

IDS 2935: Impact of Materials on Society

Quest 2

I. General Information

Class Meetings

- Fall 2024
- MWF 3rd period (9:35-10:25AM)
- Pugh 170

Instructor

- Kevin S. Jones
- 160 Rhines Hall
- MWF 4th period
- kjones@eng.ufl.edu
- 352 846-3301
- 352 219-6641 (cell)

Teaching Assistant

Caitlin Field (caitlin.field@ufl.edu)

Aldo Watanave (aldowatanavesina@ufl.edu)

- The TAs are critical for the class. They are also responsible for working with the break out groups to facilitate the exercise the students are working on collaboratively (in the 5 groups of 7 that comprise each break out group). The TA's work with each group by circulating around, answering questions and discussing their ideas with them. The TA's are responsible for grading and recording the student scores on the homeworks and class assignments done in the breakout groups. The TA's are also responsible for helping with the multiple experiential learning experiences. They help assemble the materials and help instruct the student on the making of concrete bars. The TA's also help with the class experience of testing the strength of their concrete bars by working with the students as they perform the impact test. We

also have two exams the TA's help proctor and grade with the instructor. Finally, there are two large poster sessions at the end of the semester and the TA's help with judging the posters as well recording the scores.

Course Description

We are facing many significant societal challenges including sustainable energy, clean water, pandemics etc. Materials have been critical to the advancement of society. How will materials help us solve critical issues of today? In this class we discuss how materials were discovered, synthesized, refined and utilized from a scientific, historical, technological, economic and political perspective and the impact their development has had on society. We also discuss how society impacts the utilization, acceptance, sustainability and perception of materials. The students are also introduced to materials of the future including nanomaterials, superalloys, biomaterials, etc. and challenged to explore how these new materials and the social lessons of the past can help them design and implement new methods to address some of these critical global issues.

Modality

This is a 3 credit course. The class is in person.

Quest and General Education Credit

- Quest 2
- Physical Sciences

This course accomplishes the [Quest](#) and [General Education](#) objectives of the subject areas listed above. A minimum grade of C is required for Quest and General Education credit. Courses intended to satisfy Quest and General Education requirements cannot be taken S-U.

Required Readings and Works

*All of the reading assignments are listed in the weekly schedule posted in Canvas on a very extensive and comprehensive website
We have written an open source textbook entitled the Impact of Materials on Society. This book is required reading and is free to all students.*

<https://ufl.pb.unizin.org/imos/>.

In addition, there are segments of the paperback book the Substance of Civilization by Stephen Sass

The Substance of Civilization by Stephen L. Sass, ISBN-13: 9781559704731

For additional fun reading you may want to get a paperback copy of The Alchemy of Us by Anissa Ramirez

Materials and Supplies Fees: n/a

II. Graded Work

Description of Graded Work

All students are expected to attend and participate in class. The class is taught in an interactive lecture format, and includes discussion and practice activities. Cell phones should be turned off in class. Reading of newspapers, work on assignments for this or other classes, or other activities that are not part of the class are not allowed during class time. There are a set of requirements for each module. This includes the following:

- Before the module begins it is recommended you read the material in the Sass book. It's only a few pages and helps get you ready for the lecture.
- Before the Social Science lecture you should read the chapter from the open source textbook IMOS. This link to this in the digital version of the syllabus. The chapters are also posted in each module on the canvas website.
- On the next day (after the social science lecture and before the third class for the module) you should watch the IMOS video on future materials. The videos are between 12-18 minutes long and after watching them you do a short homework assignment that is posted in canvas about the video. The homework asks questions about the video and also sets up the background for the breakout sessions the next day. For example, in the steel module, in the homework you would be asked questions like give 3 examples where Mg alloys are replacing high carbon steel. Or in the semiconductor module you are asked to interview a relative about what they are delegating to their electronic devices.
- On the third class day for each module you will be required to
 1. Turn in the Homework
 2. There will be a short lecture and then you will join your groups in breakout rooms to work in teams on an in class assignment. These assignments have been carefully developed to help you apply the social principle of the week with a new material you have just learned about. Often this may involve starting a new company and exploring the social challenges with your team.
 3. Turn in one group in class assignment per group
 4. The group assignment will require you as a group of 4-5 to fill out a worksheet. You are allowed to use the internet and any other resources and a single grade will be given for each group. If you are not present you will receive a 0.
- During the semester there will also be two exams. They will happen during the class period as scheduled below. They will be a combination of multiple choice and short answer questions. The second exam will not be comprehensive.
- At the end of the semester there will be 2 final poster sessions. You will be required to create an poster complete with an introduction, materials description, discussion of the impact paradigm questions, conclusions and references. In one poster

session you will present your poster 5 times to 5 others in the class. In the next poster session you will evaluate 5 others posters. You will be graded both on your evaluation scores and how well you evaluated others. You will also turn in your poster for grading. This comprises your final project grade as well as your writing assignment.

- You will be asked at the end of the semester to evaluate the others in your group. This will be used for your class participation grade.
- There is no final exam.
- If you have any questions feel free to email me at kjones@eng.ufl.edu and I will usually respond immediately or within 24 hours.

<i>Assignment</i>	<i>Due Date</i>	<i>Credit</i>
Weekly Homework	See Due Dates Below	30%
Exam 1	Wednesday Oct. 9 in class	20%
Exam 2	Monday Dec. 2 in class	20%
Final Project	Tuesday, Wednesday Dec. 3,4	20%
Class Participation	Weekly group exercise	10%

*Extra-credit opportunities may be announced throughout the semester.

Grading Scale

For information on how UF assigns grade points, visit: <https://catalog.ufl.edu/UGRD/academic-regulations/grades-grading-policies/>

A	94 – 100%		C	74 – 76%
A-	90 – 93%		C-	70 – 73%

B+	87 – 89%		D+	67 – 69%
B	84 – 86%		D	64 – 66%
B-	80 – 83%		D-	60 – 63%
C+	77 – 79%		E	<60

Grading Rubric(s)

Homeworks

Rubric

Homeworks

Homeworks				
Criteria	Ratings			Pts
This criterion is linked to a Learning Outcome Answers thoughtful answers to questions	2 pts Full Credit Answered all the questions thoughtfully	1.2 pts Partial Credit Answer some of the questions but not well thought out response	0 pts Missing No Work turned in	2 pts
	Total Points: 2			

In Class Assignments

Rubric

In Class Assignments

In Class Assignments				
Criteria	Ratings			Pts
This criterion is linked to a Learning Outcome Description of criterion	10 pts Full Credit All of the answers were addressed thoughtfully	6 pts Partial Work Only some of the answers were completed or answers were lacking in thought	0 pts missing No work was turned in or your name was not on the group assignment	10 pts
Total Points: 10				

Poster Evaluations

Rubric

Poster Evaluations

The poster grading rubrics include Name and Title, Introduction, answering at least three different impact paradigm questions they have discussed during the class, the ratio of graphics to images, was the presentation engaging, are the conclusions supported by the poster and are their references.

Poster Evaluations						
Criteria	Ratings					Pts
This criterion is linked to a Learning Outcome Poster Assessment	10 pts 100% If the poster was outstanding and clear	9 pts Excellent If the poster was excellent but perhaps had a 1-2 things they could do better	8 pts Very Good If the poster was very good but had one or two major weaknesses	7 pts Good The poster was good but had major flaws and needs some work	0 pts Poster was not presented Nothing was presented	10 pts
	Total Points: 10					

Participation Rubric Peer Assessment

Instructions

This quiz is your opportunity to grade your in-class activity group members based on their participation this semester. You will need to input your group number and each group member's first and last name.

The grading scale is from 1-5 with; 1-Did not contribute to any group assignments, 2-Rarely contributed to group assignments, 3-Sometimes contributed to group assignments, 4- Often contributed to group assignments, 5- Contributed in almost every group assignment.

Your participation grade for this class will be an average of your group member's responses to this quiz.

Question 1.

Group Number:

Question 2.

Please enter the name of the Group Member and the grade in the box below: (one grade for each member of you group not including yourself)

(1-Did not contribute to any group assignments, 2-Rarely contributed to group assignments, 3- Sometimes contributed to group assignments, 4- Often contributed to group assignments, 5- Contributed in almost every group assignment)

III. Annotated Weekly Schedule

Fall 2023 –Course Outline. A more extensive course outline can be found on the Canvas Pages. There the exact day by day expectations, reading assignments, homework assignments, slides for the lectures, videos of the demonstrations as well as additional reading and video materials can be found. Below is just an overview of the activities each day of the semester.

Date	Topic (Question/Subject)	Physical Sciences + Q2 Method/Concept/Practice at Work	Reading & Activities for Before Class	Assigned Work Due
	Science and Sociology			
Fri. Aug. 23	Course Introduction,	An initial survey on the knowledge of materials is given We will discuss the impact paradigm and how we will edit this list Define the various properties of materials		
Mon Aug. 26	Introduction Continued	Introduces the structure of the course, the basic properties of materials, and the dynamic relationship between materials and society (materials shape society, but society shapes how we perceive and use materials).		Turn in Intro homework
	Science Clay			
Wed. Aug. 28	Science of Clay	Prof. Jones. Overview of clay: The structure of the material, history, early uses and applications of clay, physical-chemical properties of clay, and an introduction to rare earths and their properties	Read Excerpt (pp. 13-37) from Sass, Stephen L. (1998/2011) <i>The Substance of Civilization</i> . New York: Arcade Publishing.	
	Sociology Entanglement			
Fri. Aug. 30	Entanglement in of Clay in Catal Huyuk	Prof. Susan Gillespie (Anthropology) presents The Entanglement of Earth in the Age of Clay. Introduces the concepts of entanglement and a tanglegram	Read: The Entanglement of Earth in the Age of Clay by Susan Gillespie	
	Self Reflection Entanglement with Rare Earths			

Wed Sept. 4	Small Group exercise: Students explore their entanglement with rare earth elements	Humans and things develop interdependencies (entanglements) that trap them and constrain or limit their actions. The entanglement model developed by Ian Hodder is a method for analysis: humans depend on things, things depend on other things, things depend on humans; thus, humans depend on things that depend on other things and on humans. To prepare for Day 3, we will think about our unique entanglements with Rare Earths.	Watch this video Rare Earths	Complete Clay Homework and turn in This is to prepare you for the group activity.
	Sociology Operational Chain			
Fri Sept. 6	Obsidian and flint knapping and the operational chain	Prof. Ken Sassaman (Anthropology) presents a lecture on Obsidian to Porcelain and the concept of an operational chain	Read Firing Clay, Breaking Glass, and the Past Futures of Ceramics by Kenneth Sassaman	
	Science Ceramics			
Mon Sept. 9	Science of Ceramics and Glass	Prof. Jones (MSE) An overview of ceramics and glass: Properties, abundance, and structure of ceramics and glass; history of the use of ceramics and glass and how these materials have evolved.	Read Excerpt (pp. 98-123) from Sass, Stephen L. (1998/2011) <i>The Substance of Civilization</i> . New York: Arcade Publishing	
	Self Reflection Technical Ceramic Supply Chain			
Wed Sept. 11	Small group exercise: Students develop an operational chain for a complex ceramic they own	In this exercise we explore the concept of an operational chain as it applies to the fabrication of a technical ceramic	Watch: Ceramics (9:44) (Links to an external site.)	Complete Ceramics Homework and turn in and turn it in in class.
	Copper and Bronze			

Fri. Sept. 13		Prof. Jones will give a general introduction to Copper and Bronze: Properties of copper and bronze, natural abundance structure and location, history, native vs smelted, arsenic as an impurity, and their medical implications	Read Excerpt (pp. 59-67) from Sass, Stephen L. (1998/2011) <i>The Substance of Civilization</i>	
	Sociology Bronze Age and Trade			
Mon Sept. 16		Prof. Florin Curta (History) presents a lecture on the history of trade of copper in bronze: trade in both the materials themselves, as well as the expertise to manipulate them.	Read: Copper and Bronze: The Far-Reaching Consequences of Metallurgy by Florin Curta	
	Self Reflection Trade issues in Photovoltaics			
Wed Sept. 18	Small group exercise: Students explore creating more sustainable trade for solar cells	The availability of materials impacts their use. Thus, social constructs like trade and conflict can influence the use and acceptance of certain materials. To prepare for Day 3, we will make ourselves aware of the global trade issues involved in sourcing component materials of new photovoltaics	Watch: photovoltaics video	Complete Copper Homework and turn in
	Science Concrete			

Fri Sept. 20	Science of Concrete and building materials	Prof. Ryding presents background on building materials and concrete: the formation of the ingredients that are used in concrete specifically the formation of cement, composite types and the environmental impact of concrete.	Read Excerpt (pp. 124-133) from Sass, Stephen L. (1998/2011) <i>The Substance of Civilization</i> .	
	Sociology Symbolism			
Mon Sept 23	History of Building materials	Prof. Andy Nichols presents a lecture on the history of building materials and their influence on modern structures	Read " Engineering Society through Social Spaces " by Mary Ann Eaverly	
	Self Reflection Functional materials and Concrete			
Wed. Sept. 25	Small group exercise: Students contemplate improvements to concrete structures they deem important to them	Concrete is a versatile material made even more useful by Smartcrete technology. Yet society's use of materials is based on their ideals. How do the types of buildings made from concrete reflect our society's ideals? The Smartcrete exercise builds on this to ask if new materials can operate in new ways within or outside of societal limitations.	Watch: Video on Concrete	Complete Concrete Homework and turn in and submit it in class.
	Experiential Learning			
Fri Sept. 27	Making Concrete Bars	The goal is to put to work some of the concepts we've been studying to build and break concrete blocks, and develop some generalized IMOS principles to add to our customized Impact Paradigm.	Wear clothes that can get dirty and we will meet outside at the designated location. Bring any material you want to explore using as a reinforcement	
	Science Gold and Silver			

Mon Sept. 30		Prof. Jones gives an overview of gold and silver: properties, abundance, structure and location; manipulation, malleability, and the history of gold and silver; native vs. smelted, impurities, Roman amalgamation, liquation; Irish gold and the Gold Rush of 1848.	Read Excerpt (pp. 68-81) from Sass, Stephen L. (1998/2011) <i>The Substance of Civilization</i>	
	Sociology Intrinsic vs Extrinsic Value			
Wed Oct. 2		Prof. Florin Curta (History) presents a lecture on Gold, Silver and the Creation of Value. He will discuss: coinage and trade, intrinsic vs. perceived value of materials, physical properties and theory of exchange.	Read Gold and Silver by Florin Curta	
Fri. Oct. 4	Review for Exam 1	A review of the material to be covered on exam 1 will be presented. The exam will be short answer		
	Self Reflection Value and Nanomedicine			
Mon. Oct. 7	Small group exercise: Students explore how the perceived value of gold may affect its intrinsic value and applications in the future.	Value is a social concept that is assigned to a material based on many factors. Materials have intrinsic physical properties, only some of which are selected as more relevant by a society in meeting social needs based on cultural perspectives. But, a material's use can change and this can affect its financial value.		Complete Gold Homework and turn in

Wed. Oct. 9	Exam 1	In class, short answer exam 1		
	Sociology Carnegie and Creative Destruction			
Fri. Oct 11		Prof. Sean Adams (History) presents Carnegie, Creative Destruction and American Steel, a lecture that outlines the historical context of the rise of American steel, with a focus on the business career of Andrew Carnegie.	Read " Carnegie, Creative Destruction, and American Steel " by Sean Adams	
	Science iron and Steel			
Mon. Oct. 14		Prof. Jones gives an overview of iron & steel: review the properties of iron and steel, the history of iron making from early furnace designs to modern steel making, the concept of the iron carbon phase diagram and the different forms of alloys (wrought iron, steel, cast iron) that exist and why. The role carbon plays on the properties of these various alloys is discussed.	Read Excerpt (pp. 83-97, 203-214) from Sass, Stephen L. (1998/2011) <i>The Substance of Civilization</i> .	
	Reflection Creative destruction			
Wed. Oct.16	Small group exercise: Students the application of creative destruction to a product based on Mg alloy	The concept of creative destruction not only helps us to understand some of the social impacts of past materials, but it can also help us discover how to facilitate successful business practices using modern materials	Watch Mg alloys video	Complete Iron Homework and turn in

		innovations. In this exercise, we will consider the potential markets for magnesium alloys, imagine what sectors of the economy could be creatively destroyed by them, and brainstorm ways to put these sectors back to work: creative creation, not creative destruction!		
	Experiential Learning			
Mon Oct. 21	Breaking Concrete Bars	In this class you will be asked along with you other members of you small group to use an impact test to measure the fracture toughness of your two concrete bars. We will compare the results and discuss the reasons for your observations.		
	Science Aluminum			
Wed. Oct. 23		Prof. Jones gives an overview of aluminum: explore the origin of early chemistry and how new elements were discovered including aluminum. The properties of aluminum are discussed as well as the history of aluminum production and the birth of ALCOA.	Read Excerpt (pp. 186-197) from Sass, Stephen L. (1998/2011) <i>The Substance of Civilization</i> .	
	Sociology Monopolies			
Fri. Oct. 25		Prof. Sean Adams (History) presents "Aluminum Alcoa and Anti-trust," a lecture about the rise of Alcoa from a small business to the largest aluminum company in the world and its subsequent corporate evolution by anti-trust legislation.	Read: Aluminum, Alcoa, and Anti-Trust by Sean Adams	
	Self Reflection			

	Patents and Amorphous metals			
Mon. Oct. 28	Small group exercise: Students explore creating a new product using amorphous metals and the different approaches to protecting that invention	Just as aluminum was a material in search of an application, opportunities abound for how we might use bulk metallic glass. But, creating new knowledge about how to use metallic glass presents opportunities in the handling of intellectual property. Bearing in mind the lessons of Alcoa, how should we handle research and development versus product marketing in the metallic glass industry?	Watch video on amorphous metals	Complete Aluminum Homework and turn in during class
	Science Polymers and Plastics			
Wed Oct. 30		Prof. Jones presents background on plastics. This lecture will discuss the class of materials we call polymers, including a review of their properties, how they were discovered and some of their history.	Read Excerpt (pp. 215-237) from Sass, Stephen L. (1998/2011) <i>The Substance of Civilization</i> .	
	Sociology Urban Metabolism			
Fri. Nov. 1		Prof. Brenda Chalfin Plastics and Urban Metabolism Africa	Read S.Knight, 2023. "Designing the Apocalypse," <i>The New Yorker</i> . September 25. V.Broto et al. 2012 "Interdisciplinary Perspectives on	

			Urban Metabolism," <i>Journal of Industrial Ecology</i> . 16 (6): 851-861.	
	Self Reflection			
	Plastics Speculative Design			
Mon Nov. 4	Small group exercise: Students create speculative design prototypes for plastics connecting humans and non-human environment.	Informed by the concept of 'urban metabolism' in this assignment you will use methods of 'speculative design' to imagine a possible future for plastics that connects humans and the non-human environment, animate or inanimate by means of an imagined apparatus or 'prototype'. Enabled by your imagined prototype, the goal is to formulate a system that metabolically links plastics, humans and non-humans in some fantastic/fantasy/fictitious way that has a degree of plausibility.	A. Dunne & F. Raby. 2013. <i>Speculative Everything: Design, Fiction and Social Dreaming</i> . MIT Press. Exerpts. .	Complete Plastics Homework and turn in during class
	Science Paper			
Wed Nov. 6		Prof. Jones gives an overview of writing materials from clay through paper. This includes the processing that was required to convert the media from raw material to a final useful product. The chemistry of processing of paper including the chemistry and separation of cellulose from lignin is discussed. Finally the	Read Excerpt (pp. 134-146) from Sass, Stephen L. (1998/2011) <i>The Substance of Civilization</i> .	

		concept of magnetic storage is presented.		
	Sociology Information Storage			
Fri Nov. 8		Prof. Trysh Travis presents a lecture on how data storage and sharing are social practices that shape what we understand data to mean.	Read: Politics of Knowledge by Bonnie Effros	
	Self Reflection Digital storage and the right to be forgotten			
Wed Nov. 13	Small group exercise: Students act as members of editorial board to explore the right to be forgotten	We learn from the history of writing materials that innovations in materials often change the lives of communities in anticipated and unanticipated fashions. Who has access to writing materials, and how long the information recorded in writing materials lasts, can have profound impacts upon social equality. Here we examine new innovations in magnetic storage, enabling us to record far more than ever before. What information will we use this material to store, who will have access to this information, and how will information storage on a massive scale affect our communities and political regimes?	Watch Information Storage Video	Complete Paper Homework and turn in during class
	Science			

	Semiconductors and Silicon			
Fri Nov. 15		Prof. Jones presents background on silicon. Semiconductors possess unique electrical properties that can be manipulated in order to drive the digital revolution. This lecture covers the basics of semiconductor physics including why silicon has a bandgap and what it means in terms of electrical conduction. The goal is to give the student an appreciation for why semiconductors are such a powerful driver in today's society.	Read Excerpt (pp. 265-276) from Sass, Stephen L. (1998/2011) <i>The Substance of Civilization</i>	
	Sociology Delegation and the Web			
Mon Nov. 18		Dr. Sophia Acord (Sociology) presents "Semiconductors and Cyborgs: Human-Materials Relationships in the Digital Age". This lecture begins with an overview of the history of industrial revolutions and information revolutions, observing that the so-called "Silicon Age" is unique in that silicon ushered in both an industrial and an information revolution. As we rely upon digital devices to do more and more for us in our daily lives (we delegate tasks to them), we find ourselves developing quite curious relationships with these devices, as well as with each other.	Read excerpt from Sherry Turkle (2011) <i>Alone Together: Why We Expect More from Technology and Less from Each Other.</i>	
	Self Reflection			

	Personal Delegation			
Wed Nov. 20		As we know very well from personal experience, semiconductor-based technologies affect how we interact with each other on a daily basis. We argued that this is because we “delegate” human actions to semiconductors. If semiconductors are going to affect our lives on such a personal basis, we should be intentional in how we design and use them. For Day 3, we will conduct and mine personal interviews for information on what people would like to be able to do with 2D materials, and brainstorm ways to let our human needs drive our design of future materials innovations rather than the other way around	Watch: 2-D Materials (13:49)	Complete Semicon ductor Homework and turn in during class
	Exam Review			
Fri Nov. 22	Review for Exam 2	Exam 2 is not comprehensive and will cover all of the material presented since Exam 1.		
	Exam 2			

Mon Dec 2		In class short answer Exam 2		
	Posters Self Reflection			
Tuesday Dec. 3	Poster session 1 5-7PM Pugh 170	This project is an opportunity for you to reflect upon your own personal learning about the ways that you see the humanities, social sciences, and engineering to connect. Throughout the course, we have been exploring the major social impacts of different materials, which have fundamentally shaped human societies and cultures. We've also been discussing the ways in which the social and cultural context of engineering has shaped how we perceive and engineer materials. We have been bringing these lessons together by adding questions to the Impact Paradigm after each module and applying lessons from the past to navigate the future. You should be able to process this learning by integrating the perspectives on materials that we get from different disciplines in a study of one particular material.	Please follow these instructions for your poster Materials Poster Instructions Everyone with a Last name between A-J will present tonight Everyone with a last name K-Z will evaluate posters tonight	
Wed Dec. 4	Poster session 2 5-7PM Pugh 170			

IV. Student Learning Outcomes (SLOs)

At the end of this course, students will be expected to have achieved the [Quest](#) and [General Education](#) learning outcomes as follows:

	Physical Sciences SLOs → Students will be able to...	Quest 2 SLOs → Students will be able to...	This Course's SLOs → Students will be able to...	Assessment Student competencies will be assessed through...
Content	Identify, describe, and explain the basic concepts, theories and terminology of natural science and the scientific method; the major scientific discoveries and the impacts on society and the environment; and the relevant processes that govern biological and physical systems.	Identify, describe, and explain the cross-disciplinary dimensions of a pressing societal issue or challenge as represented by the social sciences and/or biophysical sciences incorporated into the course.	Identify, describe, and explain the reactions and processes needed to synthesize new materials, recognize the fundamental properties of materials, learn how these properties can be manipulated and recognize the fundamental structure-property-processing relationships that exist.	Homework problems, exams, break out section exercises, and poster evaluations
Content			Identify, describe, and explain how environmental concerns, economics, personal choices, national and international policies and politics affects and determines materials usage.	Homework questions on the readings, exam questions, in-class work, and the final poster project.

	Physical Sciences SLOs → Students will be able to...	Quest 2 SLOs → Students will be able to...	This Course's SLOs → Students will be able to...	Assessment Student competencies will be assessed through...
Critical Thinking	Formulate empirically-testable hypotheses derived from the study of physical processes or living things; apply logical reasoning skills effectively through scientific criticism and argument; and apply techniques of discovery and critical thinking effectively to solve scientific problems and to evaluate outcomes.	Critically analyze quantitative or qualitative data appropriate for informing an approach, policy, or praxis that addresses some dimension of an important societal issue or challenge.	Critically analyze and evaluate quantitative data to draw conclusions and test hypotheses.	Homework and break out classroom exercises
Critical Thinking			Evaluate material needs and sources so as to critically assess the supply chain and how its impacted by social pressures.	Homework problems and flipped classroom exercises.
Communication	Communicate scientific knowledge, thoughts, and reasoning clearly and effectively.	Develop and present, in terms accessible to an educated public, clear and effective responses to proposed approaches, policies, or practices that address important societal issues or challenges.	Develop and present in writing quantitative and qualitative arguments showing clearly assumptions, logical reasoning, and conclusions.	Homework problems and final poster assignment

	Physical Sciences SLOs → Students will be able to...	Quest 2 SLOs → Students will be able to...	This Course's SLOs → Students will be able to...	Assessment Student competencies will be assessed through...
Communication			Develop and present in writing and orally a particular materials challenge, address three critical impact paradigm questions and draw a conclusion	Final Poster project.
Connection	N/A	Connect course content with critical reflection on their intellectual, personal, and professional development at UF and beyond.	Develop new entrepreneurial ideas for companies based on new materials and social lessons they have learned	Flipped classroom exercises and final poster project
			Learn to apply the social toolbox they have developed through the semester to future challenges after UF	Flipped Classroom exercises

V. Quest Learning Experiences

V. Quest Learning Experiences

1. Details of Experiential Learning Component:

A significant experiential activity occurs halfway through the semester where they are given all the ingredients to make concrete. In addition, they are asked to find, bring or use other materials that can serve as reinforcement for the concrete. For an entire period they are asked to create an unreinforced and reinforced bar 2 x 2 x 8 inches in size (molds provided) that they think will have the greatest impact strength. After curing for a week we spend a class period in which they break the bars using an impact tester and their iPhone

to video tape the breaking and determine the energy absorbed by the bar. These values are posted live on the screen and find out which designs worked best and discuss why.

2. Details of Self-Reflection Component

Examples of self-reflection often occur during the flipped classroom experience at the end of each module. During this class the students break out into groups of 5. They are given a specific task to work on. For example, for the clay module they are asked to find a product important to them that contains a rare earth element and identify this element. They are then asked to draw a tanglegram describing their entanglement with this element. This includes the source of the element, the local challenges faced by the people who mine the element, including the impact this mining has on their environment, education, the political challenges with it extraction, the sustainability of the extraction process, other issues such as the codependence of the extraction process on other elements being mined and why they are being mined. These tanglegrams offer the students to reflect and prioritize the challenges they feel are most important to sourcing this material. It also gives the student the chance to understand the impact their purchases have on the world. In the next week the students are exposed to the concept of an operational chain. In the flipped classroom they are asked to describe a ceramic part in a product they own and then describe the operational chain they believe was associated with that part. They are asked to develop an alternative operational chain that increases the sustainability of the product. In the concrete module they are asked to find a concrete structure on campus that is important to their lives. They are then challenged with improving their interaction with that product through the use of smart materials like piezoelectrics and thermoelectrics.

In the paper module (which alternates with the membrane module) they are asked to determine under which conditions people have the right to be forgotten. With the growth of an on-line presence many people are now questioning how long there should be a record of their actions available (they may do something they regret as a student), ie how long should this information be available for a future employers to find in a search. The students are presented with a number of cases and asked to act as part of a newspaper editorial board to decide which stories should be erased and which ones should continue to be available in searching. The scenarios are not easy and usually the class splits on which way they lean often based on personal experience. We discuss each scenario in the class and allow students to defend their decisions.

Another opportunity for self-reflection is in the silicon module in which students are asked to interview a relative about how cell phone technology has affected their lives. There are many aspects of everyday life that we now delegate to microelectronics (driving directions, interpersonal interactions, finance, even personal appearance etc.) The students are asked to reflect on what they delegate to their phones and why. We then discuss their answers in a class discussion and speculate on what the future may hold in this area.

A final significant activity for self-reflection is the final poster session. The students are asked to create a poster about a material that is important in their lives. For example, one student chose Titanium because she played softball or another chose stained

glass because her grandmother gifted her a window from WWII Germany. The students have to answer several impact paradigm questions as they relate to their material, (historical, technological, sociological) and reflect on why this material is important to them and their lives. They must do a literature search on their material and include citations in their poster. They must present the poster at least 5 times to other students one on one and they are graded by those students. In addition, each student must evaluate 5 other posters and grade them. They are graded on the quality of their evaluations as well and the evaluations they receive.

VI. Required Policies

Attendance Policy

Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found at: <https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>

Students with excused absences will be allowed to make up missed in class work in a timely manner.

Students Requiring Accommodation

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/>. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

UF Evaluations Process

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.aa.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.

University Honesty Policy

UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Honor Code (<https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Phones

UF policy allows for professors to ask students to silence phones, but students may not be required to turn them off in the case of emergencies. I.e. this is how students receive timely information in the event of a campus emergency.

Counseling and Wellness Center

Contact information for the Counseling and Wellness Center: <http://www.counseling.ufl.edu/>, 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

The Writing Studio

The writing studio is committed to helping University of Florida students meet their academic and professional goals by becoming better writers. Visit the writing studio online at <http://writing.ufl.edu/writing-studio/> or in 2215 Turlington Hall for one-on-one consultations and workshops.

In-Class Recordings

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A “class lecture” is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations

such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To “publish” means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.