THE OHIO STATE UNIVERSITY
JOHN GLENN COLLEGE OF PUBLIC AFFAIRS

Public Affairs 7910
Policy Capstone: Analytics, Modeling, and Simulation
Spring 2018, Thurs 5:45pm-8:35pm
Page Hall, Room 240
Credit Hours: 3

COURSE OVERVIEW

Rudy Hightower, II, LCDR
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COURSE GOALS AND DESCRIPTION

This capstone course covers the theory and practical uses of policy analytics and non-linear modeling and simulation of complex public policy problems. The course is designed to be complementary to statistics and econometrics classes and accomplishes its learning objectives through online lectures, web research, and students' hands-on creation, testing, and improvement of computer models. Five specific Modeling and Simulation Framework topics covered include: 1) iterative storytelling in public policy, 2) conceptualizing complex problems and constructing reference mental models, 3) transferring mental models into computerized models, 4) simulating models and conducting "what-if" scenario planning, and 5) building multimedia interfaces, "dashboards", and visualizations/animations to present research results to policy decision-makers. The course examines the principles of mining and analyzing 'big data,' along with creating decision-making models over a wide swath of complex public policy issues, including housing, healthcare delivery systems, science and technology, and public finance.

Although there are several statistical procedures touched upon during the course, an advanced knowledge of statistics and statistical hypothesis testing is not required. A full semester of statistics is highly recommended but not required for this introductory Policy Analytics, Modeling, and Simulation course.

Students are introduced to non-linear modeling issues such as counter-intuitive behavior, results separated by time and space, information feedback loops, top-down/bottom-up

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analytical approaches, and a host of other topics. Further, graduate students will work with selected public policy problems relevant to their individual research interests. By the end of this course, students should feel comfortable using non-linear modeling techniques within their respective fields. Additionally, students should be able to recognize and outline standard modelling issues, best practices, and figures of note.

PREREQUISITES

MPA and MA students enroll in 7910 upon completion of all Glenn College core courses applicable to their degree focus with the exception of PA6060. Enrollment in this capstone course requires pre-approval from the John Glenn College Student Services Staff located in Page Hall Room 110.

COURSE OBJECTIVES

The course objectives are to:
1. Introduce theoretical and practical applications of 'big data' and policy analytics;
2. Present the relevance of policy analytics and non-linear modeling and simulation;
3. Describe the Modeling & Simulation Framework© (MSF);
4. Introduce various policy modeling and simulation paradigms including system dynamics, agent-based modeling, discrete event modeling, and spatial analysis using Geographic Information Science/Systems (GIS);
5. Achieve proficiency in crafting system dynamics models and linking models to public policy research;
6. Achieve proficiency in crafting data interfaces, 'dashboards', and other interactive presentation methods.

The course unit-level learning objectives are:
Unit 1 – Foundations of Policy Analytics, Modeling, and Simulation
- Describe policy analytics, modeling, and simulation theories and processes
- Identify and explain how 'big data' is used in policy analytics
- Conduct an Internet-based research on policy analytics
- Identify components of the Modeling and Simulation Framework (MSF)
- Craft a Policy Modeling Paragraph (PMP) for an assigned policy issue

Unit 2 – Iterative Storytelling
- Identify and explain in writing the iterative storytelling process
- Describe the concepts of feedback loops, counter-intuitive behavior, and the policy outcomes separation of time and space
- Deconstruct a policy paper and turn it into a mental model

Unit 3 – Conceptualizing
- Identify and explain in writing the conceptualization process
- Identify the specific challenges of constructing mental models

Unit 4 – Transferring

- Identify and explain in writing the process of transferring mental models into computer models
- Demonstrate proficiency in transferring mental models into STELLA modeling software

Unit 5 – Simulating
- Identify and explain in writing the purpose of simulating computer models
- Demonstrate the ability to create "what-if" alternative scenarios for selected policy issues

Unit 6 – Presenting
- Demonstrate the ability to create an interactive interface or dashboard for running a computer model
- Create a policy visualization or animation to show to policy decisionmakers
- Explain the basics of GIS and location analytics
- Research the techniques of the *New York Times* Graphics

Unit 7 – Wrap-up
- Complete the course evaluations, provide constructive feedback, and
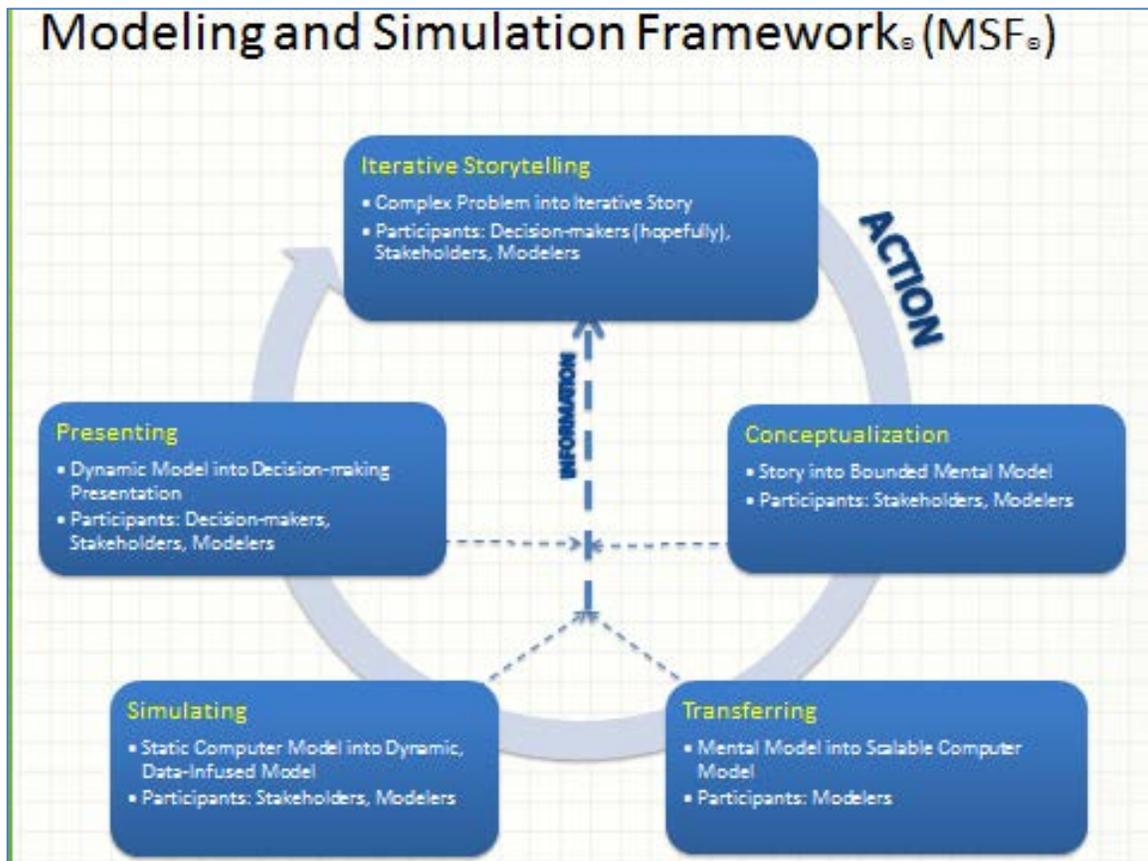
debrief

Figure 1. The Modeling and Simulation Framework

COURSE DESCRIPTION

This course tackles the question of how to analyze 'big data' and create effective and iterative computer models to aid government, business, and academic decision-makers. In pursuit of this end, we will examine the characteristics of policy analytics, the various types and rationales for modeling, and the techniques for simulating and presenting various decision-making outcomes. In addition, we will critically assess the uses of policy analytics, modeling, and simulation in US and international organizations. We will assess how organizational use of analytics, modeling, and simulation can influence judgments about whether their organizations/programs should be expanded, changed, or abolished.

This course involves a mixture of readings, lectures, videos and assignments where students analyze data, create iterative models, and conduct policy simulations. The readings are primarily drawn from research on systems thinking and system dynamics, agent-based modeling, and business and policy analytics. The online lectures are designed to elaborate on and extend the key points covered in the readings. The analysis of 'big data' in complex problems provides an opportunity to integrate and apply modern modeling and simulation techniques into real world situations.

This course is targeted at graduate students with interests in 'big data' analysis, computer modeling, and 'what-if' scenario planning.

Policy Analytics and Modeling Paradigms covered in the course:

Policy Analytics – Policy Analytics is synonymous with Business Analytics in that the purpose is to draw upon a wide range of existing data and knowledge, including factual information, scientific knowledge, and expert knowledge, and combine this with a constructive approach to modeling, simulating, and presenting results to relevant stakeholders. The term "Policy Analytics" is used to denote the development and application of such skills, methodologies, methods and technologies, which aim to support relevant stakeholders engaged at any stage of a policy cycle, with the aim of facilitating meaningful and informative hindsight, insight and foresight. Policy analytics can help leaders to weigh the benefits and costs of policy alternatives, do quantitative research and analysis. This research can be used to communicate policy decisions to constituents, stakeholders and regulatory agencies. Policy Analytics works with clients to explore the implications of state and local policy decisions; Policy Analytics provides quantitative and qualitative research to help governments and non-profit organizations to meet their strategic and programmatic goals. (Tsoukias et al, 2013)

System Dynamics - System dynamics is a computer-aided approach to policy analysis and design. It applies to dynamic problems arising in complex social, managerial, economic, or ecological systems — literally any dynamic systems characterized by interdependence, mutual interaction, information feedback, and circular causality. The field developed initially from the work of Jay W. Forrester. His seminal book Industrial Dynamics (Forrester 1961) is still a significant statement of philosophy and methodology in the field. Within ten years of its publication, the span of applications

grew from corporate and industrial problems to include the management of research and development, urban stagnation and decay, commodity cycles, and the dynamics of growth in a finite world.   It is now applied in economics, public policy, environmental studies, national security, theory-building in social science, and other areas, as well as its home field, management.

The system dynamics approach involves:
- Defining problems dynamically, in terms of graphs over time.
- Striving for an endogenous, behavioral view of the significant dynamics of a system.
- Thinking of all concepts as continuous quantities interconnected in loops of information feedback and circular causality.
- Identifying independent stocks or accumulations (levels) in the system and their inflows and outflows (rates).
- Formulating a behavioral model capable of reproducing, by itself, the dynamic problem of concern.
- Implementing changes resulting from model-based understandings and insights.

Agent-based Modeling (ABM) – Agent-based modeling is a decentralized, autonomous, individual-centric ("agents") approach to model design. The agents can be any item or figure. Autonomous agents inhabit a dynamic, unpredictable environment in which they try to satisfy a set of time-dependent goals or motivations. Agents are said to be adaptive if they improve their competence based upon experience.

Discrete Event Modeling - The world around us appears to be "continuous." However, when we analyze processes, in many cases it makes sense to abstract from their continuous nature and consider only some "important moments", "events" in the system lifetime. The modeling paradigm that approximates real-world processes with such events is called Discrete Event Modeling. The term Discrete Event is also used in the narrower sense to denote "process-centric" modeling, where the system is described as a process flowchart.
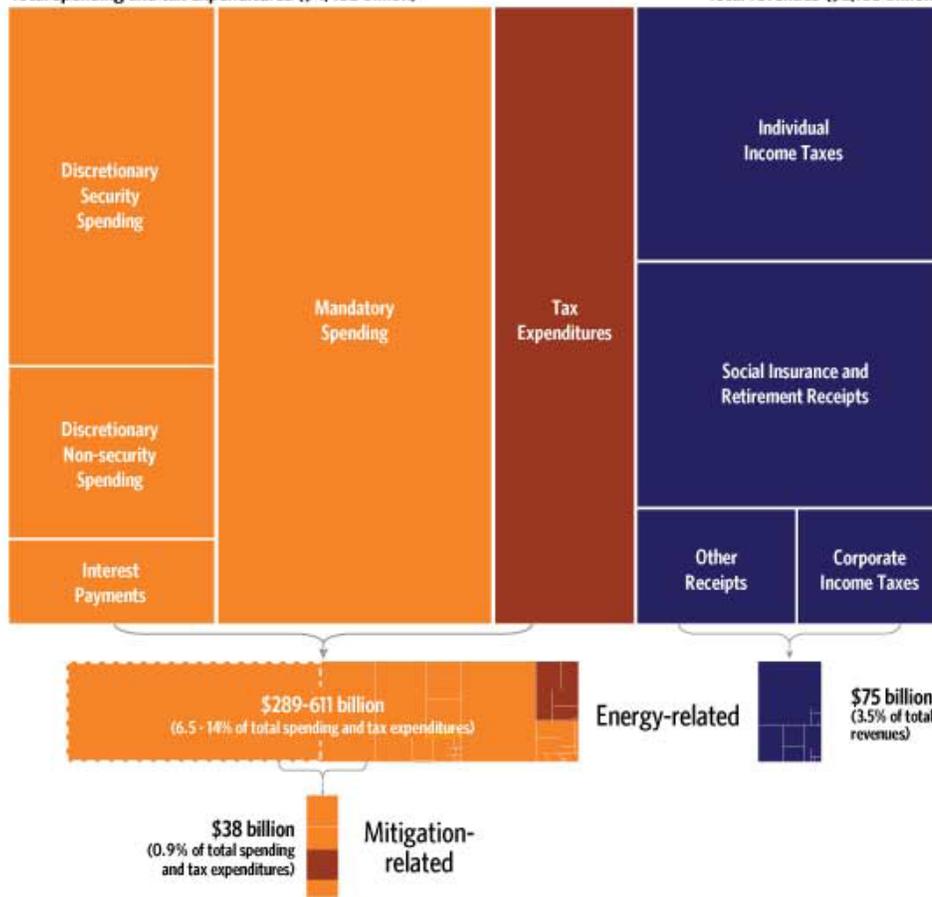
Spatial Analysis (Geographic Information Science/Systems (GIS)) - Spatial analysis or spatial statistics includes any of the formal techniques that study entities using their topological, geometric, or geographic properties. The phrase is even sometimes used to refer to a specific technique in a single area of research - specifically, to describe geo-statistics. Complex issues arise in spatial analysis, many of which form the basis for current research. The most fundamental of these is the problem of defining the spatial location of the entities being studied. For example, a study on human health could describe the spatial position of humans with a point placed where they live, or with a point located where they work, or by using a line to describe their weekly trips; each choice has dramatic effects on the techniques which can be used for the analysis and on the conclusions which can be obtained. Other issues in spatial analysis include the limitations of mathematical knowledge, the assumptions required by existing statistical techniques, and problems in computer based calculations.

Policy Visualization/Animation - The use of animation (and 3D) in data and information visualization is growing in decision support sciences. Students will explore the projects and procedures of the New York Times Graphics Department, Google Public Data, and DataViz Data Animation. Course activities also include the creation of at least one data visualization format (https://github.com/mbostock/d3/wiki/Gallery). Sample public policy visualizations discussed in the course:

THE U.S. FEDERAL BUDGET

Total spending and tax expenditures ($4,432 billion)

Total revenues ($2,163 billion)

Discretionary Security Spending

Mandatory Spending

Tax Expenditures

Individual Income Taxes

Discretionary Non-security Spending

Social Insurance and Retirement Receipts

Interest Payments

Other Receipts

Corporate Income Taxes

$289-611 billion
(6.5 - 14% of total spending and tax expenditures)

Energy-related

$75 billion
(3.5% of total revenues)

$38 billion
(0.9% of total spending and tax expenditures)

Mitigation-related

Winners and Losers: Job Gains and Losses

Track the number of sectors gaining or losing jobs each month. Boxes are shaded based on percentage change from the previous month in each sector's payrolls.

-1%   0%   0.75%

2006   2007   2008   2009   2010   2011   2012   2013   2014

RECESSION

SECTORS RISING >

< SECTORS FALLING

20 —
15 —
10 —
5 —
0 —
-5 —
-10 —
-15 —
-20 —
Unch.
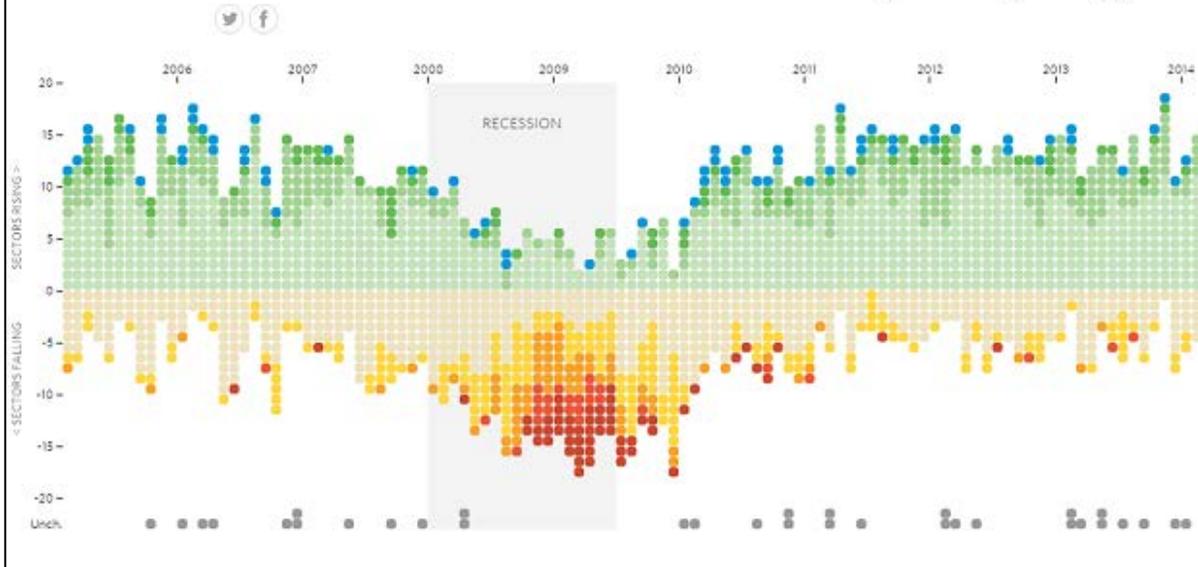
CREATING THE CAPSTONE DOCUMENT AND MODEL

The selection of your capstone project is critical because it will largely determine if you complete the course successfully. By the end of the third week you need to have finalized and refined the focus of your project analysis and purpose. An appropriate project will be:

1. Broad and significant enough to warrant two months of analysis that meets the course requirements
2. Narrow enough that it is feasible to complete in one semester
3. Interesting enough to keep you motivated and engaged for 16 weeks
4. Valuable to the client and contributes to knowledge in the field

The following information about capstone projects is from the University of Omaha's website:

"Some additional considerations to think about include:

- What do you want to accomplish with your project?
- What are your goals?
- Do you want to demonstrate your competence in an area?
- Do you want to strengthen your grasp of a body of knowledge?
- Do you want to contribute to the work of your own organization?
- What is the public purpose of your proposed topic?
- What public goal or value will be served?
- Who might use the results of your work?"

(University of Nebraska Omaha, 2005, www.mpa.unomaha.edu/mpacapstone.php)

In this course, you will work independently to investigate a significant, real world administrative or policy implementation problem. Throughout this process you are to demonstrate:

- A thorough understanding of the topic you select
- Excellent writing skills
- Outstanding research skills
- Critical thinking
- Ethical and leadership perspectives
- Strategic and systems thinking
- Academic integrity
- Application of the concept and theory to an organizational setting
- The ability to synthesize the information and provide valuable management recommendations
- Effective communication

The Preparation

This capstone course is the culminating experience of your MA or MPA program. You will need to select a significant, real world administrative or policy implementation problem that is of interest to you and has human resources, information systems, ethical,

strategic, and financial dimensions. You will research your topic by analyzing reliable, scholarly, and professional work by leaders in the field and interviewing knowledgeable professionals, such as those in the organization you are working with.

In this course, you will have to synthesize and integrate the knowledge you have gained during the MPA program. You will also need to professionally and academically communicate your findings through written and oral presentations.
This course challenges you to complete a professional paper (report) that successfully demonstrates your understanding of current issues, topics, practices, and concepts in public administration. To successfully complete the capstone you will need to:

- Develop a project proposal.
- Complete a literature review relevant to your project by analyzing the professional and academic work on the field.
- Demonstrate critical thinking and logical reasoning abilities.
- Synthesize information to provide valuable insights and new perspectives.
- Effectively communicate your analysis and recommendations.
- Demonstrate the knowledge you have gained from every course you have taken in the MPA program.

You should work closely with your course instructor and teaching assistant who will provide guidance and feedback to you throughout the process.

The Process
You are required to complete the following steps:

1. Read ALL of the readings in the course. If you have any questions, contact your professor immediately.
2. **Select a** significant, real world administrative or policy implementation problem that you want to investigate **and formulate a research question or problem statement that can be addressed in two months.** For example: How can management at the Erie County Head Start program improve parental involvement that positively impacts learning?
   Reflect on previous courses in your MA or MPA program, including courses in your specialization, and/or reading you have completed in the field of public administration. What interested you enough to want to do further research?
   Specialization courses: You should also apply relevant aspects what you learned in your specialization courses in the capstone project. If you have completed a specialization track, you are required to incorporate an aspect of the project that is relevant to your track.
3. **Participate in the class discussions:** Give and receive feedback regarding your topic and those of your classmates. This is a great opportunity for you to receive support from your peers as well as provide support to them. Take advantage of this and other support opportunities built into the course.
4. **Submit a Capstone Project Proposal** to your instructor for approval within the first three weeks of the course. Your proposal is to include a brief discussion of your proposed significant, real world administrative or policy implementation problem with a clear explanation of its focus and should explain how it has human

resources, information systems, ethical, strategic, and financial dimensions. You should clarify the essential purpose of your paper by identifying a relatively specific question that you intend to answer. The proposal is to be one to two pages in length.

5. **Review the rubric for the Capstone Paper.** It can be found in this syllabus.

6. **Complete a Literature Review.**
   A literature review requires you to research and read current academic and professional literature (journal articles, books, websites, etc.) in the field of public administration related to your topic. You may find USC's The Literature Review library guide a helpful resource as you complete your capstone project. As you complete your literature review, keep in mind that you are to be synthesizing information from all of your MA and MPA courses. You should look at your topic through the lenses of each course.

7. **Schedule and complete** interview(s) with relevant professionals in the organization and/or the area you are analyzing.

8. **Communicate** with your instructor and teaching assistant as needed. Write your capstone paper and build a model as though you were submitting it to the management of the organization.
   The body of your paper is to be at least 2/3 of the total length of the pape, not including the model pages and appendices. Approximately one-third of the paper will be dedicated to your introduction and your literature review. The rest of the paper is to be dedicated to your application, recommendations, conclusions, and implementation plan. Your model pages will not count towards or against your total paper page count. Your model should be able to be extracted from your capstone and presented as a standalone product. Your instructor will guide you in the model-building and presenting process.
   Your paper is to demonstrate that you have thoroughly researched your selected significant, real world administrative or policy implementation problem, considered the challenges or support from the perspective of each of your courses (human resources, information technology, finance, etc.), written recommendations that are supported by your research, provided conclusions, and outlined an implementation plan. Your citations and reference list must adhere to APA guidelines.

9. **Review the rubric.** This self-assessment step often prevents students from submitting incomplete work.

10. **Submit your paper to turnitin.com**. Make any revisions necessary.

11. **Submit your paper and model assignment** as indicated in the assignments throughout the course.

12. **Deliver your presentation**

FORMATTING YOUR CAPSTONE PROJECT

Your capstone paper is a formal academic document. There is no need or desire for literary creativity in the formatting of the document. All capstone documents submitted should follow this exact format:

A.   **Title page,** running head, page numbers
B.   **Table of Contents**
C.   **Executive Summary**:This should be a one to two page summary that tells someone who only reads the executive summary the key information in the report.
D.   **Introduction**: Indicate the purpose of the paper and describe the significant, real world administrative problem or policy issues with administrative elements that you investigated. Include your thesis statement or purpose statement. Include an explanation of your proposal and your success in accomplishing it.
If your paper is written in response to a specific issue for a specific organization, the introduction should include background information about the organization. If you used specific key terms, the introduction should include these terms and their meanings.
E.   **Review of the Literature**: Discuss the major scholarly thoughts that surround your chosen topic. Then, present the major scholarly counter-arguments present in the literature.
F.   **Analysis**: This should be the largest portion of your paper. It should present your analysis of data, facts, and evidence you have completed to analyze the administrative or policy implementation problem you presented in the Introduction. The body of the paper should include a discussion of your findings or results and key assumptions and generalizations you are making.
The headings and subheadings for this part of your paper will be unique to your paper. However, keep in mind that your analysis must apply and synthesize concepts and theories from the MA or MPA and elective coursework.
Properly cite information you gain from your research. Keep in mind that your paper is to be written in your own words. Analyze the information you gathered during your research, synthesize it, and write the body of your paper based in your thoughts and ideas.
G.   **Recommendations and Conclusions:** In some ways, this section is the most important part of the paper as you are presenting your conclusions about and suggestions for addressing or remedying the administrative or   policy implementation problem you have analyzed. Key Conclusions sum up the main points of your analysis and recommendations are your suggestions for future action by the organization and or policy. Your recommendations must be justified from a political and ethical perspective.
H.   **Implementation Analysis:** The Implementation Analysis section is to identify key issues and challenges of implementing your recommendations and also important impacts that implementing the recommendations could have on the organization. This is where you demonstrate that you understand the practical, management challenges and implications for an organization that chooses to carry out your recommendations.
This section will also be where you present your system dynamics model and interactive interface ("dashboard").

You will make the case for why your proposal and model are feasible, beneficial, reasonable, and realistic in implementing your recommendations. Be honest about the challenges and impact. Your analysis should addresses budget, human resource, technology considerations, resources needed, and any other notable considerations. If appropriate, provide a general implementation timeline.

I.   **Reference** section: Keep in mind that you are to adhere to APA guidelines.

J.   **Appendix**.

K.   **Rubric** at the end of the paper for the version you submit to the instructor, but this should not to be in your table of contents.

COURSE REQUIREMENTS

1. Class Participation:
Students are expected complete readings and actively participate in class discussions, online tutorials, and group projects.

2. Group Modeling & Simulation Project:
Students will be separated into groups to study and collaborate to create a model and analysis of an assigned public policy issue. Again, thorough preparation is essential and it is expected that each group will use concepts discussed in class to support their model and associated presentation. The group project must cover all five components of the Modeling and Simulation Framework.

3. Capstone Document and Model
Students will be required to complete a capstone paper with relevant models. Students have two options for satisfactory completion of this assignment:

> Option 1: Students may use a pre-existing research paper (provided that the student is the author of said paper), and expand their work to include non-linear modeling and simulation, or,
> Option 2: Students may choose to create a new research paper, which must also include non-linear modeling and simulation.

Those choosing Option 1 are required to turn in a paper and model of 30 to 35 pages, while Option 2 requires a paper and model of 20 to 25 pages. References and Appendices do not count towards page count.

The capstone document and associated model will have two graded components:
1. A Midterm Assessment. The instructor and a John Glenn Faculty member will serve as evaluators for the mid-course progress of the capstone document and model. This formal assessment will serve the same role as a Comprehensive Exam. The Midterm Assessment is worth 30% of the final grade.
2. Final Capstone Document and Model. The final version of the capstone and model is worth 50% of the final grade and is due in Finals Week.

KEY ASSIGNMENT DATES

Due Date	Assignment
Feb. 1	Online Class
Feb. 15	Group Project Due
March 1 & 8	Midterm Assessments of Capstone Draft and Model
March 22	Online Class
April 19	In-Class Capstone Presentations
April 26	Capstone and Model Due

GRADING

The final grade will be determined as follows:

Group Project –	10%
Midterm Assessment - Capstone Draft and Model	30%
Final Capstone Paper and Model -	50%
Capstone Presentation -	10%

<u>Statistical Consulting</u>: Students wishing to have additional help with the statistical analysis for their papers may consult with the Statistical Consulting Service (www.scs.osu.edu/) and enroll in their Stat 5700 course (http://www.scs.osu.edu/stat5760.html).

Capstone papers from previous semesters can be found at https://osu.app.box.com/v/JGCGradCapstones

COURSE READING MATERIAL

The required texts for this course are:
1. *Handbook on decision support systems*, Burstein and Holsapple, Springer, 2008. (http://osu.worldcat.org/title/handbook-on-decision-support-systems/oclc/232302177&referer=brief_results) This text is available as an eBook in The Ohio State University Libraries.
2. Excerpts from *Thinking in Systems: a Primer*, Donella H. Meadows
3. *Visualize this : the FlowingData guide to design, visualization, and statistics*, Nathan Yau. 2011. Wiley. (http://proquest.safaribooksonline.com.proxy.lib.ohio-state.edu/9781118140260?tocview=true) This text is available as an eBook in The Ohio State University Libraries.

All other required readings will be handed out the week prior to the week the readings are required.

Students will be required to purchase a Student Perpetual license of STELLA Architect software (~$150). Students can jointly purchase the software if necessary.

Students will be required to get a free version of the Tableau data visualization software: https://www.tableau.com/academic/students

COURSE POLICIES

The preference is for students to complete written assignments in Microsoft Word and models in STELLA. If you have difficulty with this, you can always deliver your assignment in person, or send via e-mail.

ACADEMIC MISCONDUCT

It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term "academic misconduct" includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct (http://studentaffairs.osu.edu/info_for_students/csc.asp).

DISABILITY SERVICES

The University strives to make all learning experiences as accessible as possible. If you anticipate or experience academic barriers based on your disability (including mental health, chronic or temporary medical conditions), please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. **SLDS contact information:** slds@osu.edu; 614-292-3307; slds.osu.edu; 098 Baker Hall, 113 W. 12th Avenue.

Glenn College Diversity Values Statement

The Glenn College is committed to nurturing a diverse and inclusive environment for our students, faculty, staff, and guests that celebrates the fundamental value and dignity of everyone by recognizing differences and supporting individuality. We are dedicated to creating a safe space and promoting civil discourse that acknowledges and embraces diverse perspectives on issues and challenges that affect our community.

Mental Health Statement

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down,

difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance
or reduce a student's ability to participate in daily activities. The Ohio State University offers services to assist you with addressing these and other concerns you may be experiencing. If you or someone you know is suffering from any of the aforementioned conditions, you can learn more about the broad range of
confidential mental health services available on campus via the **Office of Student Life Counseling and Consultation Services (CCS) by visiting ccs.osu.edu or calling 614-292- 5766. CCS is located on the 4th Floor of the Younkin Success Center and 10th Floor of Lincoln Tower. You can reach an on call counselor when CCS is closed at 614--292--5766 and 24 hour emergency help is also available through the 24/7 National Suicide Prevention Hotline at 1--800--273--TALK or at suicidepreventionlifeline.org. Also, the OSU Student Advocacy Center is a resource to help students navigate OSU and to resolve issues that they encounter at OSU – visit http://advocacy.osu.edu/**

PA7910 Capstone Rubric

	Unacceptable 0-79 pts.	Meets Expectations 80-89 pts.	Exceeds Expectations 90-100 pts.	Score
Title Page, Table of Contents, Executive Summary, Introduction, and Appendices	Paper does not include required Title Page, Table of Contents, and Appendices. The executive summary is poorly written. Statement about the main problem and introduction of the context were not included or incomplete Not clear that the paper is relevant to the student's policy research specialization area or that it is not relevant to the student's specialization area in a meaningful way.	Paper includes required Title Page, Table of Contents, and Appendices. Executive summary captures reasonably well the key points in the report. Description of the problem and the context were included, but it included irrelevant details. Explains why the reader should be interested in the report. Clear that the paper is relevant to the student's policy research specialization area in some meaningful way.	Paper includes required Title Page, Table of Contents, and Appendices. Executive summary concisely captures well the key points in the report. Clearly and concisely describe the purpose, problem, and context of the project. Introduction strongly engages the reader and compels the reader to want to read the report. Clear that the paper is highly relevant to the student's policy research specialization area in a very meaningful way.	
Review of Literature	Few references are made to the project topic. Selected literature is of little significance to the project topic and the relevant field. Few changes made in response to feedback or changes do not appropriately address feedback.	Sufficient relevant literature has been studied, and its relevance is made clear. The significance of the project topic and the relevant field is evident. Many changes made in response to feedback and changes appropriately address feedback.	The literature lays the groundwork for the direction of the project and is highly relevant and masterfully incorporated. Sources are cited when specific statements are made. Significance to the project topic and to the relevant field is unquestionable. All relevant changes made in response to feedback and changes effectively address feedback.	

	Unacceptable 0-79 pts.	Meets Expectations 80-89 pts.	Exceeds Expectations 90-100 pts.	Score
Analysis	The analysis was not included or was minimal. Course concepts were not referenced or not accurately applied. Model not well defined. Not presented in a reader-friendly manner.	Analysis, assessment, and content knowledge were evident and adequately developed. Model logical and well-defined. Adequate investigation of the real world problem was demonstrated. The analysis presented in a reader-friendly manner, using visuals.	Analysis demonstrated a depth of insight and knowledge, was well developed and emerged logically from information presented. The analysis demonstrates a comprehensive investigation of the real world problems. Model is logical, well-defined and would be a a realistic simulation tool for decisionmakers. The analysis presented in a very reader-friendly manner, making highly effective use of visuals.	
Recommendations and Conclusions	Recommendations and conclusions were minimally supported. Few key arguments have been made.	Recommendations and conclusions were fairly logical and reasonably supported. Most key arguments have been made.	Recommendations and conclusions were strongly supported; The key arguments have been made, and no major points have been left out. Additional research was incorporated to provide credibility, support, and detail.	
Implementation Analysis	Key issues, challenges, and impacts of implementing the recommendations were incomplete and unrealistic.	Key issues, challenges, and impacts of implementing the recommendations were included and complete, but it does not describe a practical example.	Key issues and challenges of implementing the recommendations were made. The important impacts that implementing the recommendations could have on the organization are also covered. State why the implementation is feasible, beneficial, reasonable, and realistic to implement your recommendations	

	Unacceptable 0-39 pts.	Meets Expectations 40-44 pts.	Exceeds Expectations 45-50 pts.	Score
APA, Turnitin.com, and Revisions	No attempt was made to follow APA guidelines. Document not submitted to turnitin.com OR necessary revisions not made. Few changes made in response to feedback or changes do not appropriately address feedback.	Citations included but the application of APA guidelines was incomplete. The document was submitted to turnitin.com. Most necessary revisions were made. Many changes made in response to feedback and changes appropriately address feedback.	Demonstrated an excellent knowledge and application of APA guidelines. The document was submitted to turnitin.com, AND all necessary revisions were made. All relevant changes made in response to feedback and changes effectively address feedback.	
Reader-Friendly Formatting, Structure, and Use of Visuals	Overall document is not reader-friendly (e.g., did not include headings, subheadings, etc.). It is not well formatted or structured and does not make use of visuals.	Overall document is reader-friendly (e.g., included headings, subheadings, and other formatting techniques). It is well formatted and structured and makes use of reader-friendly visuals.	Overall document is very reader-friendly (e.g., included headings, subheadings, and other formatting techniques that enabled easy understanding of technical information). It is very well formatted and structured and makes use of strongly reader-friendly visuals.	
Course Participation	Missed one or more class sessions. Had many late submissions.	Participated in all class sessions. Most submissions are made timely.	Actively participated in all class sessions. Timely submitted all project required work products.	
Total (out of 650 points):				

COURSE OUTLINE

Jan. 11:   **Course Overview and Introduction**
                   Reading(s):
                   1. Alexis Tsoukias et al, Policy analytics: an agenda for research and practice, in EURO Journal on Decision Processes, Springer, 2013.

Jan. 18:   **Big Data, Policy Analytics, and Decision Support Systems**
                   Reading(s):
                   1. Alex Bennet and David Bennet, The Decision-Making Process in a Complex Situation in Handbook on decision support systems, Burstein and Holsapple, Springer, 2008.
                   1. Roger Alan Pick, Benefits of Decision Support Systems in in Handbook on decision support systems, Burstein and Holsapple, Springer, 2008.

Jan. 25:   **Three Modeling and Simulation Paradigms**
                   Reading(s):
                   1. AnyLogic website: http://www.anylogic.com/
                   2. ESRI website: http://www.esri.com/
                   3. System Dynamics Society website: https://www.systemdynamics.org/for-academia

Feb. 1:   **Iterative Storytelling in Public Policy (ONLINE)**
                   Reading(s):
                   1. Rudy Hightower II, Iterative Storytelling in Public Policy: Systems Thinking Approach in *Simulation for Policy Inquiry*, 2012, pp 203-223, 2012, Springer.

Feb. 8:   **Policy Analytics, Modeling, and Simulation (PAMS) Workshop I**

Feb. 15:   **Policy Analytics, Modeling, and Simulation (PAMS) Workshop II;**
                   Deconstructing Policy Stories and Building Mental Models
                   Reading(s):
                   1. Jay W. Forrester The Beginning of System Dynamics // *The Mckinsey Quarterly 1995 Number 4*
                   2. *What are Mental Models?,* Jeremy Merritt.
                   3. Donella Meadows, System Dynamics Meets the Press, an excerpt from The Global Citizen

Feb. 22:   **Midterm Assessments; One-on-One Model-building Training**

March 1:   **Midterm Assessments; One-on-One Model-building Training**

Group Modeling Project Due

March 8:   **System Dynamics Fundamentals and Archetypes**
Reading(s):
1. What is System Dynamics?, systemdynamics.org
2. The potential of system Dynamics: A new era of strategic planning?
3. The First Step (Leslie Martin)

Written Capstone Paper Draft and Model Draft(s) due

March 15:   **Spring Break (NO CLASS)**

March 22:   **Intro to Time Paths, Time Delays, and Feedback (ONLINE)**
Reading(s):
1. Roberts, et al. Introduction to Delays, Chapter 17
2. Kamil Msefer, Mark Choudhari Answers to Exercises for Chapter 17: Introduction To Delays from Introduction to Computer Simulation
3. Leslie Martin, An Introduction to Feedback
4. Michael J. Radzicki, Robert A. Taylor. 1997. *Introduction to System Dynamics:* A Systems Approach to Understanding Complex Policy Issues

March 29:   **Running Model Simulations and "What-if" Scenario Planning; Equilibrium/ Reference Pattern Behavior Graphs**
Reading(s):
1. Chris Soderquist and Susan Overakker*, Education for Sustainable Development: A Systems Thinking Approach*
2. A. Oh - Graphical Integration Exercises Part 1: Exogenous Rates
3. Kevin Agatstein, Lucia Breierova Graphical Integration Exercises Part 2: Ramp Functions
4. Diana Scearce, Katherine Fulton, What-if? The Art of Scenario Thinking for Non-Profits

April 5:   **Creating Presentation Graphics, Interfaces, and Dashboards; GIS, Policy Visualizations and Animations**
Reading(s):
1. Michael J. Radzicki, Robert A. Taylor. 1997. *Introduction to System Dynamics:* A Systems Approach to Understanding Complex Policy Issues

April 12:   **Final Capstone and Model Presentations**

April 19:   **Presentations; Course Wrap-up**

April 26:   **Written Final Capstone and Model Due**