposed project for those who are interested in this presentation. Information from this presentation may prove beneficial in strengthening your thesis project. Your presentation should be scheduled at a time and place that allows for the greatest-number of faculty and students to attend. Typically, the last Friday of the month works well for most faculty and students. Note that it is your responsibility (along with your thesis advisor) to announce in writing and post, to all Exercise and Sport sciences graduate faculty and students with a campus mailbox, the time date, and place of the proposal presentation at least one week in advance of the event.

- _____6. Prepare and sign a Certificate of Proposal Approval form (Appendix A). Attach a revised 1-2 page outline of your proposal that considers comments made at

the successfully completed proposal meeting Your advisor and committee members should also show approval of the proposal by signing the form and submitting the original form to the graduate chair for approval.

- _____7. Complete application for approval from the HSRC and submit to thesis advisor for review and signature (HSRC meets once a month; must submit to weeks prior to meeting). Allow ample time for review by thesis advisor and revisions to be made prior to submission to HSRC. This proposal may not be necessary if your project does not require human subjects or falls outside the purview of the HSRC.
- _____8. Submit application to the HSRC. While waiting for the HSRC decision and under the guidance of your theses advisor, you should hone your methodology and practice techniques that will be employed in your data collection.
- _____9. Following approval by the HSRC, begin subject recruitment and data collection. During this time keep in good communication with your advisor.
- _____10. Upon completion of data collection, work with thesis advisor and second reader during analysis and writing of results and discussion sections of your thesis. Select a thesis format (traditional or article) in conjunction with your thesis committee. Examples of each format can be provided by the library, graduate chair, or your advisor. Attached you will find a model of the key element for each format
- _____11. Schedule a defense date upon completion of thesis writing and defense ready approval for thesis advisor and second reader. Your defense should be scheduled at a time and place that allow: for the greatest number of faculty and students to attend. Typically, the last Friday of the month works well for most faculty and students.

***Please Note:** Thesis defense should occur only after the thesis advisor and second reader agree the candidate is fully prepared and the thesis is in the final stage of approval (i.e., ready for their signatures). It is your responsibility (along with your thesis advisor) to announce in writing and post, to all Exercise and Sport Sciences graduate faculty and students with a campus mailbox, the time, date, and place of the thesis defense presentation at least one week in advance of the event. Included with this announcement should be a 1-2 page outline of your research project and presentation.

- _____12. Defend thesis. You should be prepared for a 15-20 minute presentation of your thesis. This presentation should include the following:
 - How did you get interested in this topic?
 - Why is this topic important?
 - What was the problem you investigated?
 - What is the key research supporting this area of investigation?

- What procedures did you follow in this investigation (i.e., methods)?
- What were your major results?
- Did your results lead to the rejection or acceptance of your hypothesis?
- How did your results directly answer your research question(s)?
- How do your findings compare to the results of other studies?
- What contribution does your study make to the profession?
- How can your results be applied in the 'real world'?

_____13. Make final revisions on thesis.

_____14. Submit final revisions to thesis advisor and second reader for final approval and signatures. Be sure to submit at least five original copies of your CERTIFICATE OF APPROVAL page. Each must have an original signature. If you desire additional copies for yourself (i.e., family, etc.), provide the corresponding number of CERTIFICATE OF APPROVAL pages.

_____15. Following approval and signatures from this thesis advisor and second reader, submit thesis to 'Graduate Chair for approval and signature. Please note: The Graduate Chair must have the signed thesis at least six (6) weeks prior to by your desired degree posting date. This allows time for process remarks from the Chair and subsequently obtain the approval of the Graduate Dean before the degree posting date, although these dates vary from year to year it is safe to assume July 15 (September graduation), November 1 (December graduation), and April 1 (May graduation) as the submission deadline to the Graduate Chair for each prospective graduation deadline.

_____16. Following approval and signature of Graduate Chair, the Graduate Chair will submit your thesis to the Graduate Dean for approval and signature. This must be done at least one (1) month prior to your desired degree posting date. Please Note: This means that the Graduate Dean must have the thesis, signed by the Graduate Chair, thesis advisor, second reader, and candidate on his desk at least 30 days in advance of graduations

IT IS YOUR RESPONSIBILITY TO CHECK SPECIFIC DATES. A THESIS TURNED IN AFTER THESE DATES CANNOT BE GUARANTEED A PROPER RENEW OR APPROVAL FOR THE DEGREE POSTING DATE IN QUESTION.

_____17. Following approval from the Graduate Dean-CELEBRATE

*Please note: It is not uncommon to have one final revision in order to incorporate changes requested by the Graduate Dean.

- _____ 18. Have five copies of your thesis bound (plus any additional copies for yourself as directed by your advisor.
- _____ 19. Provide one bound copy of your thesis to each of your committee members, one to the graduate Chair and two copies on 20 lb. white paper (25% rag content) to the library.

Thesis Do's and Don'ts

“Do's” and “Don'ts” for your thesis project

DO:

- * Complete a literature review on your topic and keep it updated with monthly searches of new research.
- * Review other theses in your concentration area before writing your proposal.
- * Learn to use appropriate computer software yesterday!
- * Make sure you have backup copies of your work on separate disks at all times and in your NOVA account.
- * When submitting a draft of anything, allow to (2) weeks for your thesis adviser or committee members to read it. Many times it will be read earlier, but two weeks is reasonable.
- * Prepare. Thoroughly understand your topic, previous literature, methodology, data collection, use of any required equipment, etc.
- * Before each meeting with your adviser or committee member, prepare a list of your questions or concerns. Prior to your meeting, have a clear understanding of your goal and the problems you are encountering. You are responsible for actively participating in these meetings and are expected to present your ideas. **BE PREPARED!!**

DON'T:

- * Don't try to conquer the world by yourself. Seek advice from your adviser during all stages of the project to keep on the right track.
- * Don't hesitate to seek assistance from others--classmates, friends, when in need. They will be in need someday and will come calling on you.
- * Don't waste anyone's time. If you are using human subjects, know your data collection procedures well and practice them in advance.

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In Exercise &
Sport Sciences _____

Date: _____

**CAREER TERMINATION AND TRANSITION
FROM INTERCOLLEGIATE ATHLETICS: THE
EXPERIENCE OF FORMER DIVISION III FEMALE
ATHLETES**

**A Masters Thesis presented to the Faculty of the
Graduate Program in Exercise and Sport Sciences
Ithaca College**

**In partial fulfillment of the requirements for the degree
Master of Science**

by

Beth Howland

May 2001

**Ithaca College
School of Health Sciences and Human Performance
Ithaca, New York**

CERTIFICATE OF APPROVAL

MASTER OF SCIENCE THESIS

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APPENDIX D

Abstract

ABSTRACT

This study examined the effect of two days of partial sleep deprivation (PSD) on indicators of performance in female basketball players. Subjects (N = 12) volunteered for the study and were experienced female basketball players with four years of high school and/or collegiate varsity basketball playing experience. Subjects completed a Sleep Quality scale and see Morningness-Eveningness and Eynseck Personality questionnaires. During PSD, subjects slept 2.5 h on each of the two successive days (PSD- 1, PSD- 2). They were tested at 0900, 1400, and 1900 h during BL and PSD conditions. At each testing session body temperature, hand steadiness, short-term memory, reaction time, basketball skill (i.e., vertical jump, free throw shooting, passing, control dribbling, defensive movement, and speed shooting) and maximal leg strength were measured. During the PSD testing weekend, subjects slept only five hours in a 60-h period. Data were analyzed using a separate 3 x 3 factorial ANOVA with repeated measures for each dependent variable to determine significant differences between days and times. A post-hoc comparison test was used for pair-wise comparison when ANOVA yielded a significant effect. The results show PSD has no general impact on basketball performance indicators of body temperature, short-term memory, and maximal leg strength in college-aged female basketball players. Reaction time slowed after two nights PSD with a significant decrement evident only following the second night of PSD. One paradoxical finding was hand steadiness improved with PSD. There was no significant diurnal rhythm in hand steadiness short-term memory, reaction time or eccentric muscle strength. Body temperature did exhibit a time if day oscillation with peak temperature at 1400 h. Practical application of the study's results should be made judiciously when attempting to relate the impact of PSD to actual short performance.

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PROPOSAL

INTRODUCTION

Partial sleep deprivation (PSD) represents a frequent occurrence in society, especially for airline personnel, shift workers, health care professionals, and college students. Many college athletes especially, are faced with juggling the pressures of academic responsibilities, work, and athletics into a single 24-hour time period. To accomplish this, PSD is sometimes chosen as a means of balancing responsibilities. PSD is considered a reduction in average sleep time, usually a loss greater than 40-50 % of the typical amount of sleep, and less than the recommended eight hours (Horn & Dollinger, 1989). While most research has focused on exercise performance under sleep loss conditions, unfortunately, few studies exist defining the effect of PSD on indicators of sport performance.

Sleep loss conditions may also influence individual circadian rhythms. Circadian rhythms are daily biological events governing most physiological functions such as temperature, hormonal levels, heart rate, and sleep-wake patterns, with a repeating length of 24 hours (Hill, Cureton, Collins, & Grisham 1988). Circadian rhythms, also known as "diurnal variations" can exhibit wide individual differences among people. Certain physiological functions can show maximum and minimum fluctuations throughout specific times of the day for individuals (Winget, Delkoshia, & Holley, 1985). These various "feeling best" times may impact psychological and physiological factors that can affect performance (Hill et al., 1988). Considering circadian rhythms are cyclic, athletic participation occurring before or after a peak performance time may impact optimal effectiveness (Atkinson & Reilly, 1996; Kircaldy, 1984; & Winget et al., 1985).

When athletes undergo PSD, circadian rhythms may be altered. Alterations in the sleep-wake cycle from early/late start of an event, anxiety causing midnight insomnia, or transmeridian travel can provoke changes in circadian rhythms. Johnson and Naitoh (1974) found an important source of variance in performance during sleep deprivation (SD) studies was a circadian alteration caused by the timing of the sleep-wake cycle.

Given the potential impact of SD on athletic performance and circadian rhythms and the lack of study of these factors on sports performance, it is necessary to gather information on these topics for application by college-aged athletes and coaches. College-aged athletes are naturally prime candidates for PSD but rely on acute synchronization of psychological and physiological factors for optimal sport participation

Statement of Purpose

The purpose of this study will be to examine the effect of PSD, with sleep curtailed to only 2.5 hours for two consecutive nights, on indicators of sport performance in female basketball players.

Hypothesis

The null hypotheses for this study are

1. Sleep limited to 2.5 hours for two consecutive nights will have no effect on body temperature, hand steadiness, reaction time, short-term memory, and eccentric muscle performance (i.e., knee flexion, extension, and quadriceps to hamstring ratio at 150 degrees/second) in college-aged female basketball players compared to a baseline condition that allows for a typical night of sleep.
2. There will be no differences in the measure of body temperature, hand steadiness, reaction time, short-term memory, and eccentric muscle performance (i.e. knee flexion, extension,

and quadriceps to hamstring ratio at 150 degrees/second), in college-aged female basketball players, in relation to time (0900, 1400, and 1900 hours) of testing in college-aged female basketball players.

Scope of the Problem

The average person typically sleeps for a single stretch of 7.5 hours out of each 24-hour day (Colquhoun, 1971). Though PSD can negatively impact various types of performance, college-aged athletes often choose PSD as a time balancing means. This study will look at the impact of less than three hours sleep on two consecutive nights on performance in female college basketball players. These athletes rely on physical, cognitive, and emotional parameters for optimal athletic skill performance. Practice and games may be scheduled for various times of day potentially after differing sleep conditions. The change in the sleep-wake cycle may impact negatively on measures of body temperature, hand steadiness, short-term memory, reaction time, and/or muscular strength. While most previous research has focused on exercise performance, few studies have examined the impact of PSD loss on sport related skill for college-aged female athletes. The results should be of interest to coaches and athletes alike.

Assumptions of Study

For the purpose of this study, the following assumptions will be made at the start of the investigation:

1. The subjects are representative of typical college-aged female basketball players.
2. PSD that allows only 2.5 hours of sleep represents typical SD that has the potential to impact circadian rhythms and performance.
3. The subjects will supply honest answers to health habit questionnaires and refrain from

Introduction

partaking in contraindicated activities, as outlined in the protocol, throughout the duration of the study.

4. The timing of subjects' menstrual cycles will not influence the outcome of the study.
5. The subjects are representative of a variety of circadian types.
6. Subjects will sleep the entire 2.5 hours without major interruption and complete SD will not be experienced.
7. Eccentric contractions at 150 degrees as measured by the Kin Com are valid indicators of muscular patterns used by basketball players.

Definition of Terms

The following terms are operationally defined for the purpose of this investigation:

1. Rapid Eye Movement (REM)- representing roughly 20 to 25% of total sleep time, occurring approximately 90 minutes after sleep onset
2. Non-Rapid Eye Movement- constitutes sleep Stages 1- 4
3. Sleep- restorative process for body functioning, characterized by cycles of REM and NREM stages that recur about every 90 minutes
4. Sleep-wake cycle- rhythm of daily arousal level, sensitive to changes in light; usually following a pattern of sleeping an average of 8 hours at night and working during daylight hours
5. Sleep deprivation- total loss of sleep
6. Partial Sleep Deprivation- a minor reduction in normal average sleep time, usually a loss greater than 40-50% of typical sleep time
7. Circadian Rhythm- (circa- about, dies- a day) daily biological rhythms governing physiological events, showing fluctuations throughout specific times of the day, with a

Introduction

period of 24 hours

8. Diurnal variation- sharp contrasts in physiological responses between day and night,

another term to express circadian ejects

9. Chronotype- individual differences

10. Eccentric Contraction- lengthening of muscle through full range of motion while exerting

force, also called negative work

11. Body temperature- degree of heat internally generated, usually maintained in proximity to

98.6 degrees Fahrenheit (37 C)

12. Reaction Time- duration needed to respond to a stimulus

13. Hand steadiness- fine motor control of the upper extremity measured by amount of

movement from a fixed position

14. Short-Term Memory retaining and recalling information once presented, after a brief

period of time

Delimitations

The delimitations of this study are as follows

1. College-aged female basketball players from Marietta College will be used as subjects.

2. Only the effects of partial sleep deprivation, with sleep curtailed to 2.5 hours on two consecutive nights, will be studied.

3. An oral thermometer, hand steadiness tester, reaction time apparatus, Kin Com machine, and word list will be used as measurement tools.

4. Only eccentric, isokinetic, peak torque of the knee flexor and extensor muscles at 150 °/sec will be measured by the Kin Com to estimate muscle performance capacity.

Limitations

The limitations of this study are as follows:

1. The results may only be generalized to college-aged female basketball players.
2. The results may only apply to sleep conditions with sleep curtailed to 2.5 hours for two consecutive nights.
3. The measurement variables selected may only indicate performance capabilities on the specific tests administered and not be accurate indicators of actual basketball skill performance.

PROPOSAL

REVIEW OF LITERATURE

Introduction

Sleep and sport performance are highly specific functions, impacted by many factors. The majority of the factors affecting sport performance vary with time of day, individual circadian differences, and potentially the quality and quantity of sleep. This review outlines the nature of sleep, and how sleep deprivation impacts various types of physiological functions, exercise capacity, and sport performance. Another major section is dedicated to examining the impact of circadian rhythms on physiological function, and athletic performance.

Nature of Sleep

Sleep is generally regarded as important for maintaining physical and psychological well-being (Savis, 1994). It has been commonly assumed that the primary function of sleep is to destitute certain physiological processes which deteriorate during periods of wakefulness (Taub & Berger, 1973) such as tissue restitution or avoidance of exhaustion (Reilly, 1990). Sleep has also been proposed as a restorative process for central nervous system function (Chen, 1991). Sleep has been shown to be important for learning, short term memory, and memory consolidation (Demingy Zhenyun, Daosheng, & Shanxun, 1991).

Sleep can be divided into five individual stages. Stages one through four are collectively known as non-rapid eye movement (NREM) sleep states followed by stage five known as rapid eye movement (REM) (VanHelder & Radomski, 1989). The transition from stage one through to stage four represents progressively deeper levels of sleep (Tilley & Wilkinson, 1984). NREM and REM sleep repeat in cycles of approximately 90-minutes.

PROPOSAL

METHODS

This chapter describes in detail the methodology of the study. The methods section is subdivided as follows (a) subjects, (b) design, (c) measurement and procedures, and (d) data analyses.

Subjects

After approval of protocol by Ithaca College's Human Subjects Research Committee, the study will commence. Twelve college-aged female students (N = 12) from the population of Marietta College located in Marietta Ohio will participate in the study. The subjects will range in age between 18 and 22 years and will be recruited solely on a voluntary basis. The main criterion for subject participation will be four years of high school and/or collegiate varsity basketball playing experience. During a preliminary subject recruitment meeting, interested athletes will be asked to complete a Sleep Quality scale (Appendix A) and Medical History Habit questionnaire (Appendix B). These questionnaires will be used to determine regular nocturnal sleeping patterns and non-reliance on tobacco, alcohol, and other drugs, including coordinated products (e g , coffee, tea, cola), which will be deemed unacceptable for subject participation. The subjects will all be in good health and will have clearance to participate in intercollegiate athletics.

Once selected for participation, subjects will be made aware of the study protocol, risks, and benefits. The main potential risk associated with this type of study is possible sleepiness throughout and after the two day PSD testing period. Sleepiness may cause feelings of fatigue (Reilly & Pierce, 1994), changes in mood (Herscovitch & Broughton, 1981 . & Dinges et al , 1997), decreased working efficiency (Wilkinson, Edwards, & Haines,

1966), and slowed reaction time (Reilly & Deykin, 1983). Additional risks could occur during sports skill testing including but not limited to sprains, strains, abrasions, and contusions. All subjects will be given the opportunity to ask questions about their role in the study and will be required to read and sign an Informed Consent form (Appendix C). A sleep log (Appendix D) will be distributed, for completion, to be brought to the first testing session. The sleep log will assess self-reported estimates of sleep quality and quantity.

Design

The PSD treatment will consist of 2.5 hours sleep on each of the two successive days (PSD-I, PSD- 2) of the experimental condition. To minimize the impact of an order effect on learning, subjects will be randomly placed into two testing groups. All the subjects will be tested at 0900, 1400, and 1900 hours during baseline and PSD conditions. Half of the subjects (n = 6) will be baseline (BL) tested one week prior to the PSD weekend, while the remaining half (n = 6) will be BL tested one week following the PSD study, after recovery sleep occurs. BL testing will occur at 0900, 1400, and 1900 hours on a day after "quality" sleep (6 - 10 hours) results. BL testing will consist of the same tests, test order, and test times as the PSD weekend with subjects only reporting for the three testing sessions. Prior to either BL testing or PSD conditions, subjects will be allowed three practice trials of each test to acquaint them with specific testing procedures to be used and to minimize the impact of learning on performance

Measurement and Procedures

Sleep Quality Scale

Sleep quality will be assessed using a psychological self-rating Sleep Quality questionnaire that incorporates both a psychometry and analogue rating scale (Visser et al ,

1978). The investigators, to subjectively determine if the subject had regular sleeping patterns, will use the Sleep Quality scale (Appendix A) as a screening tool for participation. Subjects will be required to show regular sleeping patterns, with an average nightly sleep ration between 6 - 10 hours per night, to be considered for participation in the study.

Morningness-Eveningness Questionnaire

Characteristics associated with sleep vary greatly from person to person (Sexton-Radek & Harris, 1992). A particularly important individual difference is the subject's preference towards morningness or eveningness (Aden & Almirall, 1991). The concept of a morningness-eveningness dimension describes the notion that some people (morning types) prefer day activity while others (evening types) prefer night activity (Neubauer, 1992). Horne and Ostberg's (1976) Morningness-Eveningness Questionnaire (Appendix E) will be used to determine the subject's circadian classification of "morning type", "evening type", or "neither type". This questionnaire will be administered during the subject's first testing session for descriptive purposes. The 19-item questionnaire was selected because of its acceptable reliability level of $r = .89$ (Posey & Ford, 1981). This instrument assesses self descriptions of well-being, alertness, and fatigue at different times of the day, as well as self-reported preferred times for physical activity, mental activity, and sleep (O'Connor & Davis, 1992). Horne and Ostberg (1976) designed an arbitrary scoring scale as can be seen in the bold print of Appendix E. The appropriate score for questions 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, and 19, is displayed beside the corresponding response. For questions 1, 2, 10, and 18, the cross-made along each scale is referred to the appropriate score value range below the scale. Question 17 corresponds with the most extreme cross on the right hand side, which is used as the reference point. The appropriate score value below the scale is will then

Chapter 4

RESULTS

The raw data for the computerized CPT test scores are found in Appendix E. It is noted that $\underline{n} = 7$ for the thiamin post-test, NA condition for both groups, the thiamin post-test CV condition for the ADHD group, and $\underline{n} = 6$ for the 10-min post-test CV condition for the control group, as the participants did not show up to the test site within the scheduled time frame. An alpha level of .05 was used for all statistical tests. A summary of the final analysis are as follows:

Omission Errors

Repeated measures ANOVA (2 x 3 x 3) revealed no significant interactions for the study on omission errors. There was, however, a significant main effect for ADHD versus control students in omission errors scored on the CPT (Table 3). Control students responded to more targets than ADHD students on all of the test days. Interestingly, for the ADHD group, the mean values, over time, for the CV exercise sessions trended downward indicating improved attention (Table 4, Figure 1), but these values did not reach significance.

Reaction Time

Repeated measures ANOVA (2 x 3 x 3) revealed no significant interaction for the study on reaction time scores. Although the ADHD group scores were generally slower from the non-ADHD group, differences between group, activity, and time were not statistically significant (Table 5). Reaction time T-scores less than 40 are considered

Table 3.

Repeated Measures ANOVA Summary Table for Omission Errors

Source of Variation	SS	df	MS	F	p
Group	5427.69	1	5427.69	6.23	0.03*
Error1	7836.76	9	870.75		
Activity	93.10	2	46.55	0.65	0.53
Group x Activity	139.65	2	69.82	0.98	0.40
Error 2	1285.36	18	71.41		
Time	138.05	2	69.02	1.57	0.24
Time x Group	108.59	2	54.30	1.24	0.31
Error 3	790.54	18	43.92		
Activity x Time	79.86	4	19.97	0.38	0.82
Activity x Time x Group	61.32	4	15.33	0.29	0.88
Residual	1891.37	36	52.54		

Note: *p<0.05

Table 4.

Summary of Mean and SEM for the Number of Omission Errors

		ADHD Group			Control Group		
		Mean*	SEM	N	Mean*	SEM	N
CV Activity	Pre-test	20.12	6.63	8	1.50	0.57	8
	10-min Post	20.12	5.66	8	1.17	0.48	^b
	60-min post	18.71	8.79	7 ^a	1.63	0.84	8
CPM Activity	Pre-test	10.63	3.16	8	0.88	0.23	8
	10-min Post	22.25	7.59	8	1.88	1.06	8
	60-min post	18.25	6.73	8	1.63	0.46	8
No Activity	Pre-test	17.38	8.09	8	1.25	0.45	8
	10-min Post	19.00	5.71	8	0.75	0.41	8
	60-min post	19.57	4.88	7 ^a	0.86	0.34	7 ^a

Note. Mean data are expressed as percentile values.

^aIndicates that one student missed a post test session. ^bIndicates that two students missed a post-test session.

*p , 0.05; ADHD scores on all conditions were greater than controls indicating greater attention

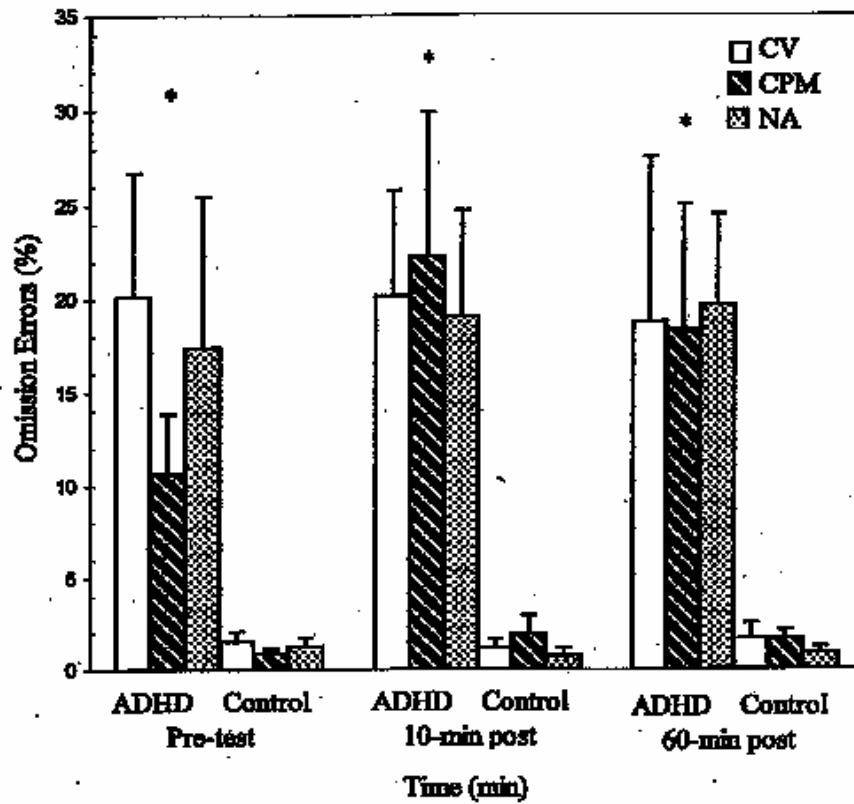


Figure 1. Mean score data for omission errors of ADHD and control students. Increased omission errors indicate inattention. Thus, decreased omission errors indicate improved attention.

* $p < .05$; ADHD scores are greater than controls.

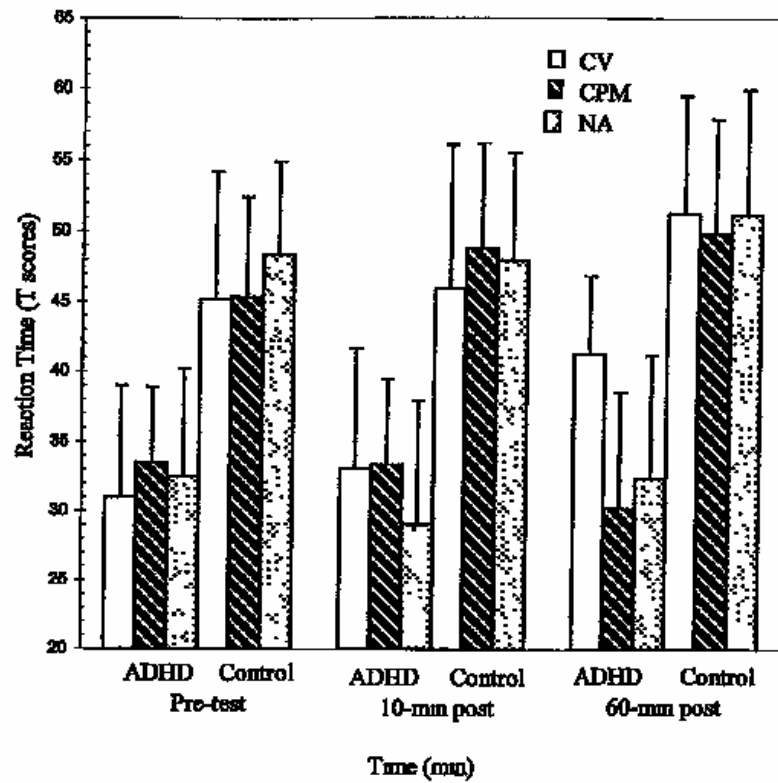


Figure 2. Mean score data for omission errors of ADHD and control students. Increased omission errors indicate inattention. Thus, decreased omission errors indicate improved attention. * $p < .05$; ADHD scores are greater than controls.

APPENDIX Q

Summary, conclusions, recommendations

Chapter 6

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

This study examined the effects of association and dissociation on pain tolerance and performance in athletes with exercise-induced muscle soreness/damage. Female ($n = 20$) and male ($p = 14$) athletes volunteered to participate in this study. Muscle soreness/damage was induced in the hamstring and quadricep muscle groups on the Biodex System 2 via eccentric knee flexion and extension at a speed of $90^\circ/\text{sec}$. Subsequent data analyses were conducted on a sample size of 30 after 2 females and 2 males reported for Session 2 with no muscle soreness in both muscle groups. Because muscle soreness was necessary in this study, these 4 subjects were excused from further testing.

Interclass correlation coefficients (R) revealed the internal consistency of the two sets of 10 repetitions and two sets of 40 repetitions. The R values indicated that all scores of each performance variable for the two sets of 10 repetitions but only the scores from the first set of 40 repetitions be used for subsequent data analyses. Mixed model ANOVAS and post hoc Tukey analyses revealed that there were significant differences ($p < .05$) in PT, TW, and AP from Session 1 to Sessions 2 to Session 3. Analyses of the MSS, SAT, Pre-PPS, and Post-PPS in Session 2 and the MSS, SAT, and Pre-PPS in Session 3 revealed that there were no group differences on these measures. These results led to acceptance of the research hypothesis that actual muscle soreness, and not anxiety or pre-perception of performance, was closely related to the decreased performance scores in Sessions 2 and 3 from Session 1.

Examination of Figures 4, 7-12 illustrates a trend for both the association and dissociation scores of PT for both muscle groups to increase their scores of PT for both muscle groups with 10 and 40 repetitions and for TW and AP of muscle groups only at 40 repetitions. This would indicate that cognition intervention was marginally successful in of both muscle increasing performance scores, but not in a statistical sense.

Analysis of the Post-PPS in Session 3 revealed that the association and dissociation groups differed significantly from the control group. These treatment subjects perceived that the strategies had significantly improved their performance when in reality their performance had not significantly improved.. This apparent illusion has both positive and negative effects in relation to sports injury rehabilitation. Those athletes with low pain tolerance tend to adhere less to their rehabilitation (Fisher, 1990) and could be greatly helped by these strategies. Should these injured athletes be provided with an enhanced sense of self-efficacy in tolerating pain by these strategies, then the positive feelings that these strategies seem to evoke can only be beneficial. However, athletes with high levels of pain tolerance may increase the severity of their injury while utilizing such strategies because they might ignore the cues their pain could be providing.

Therefore, it appears that association and dissociation is effective in increasing perceptions of performance but only marginally effective at actually increasing performance. Perhaps the acute long-lasting pain that is associated with exercise-induced muscle soreness/damage explains, in part, this paradox. However, the illusory efficacy that these strategies provided is worthy of future research into their application to sports injury rehabilitation.

Conclusions

The results of this study yielded the following conclusions:

1. Athletes' perception of performance is significantly improved by utilizing association or dissociation strategies.
2. Athletes with muscle soreness/damage are not able to overcome the effects of this soreness and significantly enhance their strength performance while utilizing association or dissociation strategies.
3. Athletes' perception of effort and motivation appear to be enhanced by utilizing association or dissociation strategies.

Recommendations

The following recommendations for further study were made after the completion of this investigation:

1. Tests of the effectiveness of cognitive strategies should be undertaken using actual injured athletes as subjects.
2. Tests of the effectiveness of cognitive strategies should be undertaken after injured athletes have been trained in using these strategies.
3. Further investigation into the concept of illusory efficacy, as it relates to sport injury rehabilitation, should be undertaken.
4. Further investigation into the effectiveness of cognitive strategies that address emotional, cognitive, and behavioral components seem advisable.

APPENDIX R
References

REFERENCES

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APPENDIX B

Informed Consent Form

Pre-race blood lactate levels and performance in middle distance runners.

1. Purpose of the study:

The purpose of the study is to assess the influence that warm-up has on performance, specifically investigating the effects of pre-race blood lactate on performance in middle distance runners.

2. Benefits of the study:

By participating in the study you will learn what your maximum oxygen consumption is (VO_2 max), a commonly used index of training status, and a test which can cost about \$150 on the open market. Secondly, this data may help with guiding your warm-up in future seasons in order to try and replicate those responses of a particular warm-up that may have led to an enhanced performance while avoiding those that may have deterred performance.

3. Your Participation Requires:

The first testing session will require you to report to the laboratory to complete a VO_2 max. In this test you will run on a treadmill at a speed determined by yourself. Every 2 minutes the grade of the treadmill will increase by 3% starting at a grade of 0%. The test will be terminated when you feel you can no longer continue. During the test you will be required to wear a headgear device with a breathing valve so that we can measure your expired gases. Your heart rate will be monitored throughout the test as will your rating of perceived exertion. 7.5 minutes after the conclusion of the test, we will prick your fingertip to draw a small sample of blood (25 μl) to determine your blood lactate level.

The subsequent testing sessions will take place at those meets prior to the NYSCTC Outdoor Championships. During these meets, the set of variables: heart rate, body temperature, and blood lactate, will be measured three times. The first set of measurements will be taken prior to you commencing any warmup routine for your race. The second set of measurements will be taken at 5 minutes prior to the start of your race. The final set of measurements will be taken within 7.5 minutes after the completion of the race. Blood lactate measurements will be taken as previously described while heart rate will be measured with heart rate monitors, and body temperature with a device that measures temperature in your ear canal. Your performance will also be recorded and represented as a time.

4. Risks of Participation:

You may feel some muscle soreness 24 to 48 hours after the VO₂ max test. Due to the vigorous nature of the VO₂ max test, there exists a small chance of musculoskeletal injury, lightheadedness, nausea, or even death (1 in 10,000 tests). In addition, you may experience some soreness in your fingertip(s) where the blood was drawn. As with any sampling of blood, there is a small chance of infection, for which proper sterilization procedures will be taken to prevent.

5. If You Would Like More Information about the Study:

For information at any time prior to, during, or after the study contact either Scott Williams at 277-5263, email: swillial@ic3.ithaca.edu ; or Betsy Keller at 274-1683, email: keller@ithaca.edu

6. Withdrawal from the Study:

You are free to withdraw from this study at any time without prejudice.

7. Confidentiality:

All data collected will be coded to insure your confidentiality. Your name will not appear in any reports from this study.

I have read and understood the above document. I agree to participate in this study and realize that I can withdraw at anytime. I also understand that I can and should address questions related to this study at any time to the researchers involved. I also verify that I am at least 18 years of age.

Name of Subject (please print)

Signature of Subject

Date

APPENDIX C

U.S.O.C. Sports Physiology Dept.
Lactic Acid Analysis
Preparation of Buffer and "Cocktail"

Supplies

- 200 µl - 500 µl microcentrifuge tubes with cap. We use Cain Matheson Inc., # 068-742 (500 g1). Be careful not to order tubes that are too tall or too thin.
- Triton X-100 sigma Chemical Co. # 1-6878) YSI phosphate buffer (YSI # 2357)
- Sodium fluoride-NAF Anhydrous MW 42.0 (Sigma Chem. Co. # S-1504)
- 1 ml Tuberculin Syringe (Benton, Dickinson & Co. # 5602) No needle.
- 30 ml Nalgene bottle
- 25 µl syringepet (micro pipet) (YSI # 2361)

Procedures

Buffer: to flush the all YSI analyzer and as base for "cocktail".

- 1) Empty contents of one Buffer PC package into a 500 ml YSI mixing bottle.
- 2) Add 450 ± 25 ml distilled water and shake vigorously.

Note- it is NOT necessary (nor advisable) to add the detergent (Triton X-100) or the preservative (NaF) to this stock. The effect of Triton X-100 on the analyzer membrane is unknown.

This stock should probably not be used more than one week.

Cocktail's: stock solution to fill microcentrifuge tubes. Breaks red blood cells and inhibits lactate conversion to private until samples can be analyzed.

- 1) Add appropriate volume of stock buffer in 30 ml clear Nalgene bottle (see table below).
- 2) Use tuberculine syringe to add triton X-100 to solution.
- 3) Empty NaF from microcentrifuge tube into bottle and shake.

<u>Tubes needed</u>	<u>Stock Buffer</u>	<u>Triton X-100</u>	<u>NaF*</u>
200	10.0 ml	0.022 ml	Approx. ½ tube
500	25.0 ml	0.055 ml	1 tube
1000	50.0 ml	.110 ml	2 tubes

*NaF is firmly packed into a 500 µl microcentrifuge tube

APPENDIX S
Appendices

APPENDIX D

Summary of Linear Regression for Predicting True Blood [LA] from Analysis of [LA] in
Blood Mixed with Preservatives

<u>r</u>	<u>R²</u>	adjusted <u>R²</u>	<u>SEE</u>	regression line equation
0.99	0.99	0.99	0.51	Y = 2.52x + 0.03

Note. Twenty pairs of samples were used in the regression analysis. Each pair consisted of non-preserved blood sample and a preserved blood sample, both of which were drawn from the same site at the same time.

Table A

One-way ANOVA Summary Table for Age (years) of Subjects (N=8) Grouped By Event

Source	SS	df	MS	Critical F	Obtained F	p
Between	6.75	2	3.37	5.79	5.19	0.060
Within	3.25	5	0.65			
Total	10.00	7				

Note. IV: Event (400, 800, 1500 m); DV: Age