Research Capstone Handbook PAS 5271 & 5272

Physician Assistant Program

Rocky Vista University, Parker, Colorado

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Introduction: What is the PA Capstone Project?

The Physician Assistant (PA) Capstone Project is an **in-depth research and/or academic study** that offers students an opportunity to formulate clinical questions, retrieve evidence, and analyze information to advance patient care. It is not a literature review paper. This Research Capstone Project aligns with Entrustable Professional Activities (EPA) 7 of Rocky Vista University's (RVU) PA training program. The courses, PAS 5271 Research (1 credit hour) and PAS 5272 Capstone (11 credit hours), are both required for fulfillment of the Master of Physician Assistant Studies degree.

This project is self-directed and adds to current research and literature of a particular topic of the learner's interest. Thus, it is more than a synthesis of work already completed or published. It should include one of the following research areas:

1. **basic/translational science** (e.g., investigation of a new question or surveying a population and actively collecting and analyzing data);
2. **nuanced comparison of medical guidelines** (e.g., analysis of two guidelines from a different viewpoint, research angle, or population to name a few);
3. **authoring a case report** (focus on a single patient and it must be unique; e.g., unique observations, adverse response to current therapies, or unique combination of conditions leading to difficulties in diagnosing/treatments); or
4. presenting a **barrier-to-care case study** (i.e., any obstacle that prevents/limits a population from receiving adequate health care and providing a new solution or adapting a current solution to address the issue).

In the completion of this Research Capstone Project, the learner will show their abilities and skills in critical thinking, problem-solving, written and oral communication, research evaluation, and/or leadership.

Steps for developing and conducting a PA Research Capstone Project regardless of area:

a. **Select a topic or research question:** this topic area should have a wide scope for investigation and plenty of resources that can help guide in developing a specific question that can be feasibly addressed in a time-limited study.

b. **Complete a literature review:** identify background information and evaluate the current body of knowledge that is published on the issue/problem. Identify a gap in the research that you will address.

c. **Develop a research question/objective:** explicitly state a research question or aim to address an existing gap in literature. Make this focused and not too broad to help you clarify your Research Capstone Project. This may include developing a hypothesis to

answer the research question/problem.

d. **Design the research investigation and analysis methods:** determine how you will collect data (e.g., develop a survey, identify a public database that could be used, etc.), justify the approach as the most appropriate, and verify if you need specific training, approvals, or certifications (e.g., IRB approval, etc.). Explain your approach for analysis and decide which statistics will be calculated. Identify what software/databases you will use for data collection and analysis (e.g., Qualtrics, Microsoft Excel, SPSS, PubMed, etc.). Be mindful of possible time, funding, and/or access limitations. Finally, be precise in your language (e.g., inclusion/exclusion criteria), as anyone should be able to redo your methods based on your description of the research process.

e. **Collect and analyze the data:** ensure that the gathered data (1) followed the systematic approach of the designed methods, (2) are complete and accurate, and (3) stored according to any IRB requirements. Analyze the data using the approach described in the methods. To be safe, back-up data and analyses regularly to secured digital storage. If you are completing a nuanced comparison of guidelines, consider developing a forest plot using data from recent research not included in the guidelines to help support your hypothesis.

f. **Determine the significant conclusions:** drawing from your results of the collected and analyzed data, draw conclusions that address the research question. Your conclusions should include a discussion of the limitations of the study as well as an output that can further scientific knowledge (e.g., recommendation, operational policy, etc.).

g. **Present your results to the public:** write a short communication paper (see Pages 17-21 for details), create a scientific poster (see Page 22) for the annual RVU Research Day, and orally present your results:

    1. to your classmates and the PA faculty the day before RVU's Annual Research Day, and
    2. to the community on RVU's Annual Research Day.

A successful Research Capstone Project will apply medical and research knowledge in an analytical and logical approach from designing a research question to investigation and analysis to presenting the conclusions, which address the research question in some significant way. That logic, structure, and order needs to be made clear to your audience.

Details: What Do I Need to Do?

Choose the type of Research Capstone Project to complete. The first step to the Research Capstone Project is identifying a topic. The topic is intended to reflect your overall interests, and this research should serve as a launchpad for your professional career or incorporated in to your professional practice. You will design and implement a Research Capstone Project based on one (1) of the following options:

a. Design and implement a novel research project*, or

b. Develop a nuanced and comprehensive perspective about why the guidelines for management of a particular patient condition or screening recommendations for various populations may agree and/or conflict, and how they might be applied to different patient populations and implement statistical analysis as appropriate, or

c. Identify a novel medical presentation or treatment in clinic and conduct a case report* to include, or (see d.)
   i. Conduct a thorough literature review to contextualize the case and treatment;
   ii. Perform interviews with practitioners and the patient (as appropriate)
   iii. Make recommendations for future care

d. Identify a social barrier-to-care faced by a patient or patient population in clinic and
   i. Conduct a thorough literature review to contextualize the problem and potential solutions
   ii. Implement statistical analyses as appropriate
   iii. Make recommendations for interventions (referencing existing resources when available) to make care more accessible to this person/population.

* IRB approval is required

Identify a Research Capstone Mentor (this person most likely will be your Academic Advisor). Based on your initial idea, the student researcher may identify a mentor from the RVU faculty who has some knowledge of the area in which they wish to work. Your Academic Advisor can be your Research Capstone mentor. Bear in mind that your Research Capstone mentor may not be an expert on the specific question you wish to investigate, but should be able to guide you in developing the question, methods, and/or analyses. They may comment on preliminary plans and drafts of the abstract and poster. If you encounter problems or are unsure about the way ahead, talk things over with your academic advisor/mentor or with the Director of Basic Science and Research, Dr. Jennifer Hellier (jhellier@rvu.edu).

Use your Research Capstone mentor/advisor wisely. Prepare for meetings by identifying what you would like to discuss and/or need help with. If you are asking the mentor/advisor to give their feedback/opinion on your progress, please give them enough time to review the work beforehand.

Students should contact their potential mentor/academic advisor early in their second year of the PA program and no later than six (6) months into their second year. The Director of Basic Science and Research (Dr. Jennifer Hellier, jhellier@rvu.edu) will serve as a mentor until one is identified or if a learner is not able to identify one in time.

Begin/Continue a Literature Review. If you are using an idea from the brainstorming/brain mapping session developed during PAS 5136 (Evidence-Based Practice II), then re-read and annotate the seminal papers and continue to look for new papers that may help you formulate/finalize your idea and research question. If you are working on a new research question or have changed the type of Research Capstone Project, then go back to your PA Capstone Research Project Design Notebook to help you iterate this process again.

The purpose of identifying background papers for the Research Capstone Project during PAS 5136 is to read and study so as to arrive in your PAS II year with a more focused idea and/or area for investigation. Please note that this Research Capstone Project is not a literature review paper. It is adding to current scientific knowledge by filling an unknown or gap in research.

Complete a Research Proposal and the PAS 5271 & 5272 Student Research Approval Form. Rocky Vista University is committed to producing high quality research and scholarly works of all kinds, including basic, clinical, osteopathic principles and practice, translational, and educational, to achieve new heights in medical education and be a thought leader in healthcare research. As such, the institution supports research and scholarly activities both financially and with support services available through the Department of Research and Scholarly Activity (Excerpt from RVU's General Research and Scholarly Activity Policy). Please read the policy statement prior to beginning your Research Capstone Project.

Using the research proposal that was developed when employing the PA Capstone Research Project Design Notebook, finalize the proposal and upload the details into the required RVU research forms for approval (see Page 7). According to RVU's General Research and Scholarly Activity Policy, this form is required to be completed *prior* to the start of research. This allows the Office of Research to know what types of investigations are currently underway by students, faculty, and staff.

Perform the Research and Analysis. The learner will conduct the research by following the planned methodology and data analysis. Depending on the type of Research Capstone Project

(see Page 4), the student must use an analytic approach to evaluate their research/project topic.

Demonstrate Effective Communication of a Scholarly Project. To show that the learner has strong interpersonal and communication skills, they are expected to communicate the purpose and findings of the Research Capstone Project in two (2) distinct formats:

1. Write a short communication paper (see details on Pages 17-21), and
2. Orally present a scientific poster at the annual RVU Research Day (see details on Page 22).

When writing a research paper, ensure you are using scientific language. This means developing a specific research question that is hypothesis-driven, following the scientific method, critically analyzing data, and frequently citing references to previous publications that are relevant to the topic. Clearly state your findings objectively, meaning do not include your opinions or beliefs of what the data mean. There is a difference in stating what you expected, anticipated, or hypothesized compared to what the results show.

Finally, as found on the RVU Writing Center website, the **below policy is followed in regard to authorship and the use of artificial intelligence (AI)**:

> Non-human contributors, such as artificial intelligence, machine learning, or similar technology, do not qualify for authorship. The use of these systems is not encouraged but may be permitted if this specific technology is part of the study question. Use of artificial intelligence must be included in the acknowledgement section if used in part to write the manuscript, or in the methods section if part of the study. Findings from previous publications cannot be reproduced, and authors have the responsibility of ensuring the accuracy and integrity of the writing or content generated by artificial intelligence systems.

This policy is consistent with statements from the Committee on Publication Ethics (COPE) regarding the use of artificial intelligence in research publications.

PAS 5271 & 5272 Student Research Approval Form

This form is required per RVU's General Research and Scholarly Activity Policy, prior to collecting data.

Student Name:	
Student Email:	
Student Phone:	
Mentor/Advisor Name:	
Department or affiliation of mentor/advisor:	
Mentor/Advisor Email:	
Mentor/Advisor Phone:	
Proposed Research Capstone Title:	
Research Type: (If your project is a guideline comparison or barrier to care, select option 1. If you are completing a case report, select option 3.)	1. Basic/translational science, education, patient care, population health 2. Quality improvement and/or patient safety initiative 3. Systematic review, meta-analysis, review article, textbook chapter, case report 4. Innovation in education 5. Creation of curricula, evaluation tools, didactic education activities, development of electronic education materials

Research Proposal: About 1-page (single-spaced) research question, topic, and design

[Overview of your Research Project's question, topic, background information, and design. Please include anticipated results, proposed data analysis, and a minimum of 5 references.]

Deadline Dates and Checklist

Complete the below checklist.

Proposed Research Capstone Timeline	PAS I Fall	PAS I Spring	PAS I Summer / SCPE I	SCPE II Fall	SCPE III Spring	SCPE IV Summer
Complete CITI Training for Research Contact Laura Dement for instructions.	**DUE: First day of classes**					
Complete the Student Research Approval Form. Use and finalize the plan developed during EBP II.	Possibly During EBP I	During EBP II	**DUE: 8/31**			
If needed, obtain IRB Approval Contact Jennifer Hellier or Laura Dement for assistance.	Possibly During EBP I	Possibly During EBP II	**DUE: 8/31**			
May need a Conflict of Interest Form; send to Laura Dement.	For IRB applications, this is DUE prior to IRB approval					
Complete the following PRIOR to the due date below.	Read the Research Capstone Handbook; meet with mentor to review the Introduction; meet with Writing Center for assistance in scientific writing.					
Submit Final Short Communication Introduction to Jennifer Hellier. Include a clear gap in research and how your project is addressing this knowledge gap.	Identify topic, review literature, develop research question and introduction for Student Research Approval Form. Should be working on data collection during this time. Citations in AMA format.			**DUE: 12/31**		
Complete the following PRIOR to the due date below.	Read the Research Capstone Handbook; meet with mentor to review the Introduction and Materials & Methods sections; meet with Writing Center for assistance in scientific writing.					
Submit Final Short Communication Materials & Methods and Reference Sections to Jennifer Hellier. Include details of the process and software used for data collection and analysis.	Finalize the Materials & Methods and Reference sections of your Short Communication paper. Continue collecting data, begin analyzing data, and begin to determine your results. Ensure citations are in proper AMA format.				**DUE: 4/30**	
Complete the following PRIOR to the due date below.	Read the Research Capstone Handbook; meet with mentor to review your Short Communication; meet with RVU writing center for assistance in scientific writing.					
Submit Final Short Communication and Poster Draft to Jennifer Hellier. Complete the remainder of your paper: Results & Discussion and Conclusion sections. Review previously turn-in sections and incorporate suggested edits and comments.	Finalize data collection/analysis, identify and discuss most significant results, design figures/tables, draw important conclusions, and complete your Short Communication Paper. Ensure to incorporate previously suggested edits and comments. Ensure each reference is cited at least once in the paper and is in proper AMA format.					**DUE: end of your research month**

Deadline Dates: Details

Deadlines for each part of the Research Capstone are listed below and must be met by each student. If deadlines are not met by the specified date, then it will be noted in your student files as a lack of professionalism and may affect credentialing when seeking employment as a PA.

Due Date	Tasks
During Spring Semester of PAS I	Each student will: • brainstorm and develop their Research Capstone Project in the PAS 5136 Evidence-based Practice II course. • read primary sources (e.g., original resources, datasets, etc.) and annotate text for their Research Capstone topic. • make initial contact with your advisor or potential mentor. • outline/plan data collection methods and analyses. If data collection involves human subjects, you must follow the RVU Institutional Review Board (IRB) guidelines. Contact IRB Compliance Officer Laura Dement (ldement@rvu.edu) for assistance.
Last day of SCPE I (DUE: August 31)	• PAS 5271 & 5272 Student Research Approval Form must be submitted to the RVU Research portal for approval. • A planned schedule of meetings with your Research Capstone mentor/advisor must be identified. • If IRB approval is required, this process should be completed by this time. • Ensure citations are in AMA format.
All of PAS II - SCPE	The learner is responsible for: • reading the Research Capstone Handbook; • working independently and meeting with their advisor/mentor according to the predetermined schedule; • reading and responding to emails sent by the Director of Basic Science and Research (Dr. Jennifer Hellier); and • completing check-in surveys sent by the Director of Basic Science and Research (Dr. Jennifer Hellier). If the learner needs to change their Research Capstone project, contact the Director of Basic Science and Research (Dr. Jennifer Hellier) as soon as possible to determine how to proceed.
SCPE II (Fall) (SHORT COMMUNICATION INTRODUCTION is DUE: December 31)	• Read the Research Capstone Handbook. • Meet with your mentor to review the Introduction. • Ensure to include a clear research question and how your project is addressing this knowledge gap. • Meet with the Writing Center for assistance in scientific writing. • Background research must be completed and Short Communication Introduction (with references/citations) must be submitted to the Director of Basic Science and Research (Dr. Jennifer Hellier).

	• Ensure citations are referenced at least once in your Introduction and in AMA format. • Student researchers should begin to collect data.
SCPE III (Spring) (SHORT COMMUNICATION MATERIALS & METHODS SECTION is DUE: April 30)	• Read the Research Capstone Handbook. • Meet with mentor to discuss your progress and review the Introduction and Materials & Methods sections. • Meet with Writing Center for assistance in scientific writing. • Ensure citations are referenced at least once in your Introduction and/or Materials & Methods in AMA format. • Data collection continues. • May begin to analyze data and develop figures.
Research Month of SCPE IV (Summer) (SHORT COMMUNICATION & POSTER DRAFT are DUE: end of dedicated research month)	The learner will have a dedicated research month to: • Read the Research Capstone Handbook (remember this is a yearlong project and not just a literature review). • Finalize data analysis. • Write and finalize the short communication (see Pages 17-21). • Meet with RVU writing center for assistance in scientific writing. Schedule an appointment with the writing center (https://www.rvu.edu/writing-center/) • Create figures and design a draft of the Scientific Poster (see Page 22). • Meet with mentor to review your Short Communication and Poster Draft prior to submitting draft to the Director of Basic Science and Research (Dr. Jennifer Hellier). **Short communication:** Due by 5:00 p.m. on the last full day of the research month; assessed by the Student as Scholars Program rubric (see Pages 23-24), must achieve a milestone level 2 or higher for each criterion in order to pass. **Poster draft:** Due by 5:00 p.m. on the last full day of the research month; assessed by completion only. Must use the RVU poster template.
Fall of Year III – CAPSTONE (FORMAL PRESENTATION OF POSTER AT THE RVU ANNUAL RESEARCH DAY – OCTOBER)	• Register for RVU's Annual Research Day (e.g., submit abstract). • Incorporate suggested edits and comments into your completed research poster for presenting at RVU's Annual Research Day. • Consider submitting your short communication paper for publication (e.g., RVU's Articulate: an integrative exploration of the arts and science in healthcare). • Have your poster printed at RVU's Print Center. • Oral presentation to the PA faculty and your classmates the day before RVU's Annual Research Day. **** Faculty will be grading your presentation and poster. **** • Oral presentation to the RVU community at RVU's Annual Research Day.

List of Resources

RVU is committed to research and have provided several resources to assist student and faculty researchers. Below is a list of these resources. If you do not see a resource that you need, please reach out to Dr. Jennifer Hellier for assistance.

TRAINING

CITI Training (Required for all projects)

- CITI Program Instruction
- Lunch and Learn: Research 101 (PPT)
- Research Modules *(Password protected, email* ecox@rvu.edu*)*
- Research Quick Start Guide

TIPS FOR WRITING

- Case Report Templates and Checklists
- Case Report Tips and Tricks
- Literature Reviews (PDF)
- The Principles of Presenting Statistical Results Using Figures (NIH paper)

TOOLS

- Reference Manager: Zotero (register for a free online account at Zotero.org)
- Public Datasets
- Government Validated Survey Questions
- Axiom Mentor (IRB application site)

FUNDING

- Intramural Grant Instructions (doc)
- Research "Shark Tank" Style Microgrant Competition
  (please check the RVU Research website *for deadline dates)*
- Student Research Travel Fund

FORMS

- Student Research Authorization Form
- Qualtrics Account Request (Use Qualtrics for all surveys)

- Research and Scholarly Activity Attestation
- Consent forms (These can also be found in Axiom Mentor IRB under Documentation)
    - Case Report
    - BMJ Case Report
    - Anonymous Survey
    - Confidential Survey
    - Full Consent

SCIENTIFIC WRITING RESOURCES

- Chapter 5. Tables and Figures (American Society of Agronomy)
- Scientific Writing Made Easy: A Step-by-Step Guide to Undergraduate Writing in the Biological Sciences
- The Principles of Presenting Statistical Results Using Figures (NIH paper)
- The Basics of Scientific Writing (Dr. Lombardo)
- Schedule an appointment with RVU's Writing Center (https://www.rvu.edu/writing-center/)
- Grammarly Free Version to help with proofreading

Research Proposal

Your Research Capstone Project will take a minimum of one year to complete. Thus, as a second semester PAS-I student, you will develop a proposal during PAS 5136 Evidence-Based Practice II, using the PA Capstone Research Project Design Notebook. The learner is welcomed to have it reviewed by the Director of Basic Science and Research (Dr. Jennifer Hellier) to provide constructive feedback during the course. A sample research proposal is attached here for your reference. Here is another guideline developed by Dr. Jan Pryor that you can use.

SAMPLE PROPOSAL TEXT (revised from the University of Houston)	COMMENT
A Conceptual Framework for Scheduling Constraint Management	Provide a brief and meaningful title of your research project. It should include the subject types (e.g., elderly females) and the main intervention/question studied.
1. Introduction Every construction project is unique and has its own operating environment and sets of technical requirements. As a result, the execution of a construction project is subject to numerous constraints that limit the commencement or progression of field operations, which invariably have significant negative impact on overall project performance. By definition, constraints refer to any condition, such as temporal/spatial limitations and safety/quality concerns, which may prevent a project to achieve its goals. Successful execution and control of a construction project relies on effective identification and management of constraints through master planning and short-term look-ahead scheduling. While the master schedule provides a global view of a project and the overall execution strategy, a look-ahead schedule offers a detail account of operational constraints and a detailed plan showing work to be done within a relatively short time window. Ideally, these detailed schedules should reflect actual field conditions and provide field personnel with operation instructions free of constraints and conflicts (Hinze 2008). This look-ahead scheduling and constraint analysis procedure is also a critical component of the last-planner methodology proposed by Ballard (2000). This research project will provide an overview of state-of-art schedule constraint analysis practice during look-ahead scheduling. In addition, it will propose a conceptual framework for managing constraints.	Background or introduction section provides a description of the basic facts and importance of the research area – What is your research area, the motivation of research, and how important is it for advancing medicine practice and knowledge? What are the knowledge gaps in the scientific literature? This includes a review of the literature with multiple references.
2. Problem Statement The importance of developing a constraint-free and reliable work plan has long been recognized by the industry. However, numerous construction projects are still plagued by delays and cost overruns, which can frequently be traced to ineffective identification and treatment of constraints. First, when a constraint is not properly identified during scheduling, subsequent conflicts in	Problem statement provides a clear and concise description of the issues that need to be addressed – What is the specific problem in that

the field are inevitable. Today's projects are becoming more and more technically complex and logistically challenging, which exposes construction operations to even more complex constraints. Second, the traditional scheduling methods, bar charts and Critical Path Method (CPM) which are widely used as a basis for constraint analysis, greatly limit our capability in modeling and resolving constraints during look-ahead scheduling. These methods have long been blamed for their limitations in modeling and communicating constraints, including inability to cope with non-time-related precedence constraints and difficulty to evaluate and communicate inter-dependencies at the field operation level (e.g., Sriprasert and Dawood 2002; Chua and Shen 2001). In summary, there is a need for a better understanding of constraints in construction and a structured approach in identifying and modeling constraints to ensure a constraint-free work plan. More specifically, the following research questions need to be addressed: 1. What are the typical constraints found in various construction projects? 2. How to classify these constrains for easier identification and modeling? 3. What are the current industry practices as well as research advancements in modeling and resolving constraints? 4. How to unify the constraint classification knowledge and various constraint modeling efforts into a framework for total constraint management?	research area that you will address (e.g., lack of understanding of a medical issue; discrepancies in medical practice guidelines; etc.)?
3. Objectives / Specific Aims The long-term goal of the research is to develop a formalized constraint management system. Constraint management is defined herein as the process of identifying, classifying, modeling, and resolving constraints. The objective of the current study is to provide a comprehensive review of literatures and industry practices in relation to constraint analysis and outline a conceptual framework for constraint management. Particularly, the study has the following sub-objectives: 1. To provide a comprehensive review of sources and characteristics of constraints typically found in construction projects; 2. To develop a constraint classification method for easier constraint identification and modeling; 3. To review current industry practices and researches in regards to constraint modeling; 4. To outline a conceptual framework for total constraint management. The result of this study will be valuable to the industry practitioners as well as related software providers in developing better practice and tools for constraint management and look-ahead scheduling.	Objectives / Specific Aims provide a list of goals that will be achieved through the proposed research – What are the benefits/impact (e.g., better understanding, improved health outcomes, etc.) that will be generated if the research problem is answered?
4. Preliminary Literature Review A preliminary literature review shows that past studies are primarily focused on understanding and modeling a particular type of constraint, such as	Preliminary literature review: provide a summary of previous

technological, contractual, resource, spatial, and information constraints. Limited progress has been made on classifying various constraints according to their characteristics in a comprehensive manner. In terms of modeling and resolving constraints, various approaches have been recommended. For example, many CPM-based methods are applied to deal with time-related constraints; knowledge-based systems were used to automate work plan generation; network-based optimization algorithms were developed to resolve constraints; and databases and visualization techniques, such as 3D, 4D, and Virtual Reality (VR), are used to communicate and visualize constraints. What is missing from the past studies is a comprehensive and structured approach in managing constraints in construction projects.	related research on the research problem and their strength and weakness and a justification of your research – What is known/what have been done by others? And, why is your research still necessary?
5. Methodology The primary research method for this study is literature review and conceptual modeling. Constraint identification and classification through a structured approach is the very first step toward a "zero-constraint" environment. This study will first review various types of constraints in construction and their characteristics. Based on this understanding, a classification method will be developed to categorize constraint factors for the purpose of constraint identification and modeling. In the second stage of this study, existing constraint modeling methods will be identified based on a comprehensive review of current industry practices and academic researches. Finally, once the constraint classification and modeling techniques are identified, a conceptual framework for total constraint management will be outlined. This study will be conducted between September 2010 and May 2011.	Research methodology defines the research methods and logic steps – What to do and how to solve the problem and achieve proposed objectives / specific aims? Which research methods (e.g., survey, modeling, case study, etc.) will be used? Attach a project schedule table, if necessary.
References 1. Ballard, G. (2000). "Last planner system of production control." *Ph.D. Dissertation*. Univ. of Birmingham, Birmingham, UK. 2. Chua, D. and Shen, L. J. (2001). "Constraint modeling and buffer management with integrated production scheduler." *Proceedings of International Conferences on Lean Construction 2001*, Singapore. 3. Hinze, J. W. (2008). *Construction planning and scheduling*, 3rd ed. Pearson, NJ. 4. Sriprasert, E. and Dawood, N. (2002). "Requirements identification for 4D constraint-based construction planning and control system." *Proceedings of CIB W78 conference – distributing knowledge in building*, Aarhus, Denmark	All factual material must be accompanied by a reference to its source. Please use the American Medical Association (AMA) guidelines for reference and citation styles.

Data Collection and Analysis

Do you need IRB approval first? If so, please stop here and obtain your IRB approval **BEFORE** you start to collect data.

Data Collection

Depending on the type of research you are conducting, there may be specific types of data you need to collect (e.g., quantitative vs qualitative). Please watch the Research Modules *(Password protected, email* ecox@rvu.edu*)* to learn more about data collection. In addition, below are a few websites that provide definitions and explanations to help you determine your data collection type.

- Busetto et al, 2020: How to use and assess qualitative research methods
- Grand Canyon University, 2022: "Most Efficient Qualitative Data Collection Methods"
- Winston-Salem State University, no date: "Key Elements of a Research Proposal: Quantitative Design"

Data Analysis

When determining which type of statistical analyses you need, please watch the Research Modules *(Password protected, email* ecox@rvu.edu*)* developed by RVU. In addition, use the ***Stats Test Flow Chart.pdf*** provided in PAS 5136 Evidence-Based Practice II course.

RVU values strong statistical analysis and has a consultant to assist in this process for those performing novel research. Before you ask for a consultation please prepare a set of questions and be ready to discuss potential analysis options you have already identified, such as:

- What type of variables did you collect in your research?
- How many individuals or groups are you wanting to compare?
- What type of comparison do you want to make with your collected data?

Additionally, there are several courses through Lecturio that can help you identify which statistics you may need to calculate. Note you will need to use your RVU login to access these lessons. Finally, the statistics flow charts in the back of the Basic and Clinical Biostatistics book should help with this process. **Statistics consultation:** Mark Payton, PhD – Chair of RVU COM Department of Biomedical Sciences (mpayton@rvu.edu).

Short Communication Organization and Format Guidelines

Please use the following instructions and details when organizing and formatting the short communication.

Short Communication: Short communications are short papers that present original and significant material for rapid dissemination. The expected length of the short communication is 1000-1500 words, which will need to be reduced to 250-300 word abstract when submitting to the RVU Annual Research Day committee. The short communication must include:

1. **INTRODUCTION:** What is the motivation for the research/question? Why is the question important? Provide a paragraph of what is currently known, what the question of the research is, and how it will add to the body of knowledge.

2. **MATERIALS & METHODS:** What specific actions/methods/materials were employed to answer the question? What statistics were used? Provide 4-6 sentences that briefly highlight the methods, materials, and analysis used.

3. **RESULTS:** This section begins with a narrative that presents your key findings in an objective manner with tables/figures interspersed once mentioned in the text (e.g., see Table 1). This section includes: What were the main findings of the study? What was significant or an unexpected result? Ensure to include specific numbers, increases/decreases, and/or percent change in the results. Avoid using vague or exaggerated language when describing outcomes (e.g., “clear differences”, “biggest change”, “huge significance”, “very small decrease”, etc.).

4. **DISCUSSION:** What are the implications of the study? What is the impact to new knowledge? Are the results generalizable or specific to particular cases? How would a professional incorporate the conclusion of the study into practice? Make sure that the conclusions do not overstate the outcome/results.

5. **ACKNOWLEDGEMENTS (optional):** Did you have research funding for this project? Then you must acknowledge it here. Anyone who helped but are not listed as authors. If acknowledging participants in your study, do not provide any personal information (e.g., names, age, address, etc.).

6. **REFERENCES:** Include all references (in order of appearance) that are cited in your short communication. These are not included in the word count and should be in numerical order. NOTE: the first paper to be cited is number one, the second paper is number two, and so forth.

Formatting Guidelines for Short Communication

A high level of care in written presentation is essential.

1. The short communication must be developed using the formatting guidelines on the following pages.
2. References should appear within the text as superscripts and should be in numerical order in the reference section. For example: "…temperatures over 70 °F have been found to be harmful[1]." NOTE: the first paper to be cited is numbered one, the second paper is numbered two, and so forth.
3. Citations must be accurate, referenced in the text at least one time, and included in a bibliography (not included in word count). Please use the current AMA format, created by the American Medical Association.
4. Accuracy in the use of English is a necessity, as is correct spelling. Please use a spellchecker, proof-read your work rigorously, and meet with RVU's Writing Center for assistance in scientific writing. For example: the word "data" is the plural form of the word "datum". Please ensure the correct verb is used for the correct form of the word (e.g., "These data show a significant increase…"). Here is a reference for Effective Writing (Nature.com).
5. In scientific writing, do not start a sentence with an acronym or a number (unless the number is spelled out).
6. Acronyms must be spelled out (defined) the first time they are used.
7. Whole numbers from zero to ten need to be spelled out.
8. Scientific writing should use statements that can be tested, "I anticipate...", "I expect...", "I predict...", "I hypothesize...". Do not use statements such as: "I hope…", "I feel..." or "I believe..." as these are not testable.
9. Avoid deliberately offensive language; ensure confidentiality where appropriate when referring to research subjects; and include acknowledgments of any funding or assistance (not included in word count).
10. Finally, refer to textbook or journal articles on how to write scientifically.
    i. Chapter 5. Tables and Figures (American Society of Agronomy)
    ii. Scientific Writing Made Easy: A Step-by-Step Guide to Undergraduate Writing in the Biological Sciences
    iii. The Principles of Presenting Statistical Results Using Figures (NIH paper)
    iv. The Basics of Scientific Writing (Dr. Lombardo)

TITLE OF YOUR SHORT COMMUNICATION (TNR, Bold, 14pt, centered)

Author, A[1], Author, B[2], and Author, C[3] (TNR 12pt centered)

[1]Institution 1(TNR 12pt centered)
[2]Institution 2 (TNR 12pt centered)
[3]Institution 3 (TNR 12pt centered)
E-mail (corresponding author)

1. INTRODUCTION (headlines: TNR Bold, 12pt)

(NOTE: Paragraphs are indented.) The manuscript should be prepared on an A4-sized paper with 1-inch margins on all sides and typed with single spacing using size 12 Times New Roman font. All illustrations must be prepared inside of the main text.

2. MATERIALS AND METHODS (headlines: TNR, Bold, 12pt)

(NOTE: Paragraphs are indented.) The methodology must be clearly stated and described in sufficient detail or with sufficient references. Include statistical analysis used for analysis.

3. RESULTS AND DISCUSSION (headlines: TNR Bold, 12pt)

(NOTE: Paragraphs are indented.) The findings and arguments of the work should be explicitly described and illustrated. Supporting figures, tables and images of the data are integrated throughout the narrative. Please include no more than 4 data figures and/or tables.

4. USING TEMPLATES FOR SEVERAL COMPONENTS THAT WILL BE INTERSPERPED THROUGHOUT THE MANUSCRIPT

4.1 Equations

Equations should be centered and numbered consecutively, as in Eq. [1]. An alternative method is given in Eq. [2] for long sets of equations where only one referencing equation number is wanted.

(1 line spacing here)

$$\mathrm{F}((\mathrm{A}-\mathrm{b_n})^2, \mathrm{c_n^2}, \mathrm{D}) = \frac{1}{(23\pi)^{1/3}} \int \frac{\mathrm{d^3 b_n}}{3\omega_i} \delta^4 (\mathrm{A} - \mathrm{b_n} - D + c_n) \qquad [1]$$

(1 line spacing here)

where,

$$\begin{aligned} \mathrm{A} = & \left[E_{11} E_{12}{}^* E_{21}{}^* E_{22} \right] \\ & - \left[E_{12} E_{13}{}^* E_{22}{}^* E_{23} \right] \end{aligned} \qquad [2]$$

4.2 List

Lists can be provided using either numbers or bullets:

i. List item 1 like this;
ii. List item 2 is an example of a longer list item that wraps to a second line, where the second line is indented.

The example for bulleted items like this:

- List item 1;
- List item 2.

4.3 Tables and figures

Tables and figures should be embedded in the text using the text wrap feature for a text box and should be numbered consecutively. It is preferable that figures be mounted in portrait style and figure captions are no longer than two lines.

Tables should be designed to have a uniform style throughout the paper, following the style shown in Table 1. Table captions should be in 10pt "Time News Roman" bold, centered, and the texts in Table should be set in 9pt "Time News Roman" font.

Table 1. Caption heading for a table should be placed at the top of the table and within table width.
(Use "Times New Roman" font, size 10pt, No spacing after table title)

	A	**B**	**C**	**D**
A	Aa	Ab	Ac	Ad
B	Ba	Bb	Bc	Bd
C	Ca	Cb	Cc	Cd
D	Da	Db	Dc	Dd
E	Ea	Eb	Ec	Ed

Authors are advised to prepare their figures in either black and white or color. Please prepare the figures in high resolution (300 dpi) for half-tone illustrations or images. Figures must be originals, computer-generated or drafted, and placed within the text area where they are discussed. Figure 1 shows one example. Figure captions should be in 10pt "Times New Roman" font, bold, centered. When applicable, the texts in graphs, illustrations or images should be set in 8pt "Times New Roman" font. On figures showing graphs, both axes must be clearly labeled (including units, if applicable).

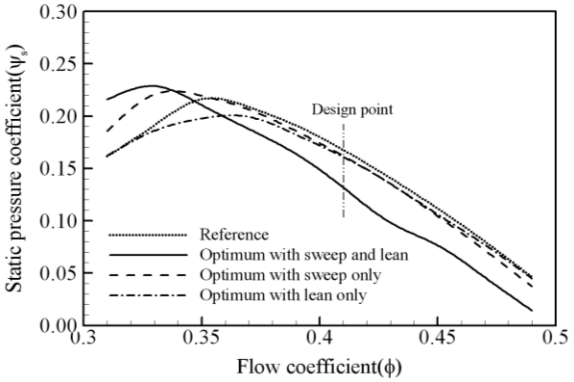

Figure 1. The caption heading for a figure should be placed below the figure and within figure/illustration width. (Use "Times New Roman" font, size 10pt, no spacing between title and figure)

4.4 Footnotes

Footnotes are denoted by a character superscript in the text [b].

4.5 Units

Use either SI (MKS) as primary units. English or CGS units may be used as secondary units (in parentheses). Avoid combining SI and CGS units. This often leads to confusion because equations do not balance dimensionally. If you must use mixed units, clearly state the units for each quantity that you use in an equation. Do not mix complete spellings and abbreviations of units. Spell out units when they appear in text.

5. CONCLUSION (headlines: TNR Bold, 12pt)

(NOTE: Paragraphs are indented.) Conclusions should include (1) the principles and generalizations inferred from the results, (2) any exceptions to, or problems with these principles and generalizations, (3) theoretical and/or practical implications of the work, and (5) conclusions drawn and recommendations.

6. ACKNOWLEDGMENT (headlines: TNR Bold, 12pt)

(NOTE: This section is OPTIONAL and section is indented.) The authors would like to express appreciation for the support of the sponsors [Project Number = XXXXXXX]. NOTE: Anyone who helped but are not listed as authors. If acknowledging participants in your study, do not provide any personal information (e.g., names, age, address, etc.).

7. REFERENCES (headlines: TNR Bold, 12pt)

References should be listed in the order in which they appear in the text. Please use the AMA reference style. Example:

1. Bradshaw JT, Peterson T, Parker LM, Richards Z, Skidmore CJ, Brighton K, Muir MW, Moody A, Collyer A, Zapata I, Brooks AE, Reyes M. A Prospective Analysis of the Simplified Student Sight Savers Program on Open-Angle Glaucoma Cost Burden in Underserved Communities. *J. Clin Med.* 2022; 11(10):2903. https://doi.org/10.3390/jcm11102903

In the text, references should be cited by superscript number with grammatical marks (i.e., period or comma) following the citation.

[b] Just like this one.

Scientific Poster Organization and Format Guidelines

Please use the following instructions and details when organizing and formatting the scientific poster.

As with your short communication, the learner should prepare and present a professional quality public presentation. The typical organization of the scientific poster will follow the structure of the short communication. Please use the PA Poster Template to assist you in creating your scientific poster. These components are:

a. **Aim:** What the study sets out to do
b. **Background:** The context and rationale for the dissertation
c. **Procedure:** How the study is organized; what it covers
d. **Method:** The approach or methodology used in the study
e. **Results:** The key findings of the study in narrative form with figures/tables
f. **Conclusions:** The principle conclusions or recommendations.

Citations must be accurate and included in a bibliography. Please use the **current AMA format, created by the American Medical Association**. Accuracy in the use of English is a necessity, as is correct spelling. Please use a spellchecker and proof-read your work rigorously. Finally, avoid offensive language; ensure confidentiality when referring to research subjects; and include acknowledgments of any funding or assistance. See Page 18 for more details and references.

Oral Poster Presentation

The learner should prepare and practice several times prior to their oral presentation of their poster to the PA Faculty and the RVU community. This is a time to share the results and conclusions of your Research Capstone Project. The researcher will have five (5) minutes to present their research background, research question, methodology, results, and conclusions. To help you prepare for your oral presentation, please watch the Research Modules *(Password protected, email* ecox@rvu.edu*)* developed by RVU. In addition, there are a few videos on how to give an oral presentation of your scientific results:

Communication in Science: Talk the Talk: Improving Your Presentations Using TED Talk Principles (2018, Marie K. Norman PhD; 50 mins)
Susan McConnell (Stanford): Designing Effective Scientific Presentations (2011, iBiology; 42 mins)
TED Talks: The Official TED Guide to Public Speaking (2016, Chris Anderson; 51 mins)
TEDxEMU – Giving Presentation Worth Listening To (2012, Gordon Kangas; 10 mins)

Grading Rubric

Both your short communication and poster will be graded using the rubric below. This rubric has been modified from the George Mason University Students as Scholars Initiative for RVU PA Program's Research Capstone Project. You must earn Level 2 in each criterion to pass PAS 5271/5272.

CRITERIA	LEVEL 3	LEVEL 2	LEVEL 1
CORE: articulate and refine a research question, problem, or challenge	Articulate and refine a novel, focused, and manageable research question, problem, or challenge that has the strong potential to contribute to the field.	Articulate a question, problem, or challenge that is generally relevant and appropriate in scope.	Not yet able to articulate an appropriate scholarly question, problem, or challenge.
SCHOLARLY CONTEXT: explain how knowledge is situated and shared in relevant scholarly contexts	Explain multiple and innovative pathways for dissemination of scholarship. Place the inquiry within a comprehensive scholarly context. Make insightful connections between, and acknowledge limitations in, own and others' work.	Explain general pathways for dissemination of scholarship. Place the inquiry within a scholarly context and be able to make some connections between own and others' work.	Not yet able to explain how scholarly knowledge is distributed.
METHODS: choose an appropriate research method for scholarly inquiry	Choose or create sophisticated and effective methods for exploring an inquiry, and identify and responsibly address advantages and limitations of different methods.	Sometimes choose effective methods for exploring an inquiry.	Not yet aware of appropriate research methods for scholarly inquiry.
DATA COLLECTION: gather and evaluate evidence appropriate to the inquiry	Acquire high-quality information or data using sophisticated strategies; used nuanced criteria to judge the credibility of the evidence.	Acquire information or data using appropriate strategies; sometimes able to judge the credibility of the evidence.	Not yet able to gather or evaluated evidence appropriate to the inquiry.
RESULTS: analysis or interpretation of scholarly evidence	Provide sophisticated analysis or synthesis of new and previous evidence to make original insightful contributions to knowledge.	Analyze or synthesize new and/or previous evidence appropriate to the inquiry.	Not yet able to analyze or synthesize information or data.
IMPACT and LIMITATIONS: implications to research and the limitations of the study are realized and evaluated	Implications, consequence, and/or questions raised by the project are thoroughly and sophisticatedly explored. Limitations are fully articulated.	Implications, consequences and/or questions raised by the project are adequately explored. Limitations are adequately articulated.	Not yet able to support or articulate impact to the field of study. Limitations are minimally or not articulated.

EXCHANGE OF IDEAS: written and orally communicate knowledge from an original scholarly project	Communicate - with clarity, accuracy, and fluency - the results of a scholarly or research project through publishing and presenting, employing highly-effective conventions appropriate to the audience and context.	Communicate knowledge from scholarly or creative project through writing and presenting, employing some conventions appropriate to the audience and context.	Not yet able to explain knowledge from a scholarly or creative project.

The 2016 George Mason's University Students as Scholars rubric can be retrieved from https://assessment.gmu.edu/student-as-scholars/outcomes-rubrics/.