

# Research and Experimentation in Technological Studies

## ETES 5070/7070

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**Textbook:** The Mechanical Design Process, 3<sup>rd</sup> Edition, David G. Ulman, ©2003, ISBN: 0-07-237338-5  
Research & Experimentation Design Notebook, Bel-Jean Copy/Print Center, 163 E. Broad Street, Downtown Athens, 548-3648

### Course Description:

This course will address the cognitive and applied approaches to designing and solving for technological problems. Study efforts will be undertaken by individual students and/or small groups of students to pursue new knowledge or to solve a specific technological problem. Experiences will range from research strategies, engineering design processes & procedures, to laboratory experimentation and developing prototypes or working models of technological artifacts. Special attention will be given to the development and implementation of a realistic problem solving agenda for the technology education curriculum.

### Course Objectives:

Upon completion of this course you should be able to:

1. Identify and define a technological problem (i.e., environmental, production, transportation, communication, societal)
2. Study and utilize the engineering design process to solve technological problems
3. Solve technological problems using a research and experimentation process common to engineers (i.e., identify problem, state hypothesis, establish research criteria, collect data, analyze data, test hypothesis, make recommendations)
4. Synthesize knowledge and be able to formulate it into a report or use it in solving a defined problem
5. Record and log experimental or design data for use in the documentation of the engineering design process
6. Develop a schedule of a plan that will be used in the pursuit of the research and experimentation process to solve identified problems
7. Evaluate the research and experimentation solutions that have been used in the solution of technological problems
8. Research and develop experimental activities that can be used in a technology education classroom
9. Develop a course portfolio that supports and references all aspects of the research and experimentation process used in technology education and in this course
10. Apply research and experimentation strategies to solve for a specific

community/societal need that is external and independent of the classroom

### **Detailed Course Requirements:**

#### **Experimentation Activities:**

Four experimentally based activities will be developed during the semester. Development of the experimental activity must include an engineering design rationale and documentation for your solution based on research (not trial & error), technical design of your solution, construction of the technological artifact, conducting the actual experimentation, and the complete write-up of the experiment procedures and results (must be word-processed and presented in portfolio format). All materials necessary to construct the support structure for the experiment must be provided by the student (i.e., purchasing from hardware stores, department stores, etc.). Selected support structures may be requested to be retained as models for future classes (reimbursements will be provided). Each student/research team will present an in-class oral summary presentation describing their experiment; its features, design rationale, application, and educational benefits.

***Each experimental activity is worth 15 points for a total of 60 points.***

#### **Original Research & Experimentation Activity**

After experiencing the experimentation activities in the earlier sections of this course, each student will develop a comprehensive experimentation instructional activity including a design brief (based on the earlier format) that is of an original design. The activity must be designed to be used in a Technology Education program at the secondary level (all components of the activity must be included: hardware - physical technological artifacts that will be a part of the learning process and software - materials that student will read, write on, watch, etc. etc.). The activity will be evaluated based upon its creativity, comprehensiveness, and level of difficulty. Each student will present an in-class oral summary presentation describing the activity; its features, application, and educational benefits.

***This assignment is worth 10 points.***

#### **Course Portfolio**

The portfolio is designed to synthesize all class experiences, activities, discussions, etc., into a useful framework for integrating research and experimentation into your classroom or training environment (current or anticipated). The primary goal of this assignment is to help you to develop a document that can be of practical use for you now and in the future.

In general, you have three tasks associated with this assignment: (a) organize all class materials meaningfully (25%); (b) customize the plan to suit your current or anticipated instructional/training needs by adding original materials and ideas (50%); and (c) document as many available resources as you can (25%). The portfolio is to reflect how you are going to incorporate research and experimentation into your teaching and I expect to see a mixture of educational philosophy and practical lesson planning. I also expect you to articulate a rationale for the materials and ideas you place in your plan. This rationale will probably swing between economic (less time, more efficient, etc.) and instructional (learning theories, differences in student learning ability, etc.) considerations. Please consider this as an opportunity to consolidate and organize all of the class information into a document which can serve several functions: (a) be referred to in future (real) lesson plans; (b) act as a handy resources of names, addresses, prices, etc.; (c) be shared quickly with parents/clients,

colleagues, administrators, and school board members/managers as an example of your educational philosophy and management.

The following sections must be represented at a minimum:

- I. Research and Experimentation as a **Concept**
- II. Research and Experimentation as an **Instructional Tool**
- III. Research and Experimentation **Examples**  
Things to include in each of these first 3 sections:
  - A. 300 word (min.) rationale/philosophy
  - B. Summary/overview of the section's original materials.
  - C. Document specific activities in which the research and experimentation is incorporated in whole or in part within technology education curriculum.
  - D. Mention references by name, and reference them in IV and/or V.
  - E. Provide examples of research and experimentation materials where appropriate, such as activities, assignments, etc., which are based on research and experimentation.
- IV. Research and Experimentation List
  - A. Includes names, addresses, phone numbers of people you could contact with questions or for information.
  - B. List of research and experimentation activities available to you and description of borrowing privileges and procedures.
  - C. Names, phone numbers, and addresses of research and experimentation vendors in your area.
  - D. Information regarding grants or other funding opportunities, including proposal deadlines, submission guidelines, contact people, etc.
- V. References/Bibliography
  - A. Cite readings, research, etc.

*Of course, you may also choose to add other sections as you see fit.*

***This assignment is worth 10 points.***

### **Unannounced Quizzes.**

Four (4) unannounced quizzes will be administered during the semester. Quizzes will be objective in nature and will be specific to the assigned reading scheduled for the date when the quiz is administered. This assignment is designed encourage students to be of fully vested in required reading for this course. Each quiz will be worth 5 points or 5% of your grade.

***This assignment is worth 20 points.***

<b>Assignments &amp; Values</b>	
<b>Assignments</b>	<b>Point Value</b>
Experimentation Activities	60 (15 pts. X 4 exp.)
Original R&E Activity	10
Course Portfolio	10
Unannounced Quizzes	20 (5 pts. X 4 quizzes)
Grad Student Supplement	15

## Graduate Student Supplemental

Each graduate student will be responsible for leading the class discussion during a specified class period. This discussion will include a complete development of the topic assigned for the specific date. Graduate students are required to read, research, and design a well developed lesson plan which will include hand-outs, overheads (preferably electronic presentations - Power Point), as well as class lecture/discussion. Specific topical areas will be based on established course outline and will be available on a first-come basis. Evaluation will be based on the level of comprehensiveness, logical presentation, and innovation/interest generation.

*This assignment is worth 15 points.*

## Laboratory Sessions:

Due dates will be specified for each experiment/activity. Each student/student group is responsible for accomplishing these experiments/activities during open lab times. Make sure you keep up with your laboratory work.

## Attendance/Participation:

Attendance is crucial especially considering the density of facts, concepts, principles, and procedures covered in each class. Missing even one class could set you seriously behind. Realize that if you are absent, even for valid reasons, you are responsible for the material and assignments discussed in each and every class. In addition, I expect each participant to take an active role by contributing and sharing thoughts and ideas, taking initiative, and seeking to help other members of the class. Each participant is expected to remain open to new ideas and different points of view.

Attendance records will be recorded at the beginning and at the conclusion of each class meeting. *Your grade in this class will be dropped 3% points for two (2) unexcused absence and you will be removed from the class role after three (3) unexcused absences. In addition, tardiness will result in a 3% point reduction in grade if more than three (3) unexcused tardy attendances occur.*

## Late Assignments

I expect assignments to be completed on time. My standard policy regarding assignments is 10% penalty for late assignments turned in within 1 week of the due date and 50% penalty for assignments turned in thereafter until the end of the course (defined as the last regular class session).

I use this system even in the event of "excusables," such as minor sicknesses or other unforeseen conflicts. However, any exceptions to this policy are made at my discretion.

## Honesty

Cheating on class assignments, examinations, or other serious forms of academic activities will result in a grade of an "F" (and a required report to University officials). Persons "borrowing" someone else's work on an assignment will receive a zero on that assignment if it is the first offense.

A second offense will be considered a serious form of academic dishonesty. (Borrowee is equally subject to penalties.) Refer to UGA's *A Culture of Honesty: Policies and procedures on academic honesty.*

## Withdrawal/Drop Policy

Drop policy is as described in the university's undergraduate bulletin, page 45.