



Human Factors Engineering Research Methods (SIE 512)

Instructor: Professor Changxu (Sean) Wu

Tu/Thu 11- 12:15, Engin 301

Description of Course and Course Objectives

Students (both onsite and distance learning) who take this course will become familiar with state-of-the-art research methods in human factors engineering, including study design, research hypotheses generation, literature search and management in human factors, experimental design and human behavior data analysis in human factors, various human behavior measurement methods, and writing conference and journal papers in human factors.

The objectives of this course is to lay a relatively solid foundation for students in human factors research and applied work, including literature review, study design, data analysis, and report writing and presentations.

Course Prerequisites or Co-requisites

It is recommended (but not required) that you have taken SIE 411/511 Human Machine Interaction.

Instructor and Contact Information

Instructor: Dr. Changxu (Sean) Wu, Professor at Department of SIE

Office: 318 ENGR

Email:changxuwu@email.arizona.edu; Phone: 621-2342 (318 ENGR)

Office Hours: Tue 1-3 PM or by Appointment

Teaching Assistants and Course Homepage Information will be announced in the classroom, depending on number of students registered.

Software Preparation

We will teach Endnote, SPSS and Minitab for this course, and students needs to buy or install trial versions of these software (See weekly schedule as needed).

Course Format and Teaching Methods

Lecture, in-class discussion, and research proposal.

Lecture: Instructor will teach a significant portion of this course with lecture,

including research methods overview, literature search, experimental design, statistics in human factors research etc.

In-class Discussion: Another significant portion of the semester will be reading (outside of class) and in-class discussion. Before the discussion, readings (either methodological papers or research studies) focusing on a particular methodology will be assigned to all students. These readings will be discussed in class. One student will be assigned to be the discussion leader (each student either onsite or distance learning, will have at least one time to be a discussion leader) and other students will be discussion participants. The instructor will facilitate the discussion and briefly address the key elements in the readings. To reduce the burden on the discussion leaders, every student will be asked to prepare summary of these papers. Please see the Course Requirement Section for the responsibilities of discussion leader and participants of discussion. For distance-learning students who is a discussion leader, the student should upload and test his/her presentation online before class.

Research Proposal: Each student will write a research proposal in the semester. It includes a literature review, development of appropriate hypotheses, and the design and data analysis plan of methodologically sound study to test the hypotheses. Please see the Course Requirement Section for its detail requirements.

Special Notice to Distance Learning Students

For the first portion of this class (lecturing), you should have no problem watching my lecture videos.

For the 2nd portion of this class involving discussion:

If you are a distance learning students who are available during our class time, please inform the instructor your Skype ID and join the discussion during class time via Skype.

If you are a distance learning students who are not available during our class time, you will watch the discussion videos offline and send your questions to the instructor and the discussion leader (you still need to submit the assignment described in the syllabus). If it is your turn to lead a discussion, please record and upload your presentation on YouTube and send the link to the instructor 12 hours before the class so that the instructor can have some time to check the link.

Learning Objectives

1. To understand, use, and evaluate a broad range of human factors research methods for studying humans, systems, tasks, environments, and their interaction;
2. To gain familiarity with the content of many relevant journals and potential areas for research.
3. To be able to propose study design in human factors, including review literature, propose experimental design's independent, dependent and confounding variables, formulate research hypotheses, propose the data analysis methods corresponding your design, understand the relationship

- between research hypotheses and appropriate methods for testing the hypotheses, understand the possible usage of human performance model at the entry level, and propose expected experimental or other results.
4. To be able to understand and use the methods in human factors engineering to measure typical dependent variables
 5. To become proficient in reading and analyzing published research in the area of human factors
 6. To become better at writing succinctly about research methods and results
 7. To be able to criticize published human factors studies and propose your solutions

Assignments (Course Requirements)

1. Paper Summary and Questions:

Everyone is responsible for reading the assigned papers, **preparing a half-page summary for each paper, posting 2 questions you have for the reading 2 days before the discussion online, and actively participating in-class discussion**. For distance learning students, you are also required to prepare a half-page summary for each paper and post two questions that you have based on the reading 2 days before the online discussion.

Due to limited students we have in this semester, for each topic on the weekly schedule, the student can choose only one of the papers in the topic to write a summary and post questions of that paper (The paper is highlighted with blue color in the weekly schedule). For other papers that are not in blue color, they will serve just as extra reading if you have time and we will not require you to read or write summary or present it to reduce your workload in this course.

Questions: Please use D2L to post your two questions in the reading **2 days** before the discussion of that reading (Required). Failure to post questions or post questions at least 24 hours before the discussion will lead to -1 point off in your performance of this class.

Summary: The summary should be written in your own words, covering a) its main topic, b) essentials of the method(s) you learned, and c) contributions and limitations of this work. Papers (paper copy) are due at the beginning of the class (keep a copy for yourself) (See weekly schedule). No late assignments will be accepted. Assignments will be graded as satisfactory (S) or non-satisfactory (N) at the end of the semester. For each paper summary, please put your name, paper number (See the number on the reading list), and date of submission on this head. Format: Font using Times New Roman 12 points, 1.5 line space, and 1 inch margin.

2. Discussion Leader:

Be prepared to lead the discussion, based on the weekly schedule. You should be prepared to talk about the paper with a PowerPoint (PPT) to address these questions:

- a) What is the research goal of this work?
- b) If this is a hypotheses-driven research, what are the research hypotheses if there are? How did the authors develop and justify the hypotheses? How were they tested? How did the hypotheses influence the type of method used, and how did the methodology constrain the types of questions that could be asked?

c) What are essentials of the method(s) you learned, including when (or in which situation) you will use this method(s) and what are its steps (how to use).

d) What kinds of analyses were used in this paper?

e) What are the unique feature(s) of the method(s) used in this paper compared with other studies?

f) Except the limitations mentioned by the authors themselves, please also find at least 3 limitations of this work by yourself and propose solutions to these limitations (including the limitations the author mentioned and the limitations you found). You also need to elicit discussions in class regarding these points.

g) Read all questions posted by students online, summarize and organize them, and answer them in your PPT. If you cannot answer some questions, please seek help from other literature or get help from instructor before the discussion starts. If you really cannot find answer for the questions, please inform instructor which question(s) you have problems **12 hours before the class**.

Please prepare and share your PPT to all classmates and instructor before the discussion: Please put your PPT file in Google drive or other online folder (e.g., Dropbox), then copy and paste its link on the discussion section of D2L under that topic before your presentation. Then, other students can access your presentation file. The file name of your PPT should start with Paper number. One PPT file for one paper. For example, if your PPT reviews Paper 30, then the file name of your PPT will be Paper_30_PPT (Avoid space in your file name). In the overall 75 minutes (**Due to limited students we have in this semester, you can present the paper with blue color on the weekly schedule**), you will probably present 40 min for these papers and the other 35 min is for discussion and a possible break. If our classroom does not have a computer, you need to bring your own laptop or USB flash drive for the presentation and make sure your files on USB flash drive or your laptop can be hooked up with the projector in the room with VGA connector only (i.e., you may need to bring display adapter).

The grading of your discussion leading will be based on: the correctness, completeness, and depth you covered for item a)-g), whether you post your slides before the presentation time, the management of your time, the quality of your presentations (you will lose points if your font size is too small or no usage of figures etc.), time management, and the quality of the questions you raised to elicit discussions.

If you are sick and cannot lead a discussion on the scheduled date, please kindly send your PPT and inform instructor at least 1 day in advance. The weekly schedule is very important to follow.

3. Research Proposal:

Locate a real-world problem or a theoretical problem in human factors with your interests. For this problem, develop a concrete proposal to study this problem based on relevant literature and your own knowledge. Describe explicitly the methods you would use to test that hypothesis (e.g., what data would you collect? How? Who would you study? Under what conditions would you collect data? How would the study be designed?) and justify those methods with appropriate references to the literature. Describe the techniques you would use to analyze the data you collect. Discuss the implications of different results you might obtain. Ideally, this project may be relevant

to your own research interests. The proposal should help you analyze the different methods with respect to their appropriateness for your topic, and thus help you select and justify a method for studying your hypothesis.

The research proposal should be composed of the following sections: abstract, research goal, literature review (including hypotheses), method, expected results (analysis), discussion, a 3-year timeline and milestones, and a reference section.

Abstract (5%): 0.5 page. Summarize your research proposal including goal, method, expected results.

Research Goal and Hypothesis (5%): 0.5 page. State the goal of your proposal and what is the problem to be solved and your hypothesis relevant to this problem. Please make sure your goal can be achieved in a 3-year research period. Your research goal including the hypothesis should either solve a real-world problem or deepen the understanding of a theoretical problem in human factors. You will lose points if your research goal does not address one of these points.

Literature Review (15%): 2 pages. Extensively search the key databases for the relevant work. You need to write down the key words (you will lose points if you missing key words) you used in the search and find at least 10-15 related work and summarize them in an integrated manner. You will lose points if your key words set is not complete or did not find enough related work.

Methods (25%): 2 pages. Propose which research methods you will use to achieve the proposed goal. You need to use at least 2-3 methods we taught in this semester and one of them has to be experimental approach. Please justify the reasons you use these methods. You also need to discuss the limitations of those methods, and how these limitations affect the expected results. In the methods for experiments, you need to describe the independent variables, dependent variables including how to measure them in details, sample size and how you get this sample size in detail, detail arrangement of the sample based on your design, participants' recruitment, experimental procedure, facilities and equipment, and planned statistical analysis and their justifications. You will lose point if the methods you chosen are (is) not appropriate lack of justification, or missing details. You will lose point if there are better methods than those you chose.

Expected Results (15%): 3 pages. Describe expected results and draw figures in detail for the expected results based on literature and your knowledge in human factors. Your expected results should also address the hypothesis in your research goal. You will lose points that you did not describe the possible expected results completely or no figures. You will lose point if the expected results are not appropriate or your figures are not appropriate drawn.

Discussion (15%): 2 pages. Discuss the implications and applications of your expected results in achieving your research goal, either solve a real-world problem or deepen the understanding of a theoretical problem in human factors. Discuss the relationships between your expected results and the literature. At least five limitations of your study. Missing any items above, you will lose points.

Budget (5%): Prepare a budget of your research proposal, including experimental equipment cost, number of human participants and experimenters and their payment, and participants requirement cost etc. Please use a table to summarize your budget and also calculate the total amount of the budget.

Timeline and Milestones (5%): 0.5 page. Draw a timeline of your proposed

research (Totally 3 years in length) and milestones (what is to be achieved) of your research in each phase. For example, if you have 3 phases of your research, then you will write down the milestone of each phase.

Reference (5%): No page limit, but your format should follow the format we taught in the class. Each reference should list all authors of a work and page range.

Format of the Proposal (5%): Subtitles within each section (For example, in the methods section, you should have a subtitle of participants) and highlights of important words are required. Avoid writing a very long paragraph which is over 0.5 page. Font 12 points (Times New Roman), 1.5 line space, and 1 inch page margin are required. Each figure and table should have its figure/table number and caption (you need to cite this number in your writing). You will lose point if the proposal does not meet these requirements.

Presentations and Submission: During our semester, each student will present your proposal for its topic and literature review (Presentation 1), experiment design (Presentation 2), and final report (Presentation 3). Please prepare PPT and submit a paper report for each presentation. If you missed your proposal presentation, you will receive a penalty of 15% of proposal. Late submission of the paper report due on the same day of the presentation, you will receive penalty of 10% of your proposal. On-site students, please present in class and submit paper format of the corresponding sections of your proposal.

Distance learning students, please record your presentation and submit its YouTube link to the instructor 12 hours before the presentation date (see weekly schedule); and your corresponding proposal section to the online system (D2L). If you missed your proposal presentation, you will receive a penalty of 15% of proposal. Late submission of the paper report due on the same day of the presentation, you will receive penalty of 10% of your proposal.

Readings

For the section to be taught by the instructor:

A) Exp Book: Experimental Methodology (8th Edition), Author: Larry B. Christensen
Publisher: Allyn & Bacon (Mainly for its Chapter 3, 6, 7, and 8).

B) DOE Book: Design and Analysis of Experiment (5 or 6 Edition), Author: Montgomery (Mainly for its ANOVA section)

C) SPSS Book: Using SPSS for Windows: Data Analysis and Graphics, Author: Susan B. Gerber

For the section of reading and discussion:

We will post around 31 journal papers and other readings in human factors engineering online as reading materials for this course, depending on number of students in the class and course schedule.

Recommended Supplies

A laptop (if our classroom has no computer) or a USB flash drive is recommended for you to present your work.

Absence and Class Participation Policy

Participating in the course and attending lectures and other course events are vital to the learning process. As such, attendance is required at all lectures and discussion section meetings. Students who miss class due to illness or emergency are required to bring documentation from their health-care provider or other relevant, professional third parties. Failure to submit third-party documentation will result in unexcused absences. Attendance will be taken randomly throughout the whole semester. A student can only sign his or her own name on the attendance sheet. If you are late or missing during the class when the attendance is taken, you are not allowed to sign the sheet after the class only except medical reasons (Doctor's note is required for each class you missed or the specify the range of dates of classes you will miss).

Students have a few presentations and leading discussions in this semester and everyone has to take their full responsibilities which is arranged at the beginning of semester. If you cannot come to the classroom due to any reasons (medical, travel, etc.), please email instructor at least 12 hours before your presentation time. If you fail to show up on time (online student should submit YouTube links 12 hours before your presentation time) while it is your presentation/discussion leading date without notifying the instructor, you will lost half of your attendance score in the whole semester and also lost 30% of discussion leading score of the whole semester. Students should arrange their travel in advance based on our weekly schedule, and if you cannot come on a certain day to present or lead a discussion, please communicate with other students in class to switch dates in advance.

Participation in class discussions will be particularly important if your final grade is borderline. If your participation is satisfactory the grade may be adjusted upward. If your participation is unsatisfactory, your grade may remain as is or adjusted downward. Participation is determined on the association of your name with class attendance, participation in discussions, offering insight to class topics, answering questions, etc.

Course Drop Policy: The UA's policy concerning Class Attendance, Participation, and Administrative Drops is available at:
<http://catalog.arizona.edu/policy/class-attendance-participation-and-administrative-drop>

Religious Reasons: The UA policy regarding absences for any sincerely held religious belief, observance or practice will be accommodated where reasonable,
<http://policy.arizona.edu/human-resources/religious-accommodation-policy>.

Pre-Approved Absences: Absences pre-approved by the UA Dean of Students (or Dean Designee) will be honored. See:
<https://deanofstudents.arizona.edu/absences>

Course Communications

If students have any questions or suggestions, please email to the teaching assistants or instructor, or inform the instructor directly in classroom or in his office hour.

Final Examination and Other Exams

This course has no final other exams.

Grading Scale and Policies

1) Grading Distributions

	Percentage
Paper Summary	10%
Discussion Leading	20%
Research Proposal	60%
Class Attendance and Participation	10%

2) Grading Scale:

Total Score	Grade
≥ 90	A
≥ 80	B
≥ 70	C
≥ 60	D
Less than 60	E

*Note: Round up policy in both tables: Say, if you get a total score 89.5, we will round it up to 90. Unfortunately, if you get 89.4, we are not able to round it up to 90. We keep this rule same across all students.

Requests for incomplete (I) or withdrawal (W) must be made in accordance with University policies, which are available at <http://catalog.arizona.edu/policy/grades-and-grading-system#incomplete> and <http://catalog.arizona.edu/policy/grades-and-grading-system#Withdrawal> respectively.

Teaching Assistant Responsibility

TA (if available) in this class will be responsible for grading all of your reading summaries and some of research proposals.

Classroom Behavior Policy

To foster a positive learning environment, students and instructors have a shared responsibility. We want a safe, welcoming, and inclusive environment where all of us feel comfortable with each other and where we can challenge ourselves to succeed. To that end, our focus is on the tasks at hand and not on extraneous activities (e.g., texting, chatting, reading a newspaper, making phone calls, web surfing, etc.). In addition, students should follow the following Classroom Behavior Policy:

- Not leaving early. Early leaving will distract both the instructor and students
- Not talking with other classmates while the instructor or another student is speaking. If a student has a question or comment, he or she should raise a hand, rather than starting a conversation about it with a neighbor
- Not packing backpacks to leave until the instructor has dismissed class

- Showing respect and concern for others by not monopolizing class discussion. Students must allow others time to give their input and ask questions. Students should not stray from the topic of class discussion
- Not eating and drinking during class time

Threatening Behavior Policy

The UA Threatening Behavior by Students Policy prohibits threats of physical harm to any member of the University community, including to oneself. See <http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students>.

Notification of Objectionable Materials

This course will contain material of a mature nature, which may include explicit language, depictions of nudity, sexual situations, and/or violence. The instructor will provide advance notice when such materials will be used. Students are not automatically excused from interacting with such materials, but they are encouraged to speak with the instructor to voice concerns and to provide feedback.

Accessibility and Accommodations

Our goal in this classroom is that learning experiences be as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, please let me know immediately so that we can discuss options. You are also welcome to contact the Disability Resource Center (520-621-3268) to establish reasonable accommodations. For additional information on the Disability Resource Center and reasonable accommodations, please visit <http://drc.arizona.edu>.

If you have reasonable accommodations, please plan to meet with me by appointment or during office hours to discuss accommodations and how my course requirements and activities may impact your ability to fully participate.

Please be aware that the accessible table and chairs in this room should remain available for students who find that standard classroom seating is not usable.

Code of Academic Integrity

1. Standards for Written Work

All written work should be typewritten/printed. Use complete, grammatical sentences. There are several style guides for sale (Chicago manual of Style, APA Style guide, etc.) for your reference. All heading styles, figure captions, table formatting, etc. should follow the APA style guide (see <https://owl.english.purdue.edu/owl/resource/560/1/>). Citations should follow the APA style guide (see <https://owl.english.purdue.edu/owl/resource/560/1/>).

Please pay attention to issues of spelling, grammar, and punctuation. While I am not giving grammar grades on the assignments, carelessly written papers that have not been proofread and contain obvious spelling and punctuation errors will be returned without a grade.

Do not quote from, copy, or paraphrase from other written sources without citing the paper you are referencing. Direct quotes must be cited appropriately with quotations marks and page numbers. Do not directly quote without doing this. Do not paraphrase text without citing the source. This must be done to prevent plagiarism, which is both illegal and unethical.

Do not use authors' first names or the titles of papers when citing material in the text. Citations should follow the style guidelines listed in the Human Factors Society Authors Guide or APA.

For example:

Jones (1996) wrote that dogs are larger than cats.

There is considerable evidence that dogs are larger than cats (Jones, 1996).

For 3 or more authors, use all the authors names for the first citation; use "et al.," afterwards. For example

First citation: Jones, Brown, and Miller (1996) wrote that dogs are larger than cats.

Later citations: Jones et al. (1996) also compared the sizes of sheep and rabbits.

2. General Requirements

Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work/exercises must be the product of independent effort unless otherwise instructed. Students are expected to adhere to the UA Code of Academic Integrity as described in the UA General Catalog. See: <http://deanofstudents.arizona.edu/academic-integrity/students/academic-integrity>.

The University Libraries have some excellent tips for avoiding plagiarism, available at <http://new.library.arizona.edu/research/citing/plagiarism>.

For example, you should follow the following integrity codes in our class:

- No copy of other people's homework In grading your homework, TA will exam all of your homework carefully and catch anyone who is copying other people's homework. Even if they are from the same software's output, TA can still judge whether it is a copy of others or not based on your writing and formatting.
- No copy or discussion in the tests/exams TA and other students all will report these behaviors in exams and your exam papers will also be checked by TA carefully for any cheating behavior. Do not seat too close to each other in the exam.

*Selling notes and/or other course materials to other students or to a third party for resale is **not** permitted without the instructor's express written consent.* Violations to this and other course rules are subject to the Code of Academic Integrity and may result in course sanctions. Additionally, students who use D2L or UA e-mail to sell or buy these copyrighted materials are subject to Code of Conduct Violations for misuse of student e-mail addresses. This conduct may

also constitute copyright infringement.

UA Nondiscrimination and Anti-harassment Policy

The University is committed to creating and maintaining an environment free of discrimination; see <http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy>

Our classroom is a place where everyone is encouraged to express well-formed opinions and their reasons for those opinions. We also want to create a tolerant and open environment where such opinions can be expressed without resorting to bullying or discrimination of others.

Additional Resources for Students

UA Academic policies and procedures are available at <http://catalog.arizona.edu/policies>

Student Assistance and Advocacy information is available at <http://deanofstudents.arizona.edu/student-assistance/students/student-assistance>

Confidentiality of Student Records

<http://www.registrar.arizona.edu/personal-information/family-educational-rights-and-privacy-act-1974-ferpa?topic=ferpa>

Subject to Change Statement

Information contained in the course syllabus, other than the grade and absence policy, may be subject to change with advance notice, as deemed appropriate by the instructor.

Send Feedback to US:

If you have any questions, suggestions or comments related to the class, you are very welcome to contact the instructor or TAs directly. We have several ways for communications:

- 1) In-Class Feedback Papers (White papers) (Anonymous)
- 2) Office Hours
- 3) Emails
- 4) Individual Appointment (if you cannot come in Office Hour).

Threatening Behavior Policy:

The UA Threatening Behavior by Students Policy prohibits threats of physical harm to any member of the University community, including to oneself. See: <http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students>.

UA Nondiscrimination and Anti-harassment Policy:

The University is committed to creating and maintaining an environment free of discrimination, see: <http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy>

Inclusive Excellence is a fundamental part of the University of Arizona's strategic plan and culture. As part of this initiative, the institution embraces and practices diversity and inclusiveness. These values are expected, respected and welcomed in this course.

This course supports elective gender pronoun use and self-identification; rosters indicating such choices will be updated throughout the semester, upon student request. As the course includes group work and in-class discussion, it is vitally important for us to create an educational environment of inclusion and mutual respect.

Additional Resources for Students Statement: Office of Diversity
(<http://diversity.arizona.edu/>)

<http://www.health.arizona.edu/counseling-and-psych-services>

http://oasis.health.arizona.edu/hpps_oasis_program.htm