

## Syllabus

TMGT 421 (001 and 301) Research and Development in Technology

Fall 2013

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### Catalog Description

TMGT 421 Research and Development in Technology (3 credit hours). The student will research and develop a solution to a technological problem. Prerequisites: Sr. standing.

### Foundational Studies Information

This course is an Upper Division Integrative Elective course (UDIE). See ISU's General Education web site and consult your advisor for your options of fulfilling the UDIE requirement.

### Note About Course Content and Terminology

Though this course is open to any major the focus of the class is **R&D in Technology**. Previously, majors such as education, speech pathology, chemistry, geology, HRD, and many others have completed high quality R&D projects related to technology. To help you choose whether this course is right for you and to give you the proper orientation, the following is presented.

**Research** is *reasoned inquiry*. Reasoned inquiry takes many forms. Don't let the word *research* scare you. By whatever name, you already know several ways of knowing by virtue of your foundational studies and your major. This class will teach you the R&D way of doing things, which will largely utilize your existing skills sets within an R&D framework.

**Development** in this class means a *thing*—a physical, tangible, lasting artifact, tool, material, etc. The *thing* for this class **cannot** be an activity, an event, a theory, etc. However, the development doesn't have to be a new tool or product. Think of a development target. It is true that the bull's-eye is a completely new thing. However, the next ring (which is still on target) would be to *modify* an existing thing. Also on target would be a new way to make or maintain the thing. Also on target would be the items that support the thing, e.g., the plans, specifications, instructions, training materials, and other documentation necessary to produce, control, set-up, sell, market, maintain, store, transport, repair, or dispose of the thing. Don't let the word *development* scare you; you have been developing things your whole life.

**Technology** in a narrow sense is the specific components and processes of agriculture, or computers, or construction, or manufacturing, or medicine, etc. By a broad definition, *technology is the extension of human potential* and includes every alteration of our natural environment. In this class we will use a middle definition. The assignment instructions go into more detail. Don't let the word *technology* scare you. Every major deals with more than enough technology appropriate for this class.

## Required Course Book

*Getting it Right: R&D Methods for Science and Engineering* by Peter Bock. ISBN: 0-12-108852-9.

## Suggested Course Material

*Publication Manual of the American Psychological Association* (APA Publication Manual, 6<sup>th</sup> Ed.). There are hardback, spiral bound, and concise versions of this text.

The R&D report must adhere to APA style. The essays can be use any style.

Other materials and learning aids:

The R&D textbook covers R&D methods including epistemology and project planning. Other readings and information are necessary to explore the cultural, social, environmental, etc. impacts of R&D and fulfill other course objectives. See the Supplemental Course Materials Bibliography section at the course site.

## Course Goals

- Increase the student's level of technological literacy.
- Increase the student's understanding and skill in solving technological problems.
- Hone the student's inquiry and information finding and processing skills.
- Help students interpret, analyze, synthesize and evaluate technological information, concepts and solutions.
- Aid the student in their understanding and appreciation of the global society in which they live and the inherent aesthetic, cultural, economic, ethical, ideological, political, etc. differences exhibited by various groups and individuals.

The course goals support the following ISU Foundational Studies goals.

- Locate, critically read, and evaluate information to solve problems.
- Critically evaluate the ideas of others.
- Apply knowledge and skills within and across the fundamental ways of knowing (natural sciences, social and behavioral sciences, arts and humanities, mathematics, and history).
- Demonstrate the skills for effective citizenship and stewardship.
- Demonstrate an understanding of diverse cultures within and across societies.
- Demonstrate the skills to place their current and local experience in a global, cultural, and historical context.
- Demonstrate an understanding of the ethical implications of decisions and actions.
- Express themselves effectively, professionally, and persuasively both orally and in writing.

The course goals support the following College of Technology goals.

- Develop critical thinking, problem solving, and communication skills through the use of practical experiences.
- Provide the knowledge and skills to prepare people to create, understand, apply, manage, and evaluate technology ethically and responsibly.

- Contribute to the areas of state economic development, technology transfer professional development and community service.
- Extend partnerships with schools, businesses, industry, and other agencies through co-op programs, internships, research and development projects to expand access to higher education and better prepare our future workforce.
- Evaluate, refine, and enhance all academic programs to assure a sound basis for lifelong learning and living in a multi-cultural and interdependent world.
- Maintain a concern for future developments; be known for innovativeness; and participate in the search and application of new technologies.

### **Specific Instructional Objectives**

Upon successful completion of this course the student will have:

1. Via the R&D project and other course activities, demonstrated a synthesis of course work (Foundational Studies and major-related) and prior life experience.
2. Collaborated with other students, faculty members, and/or business and industry partners.
3. Prepared a professional quality R&D report.
4. Presented the results of an R&D project via a poster session or other professional presentation.

To complete the above goals and objectives the following ways of knowing are utilized. Other ways of knowing may be required depending on the nature of the R&D project, especially because students are encouraged to work on a project related to their major or profession.

- Composition
- Communication
- Social and Behavioral Sciences
- Historical Studies
- Global Perspectives and Cultural Diversity
- Ethics and Social Responsibility

### **Instructional Components**

The course activities and their relative weight are summarized in the following table. The bulk of the course's activities center on the R&D project. The R&D project is a research project that requires multiple ways of knowing, critical reading and analysis, and intensive writing. A thematic approach is used in that the essays assignments are meant to interrelate with each other and the R&D project. Quizzes mainly pertain to the text book chapters.

## Grading

Evaluated Course Activity	Points	% of Total Course Grade
Essays-discussions	50	17%
Quizzes	50	17%
R&D project	200	66%
Totals	300	100%

The final grades will be determined based on the following:

Percent			Letter Grade
0.00%	-	59.50%	F
59.50%	-	62.50%	D-
62.50%	-	66.50%	D
66.50%	-	69.50%	D+
69.50%	-	72.50%	C-
72.50%	-	76.50%	C
76.50%	-	79.50%	C+
79.50%	-	82.50%	B-
82.50%	-	86.50%	B
86.50%	-	89.50%	B+
89.50%	-	93.50%	A-
93.50%	-	97.50%	A
97.50%	-	100%	A+

## Syllabus Supplement

### Academic Integrity

It should be clear that copying even one sentence or unique sentence fragment without properly quoting and citing is plagiarism. Likewise, cutting and pasting various sentence fragments from various authors to form a paragraph is also plagiarism unless each fragment is quoted and cited. To clearly **not** be plagiarism, the paragraph would have to be comprised of original thoughts and words (words that might paraphrase other's work, but that work would have to be cited as necessary).

Legal issues such as *fair use* and other copyright issues overlap with academic integrity issues but are not the same. A person could cite and quote correctly, thereby not committing plagiarism, but violate copyright laws because the person used work without permission or too much of it was used. See the file at the course site Course Documents area for more discussion of intellectual property issues.

Academic integrity is much more than not plagiarizing. Academic integrity also encompasses cheating, excessive collaboration, and other issues. Most importantly, academic integrity should not be viewed as a list of prohibitions but a rather as a proper mind set to do *one's own work* and *give credit to others* as appropriate. To this end, academic integrity encompasses how much work you use of another (similar to *fair use* laws). Many universities and associations believe that using more than 5-10% of other's work in your document (even if quoted and cited correctly) is too much; that you haven't done enough original work. ISU subscribes to *Turnitin* which checks how much of your work is original. This is not just used to check for plagiarism but also for originality. *Turnitin* will be used in this course.

All ISU policies and professional ethics regarding academic integrity apply to this course. Any willful violations will result in a failing grade and referral to the Office of Student Affairs which can result in expulsion from the University. Everyone is highly encouraged to learn more about ISU's Academic Dishonesty policy found in the Code of Student Conduct.

### Late Work and Attendance

It is imperative to keep to the schedule. Pay careful attention to due dates. Late work will not be evaluated. There is no such thing as an excused absence because attendance is not part of the grading structure. The student either performs the work (by the due date) or they do not. However, attendance and participation are strongly encouraged. A student cannot be successful in the course without regular attendance and participation (on time, per the schedule).

Some work or activities require certain places and/or dates and times of participation, e.g., participating in a certain discussion. In many instances there can be **no makeup** of these activities if they are missed. Even if the student is engaged in another approved university activity, e.g., a sporting event or a field trip, or has an emergency, no *makeup* may be feasible, possible, or permitted. If you think you may have to miss a required activity due to another official ISU activity, let the instructor know as soon as possible so the instructor can determine if a makeup is possible. Turning something in early is an option. With the communication options open to you (and especially considering that all assignments are to be word processed) every

student should be able to submit the assignment to the instructor by the due date and time. It is rare for students to do well in any of my classes if they don't fully participate and on time (whether by web or face-to-face). It is good advice to not wait until the last hour to do things.

### ***"The Sycamore Standard"***

Students at Indiana State University are expected to accept certain personal responsibilities that constitute the "standard" for behavior in a community of scholars.

As a student at Indiana State University:

I will practice personal and academic integrity; I will commit my energies to the pursuit of truth, learning, and scholarship; I will foster an environment conducive to the personal and academic accomplishment of all students; I will avoid activities that promote bigotry or intolerance; I will choose associations and define my relationships with others based on respect for individual rights and human dignity; I will conduct my life as a student in a manner that brings honor to me and to the University Community; I will discourage actions or behaviors by others that are contrary to these standards. Adopted by the Indiana State University Student Government Association April 17, 2002

### **American with Disabilities Act Statement**

“Indiana State University seeks to provide effective services and accommodation for qualified individuals with documented disabilities. If you need an accommodation because of a documented disability, you are required to register with Disability Support Services at the beginning of the semester. Contact the Director of Student Support Services. The telephone number is 237-2301 and the office is located in Gillum Hall, Room 202A. The Director will ensure that you receive all the additional help that Indiana State offers.

If you will require assistance during an emergency evacuation, notify your instructor immediately. Look for evacuation procedures posted in your classrooms.”

### **Laptop Usage**

Laptop Not Required for Course: Usage Permitted: While there will be no assignments or examinations for which the laptop will be used, your use of a laptop is generally permitted as long as such usage remains within the bounds of the Code of Student Conduct and it conforms to the provisions of its use as laid out in this syllabus. There may be occasions where laptop usage is forbidden and if that occurs, failure to comply with this direction will be viewed as a violation of the Code of Student Conduct. Note that much out-of-class computer use will be required (on a laptop or other computer).

### **Academic Freedom**

"Teachers are entitled to freedom in the classroom in discussing their subject, but they should be careful not to introduce into their teaching controversial matter which has no relation to their subject." The preceding comes from the American Association of University Professors statement on academic freedom. Though the entire statement speaks to many issues, it is this portion on the conduct of the course that is most relevant. For the purpose of Foundational Studies courses this means that faculty have the right to conduct their class in a fashion they deem appropriate as long as the material presented meets the learning objectives laid out by the entire faculty. <http://www.aaup.org/AAUP/pubsres/policydocs/contents/1940statement.htm>

[The following would not be in the actual course syllabus but would be covered in even more detail in the instructions for the project.]

### **The R&D Project**

In short, the R&D project is to research and develop a technical solution to a technical problem, prepare a report of that project, and present the results. To accomplish this following must take place.

- Think critically, locate, critically read, and evaluate information to solve a problem.
- Engage in reasoned inquiry (research) via experimentation, observation, and other experiential forms; review of literature; and reflection.
- Critically evaluate the ideas of others.

Express oneself effectively, professionally, and persuasively both orally and in writing by preparing a report and poster, and presenting the results.

The R&D project has 7 steps or sub-assignments summarized as follows. See the course web site for details of the overall project and each sub-assignment.

Evaluation Criteria for Other Project Elements Evaluated by Other Assignments	Points
1-Project identification & Problem Analysis	10
2-R&D Proposal	10
3-R&D Plan and Develop Solution progress check	5
4-R&D Solution Implementation, Testing, and Validation progress check	5
5-R&D Draft of Report	10
6-R&D Report	140
7-Poster & Presentation of project	20
<b>Total</b>	<b>200</b>

To complete the project, multiple ways of knowing are required. Following is the evaluation criteria for the R&D project. The project as a whole requires much research, critical evaluation, writing, and oral communication. The *Ways of Knowing* column implies the preceding; what is highlighted in the column are additional ways of knowing and other foundational studies elements pertinent to that portion of the R&D report. For example, various parts of the project also include issues related to citizenship, stewardship, cultural diversity, ethics, legal issues, economic factors, historical context, and other personal, cultural, and global issues.

Evaluation Criteria For the R&D Report	Points	Ways of Knowing
<b>Abstract:</b> summarizes the entire research report in approximately 1% of the paper length.	2	
<b>Table of Contents:</b> lists sections (including appendices) and important headings. <b>List of Illustrations:</b> lists figures, tables, and other graphics.	2	
<b>Introduction</b>		
Industrial-technical problem statement, requirement, or question.	2	
Rationale to include, among others, why this problem is important (to what groups, etc.), why it should be worked on in consideration of other problems.	4	Citizenship; individual, cultural, and global perspectives, ethical and political issues.
Assumptions, limitations, and delimitations (of the entire research project, as opposed to just the methodology).	2	
Explanation of terms, symbols, and conventions as necessary.	2	
Intellectual property issues.	2	Legal and ethical issues.
Overview of the cost of the project (money, time, facilities and equipment used, etc.)	2	
Executive summary (includes all parts of the report in greater detail than the abstract, e.g., 10% of the entire report). Includes acknowledgment of others.	2	
<b>Analysis: What=s the problem?</b>		
In-depth description of an industrial-technical problem as a measurable gap between <i>what is</i> and <i>what is desired</i> .	4	
Description of performance criteria, i.e., the requirements that a solution to the problem must fulfill. (Later these performance criteria will be translated to performance measures or metrics).	4	
Investigate related work ( <i>review of literature</i> ). Must use 10 sources minimum. At least 5 sources must be hardcopy sources. The following must be addressed: the history, current standing, and impacts of this problem; and related R&D, including economic, legal, social, etc. issues.	20	Historical, cultural, ethical, political, economic, and other issues.
Focusing and constraint of the task objective. Discussion of the limitations and delimitations of the project. Includes the situations, thought, rationale, etc. that lead to the limitations, delimitations, assumptions, etc.	2	



Statement of the R&D objective.	2	
<b>Hypothesis:</b> What change do we think will close the problem gap?		
Problem solving method used to determine what to develop, to determine what the solution or D should be (this is not the method to create the D).	2	
Mechanisms of the task, i.e., the equipment, instruments, and other apparatuses used to accomplish the R&D objective.	2	
Procedures used to accomplish the R&D objective. Includes procedures to make the D.	4	
Governing propositions, i.e., the summary categorization and discussion of the conditions, factors, exclusions, limitations, parameters, etc. of the R&D by which the validity of the R&D results and recommendations can be judged. In short, all the things that are important considerations for this project.	4	
Performance measures (translated from the performance criteria), i.e., by what means will the results of the R&D be measured to evaluate the project (to decide if the objective is met and the problem is solved)?	4	
<b>Synthesis:</b> Testing and measuring the problem gap after the change? Solution and experimental design to include the following.		
The procedural steps used to implement the solution, i.e., what to do to see if the objective has been met (this is broader than experimental design).	2	
Experimental design, i.e., the methods to acquire data to measure the <i>goodness</i> of the solution; to test the development. Includes threats to external and internal validity, control of bias, data measurement and recording, sampling procedures, any statistical concerns (e.g., Type I and II error), and other methodology concerns as appropriate to the methods used.	4	
Equipment, facilities, raters and other personnel used in the experiment or test.	4	
Description of experimentation, e.g., the conducting of the experiment or test.	2	
Results of the experiment or test.	4	
<b>Validation:</b> How is the problem gap now; do we still have a problem?		
Discussion of the extent to which the objective of the task has been achieved, i.e., an evaluation of the values of the performance measures compared to the desired values. In other words, what is the problem gap now. Includes discussion of apparent, statistical, and practical differences as applicable. The discussion judges goodness of the solution to solving the problem.	4	

Conclusions. The conclusion explores the generalizability, usefulness, and likely impact of the development and other results. The conclusion can include informal insights and observations garnered during the project.	4	Societal and cultural issues. Economic, environmental, etc. impacts. Ethical, legal and personal implications. Stewardship and citizenship conclusions.
Reflection. Discussion and reflection upon the project's costs/benefits, pros/cons, and other factors in light other societal problems and issues.	4	
<b>Recommendations</b> , e.g., for other projects, about scholarship or technology, about management or funding, what the researcher would do different next time, etc.	2	
<b>Appendices</b>		
A standard appendix shall be a log of activities to complete the entire R&D project.	2	
Other appendices, attachments, and artifacts as appropriate.	2	
<b>Optional Index</b> (extra credit)	2	
<b>Other project and report elements</b>		
Quality of photographs, drawings, and other graphics.	2	
Spelling, grammar, & punctuation (2 pts. off for each mistake to a maximum of 6 points).	6	
APA style (2 pts. off for each mistake to a maximum of 6 points).	6	
Adherence to report format and order. Includes using appropriate headings.	4	
Evidence of creating the D. This can take many forms and may be accomplished via other parts of the paper. The student must provide evidence (via documents, photographs, supervisor/professor statements, etc.) that the student did their R&D work (including developing the thing); not doing so is an automatic zero for the R&D project.	10	
Originality and academic honesty. To earn the 10 points here you must have properly quoted, cited, and paraphrased and have a 10% Turnitin score or less (excluding quotes and bibliography/references option).	10	
Total	140	

## Course Essays

The course essays are 1-2 page papers to be used as the basis for a class discussion of that topic. The essay and the discussion are evaluated. The essay-discussions require critically reading and evaluating information, written and interpersonal communication, and the student reflecting upon the topic across contexts, e.g., cultural or historical.

### Summary of the Relationship of Course Essays to Ways of Knowing

Essay	Ways of Knowing and other FS Issues
<b>Interview</b> (Interview a professional with 20+ years of experience to investigate their and their profession's role with technology, research, and development; also the interviewee's perspectives concerning economics, law, ethics, etc. related to R&D)	Perspectives and cultural diversity. Critically evaluate the ideas of others.
<b>Impetus</b> (Why R&D, what are the drivers, what's the impetus, push vs pull, who is in charge?)	Cultural, global, legal, and other contextual.
<b>History</b> (Select a foundational artifact/object/thing and describe why it is foundational, why and how it was researched and developed, what has spun off from that original development, what is forecast for the future)	Historical context and current and future implications for diverse cultural groups.
<b>Economics</b> (How is R&D funded; how much time and money is spent on R&D)	The cost-benefit, risk analysis, and economic issues melded with the above.
<b>Philosophy &amp; Ethics</b> (Different philosophies applied to judging the ethics of R&D, what has been developed that should and should not have been, what is being developed that should and should not be, also the should questions, e.g., how should R&D dollars be spent, who should be in charge, who should pay, etc.)	Global perspectives and cultural diversity. Legal and ethical issues. Social responsibility.

Fall 2013 Schedule TMGT 421 R&D in Technology		
Deadline <sup>i</sup> (Week of)	Assignments and Activities <sup>ii</sup>	Reading, <sup>iii</sup> Quizzes, <sup>iv</sup> and PowerPoints <sup>v</sup>
Aug 20	Log onto the course site and complete Assignment A - Getting Started. Read the instructions and overview of the R&D project. <sup>vi</sup>	Getting Started Quiz Ch. 1 <sup>vii</sup> & 2
Aug 27	Discuss potential projects with the instructor. This is done in class for on campus sections. Distance students must call the instructor if at all possible (otherwise email).	Ch. 3 & 4
Sep 3	Interview Essay	Ch. 5
Sep 10	1 - R&D Project Identification Analysis Assignment. Discuss your project idea with the instructor before you submit anything (see previous instructions)	Ch. 6
Sep 17	Impetus Essay	Ch. 7
Sep 24	2 - R&D Proposal	Ch. 8
Oct 1	Just because nothing is due doesn't mean you don't have to come to class!	Ch. 9
Oct 8	History Essay	Ch. 10
Oct 15	3 - R&D Plan & develop solution progress check	Ch. 11
Oct 22	Economics Essay	
Oct 29	4 - R&D Solution implementation, testing, & validation progress check	Ch. 12
Nov 5	Philosophy and Ethics Essay	
Nov 12	5 - R&D submit draft of report to Turnitin	Ch. 13
Nov 19	6 - R&D submit final version of report to Turnitin	
Nov 25-29	Fall break	
Dec 3	7 - R&D Poster and presentation of project	
Dec 6	Quizzes shut off All follow-up discussion completed	
Finals Week	The course has no final exam but students must attend class during the final exam period, Tue. Dec 10, 10a.	
Evaluate class after it is over using on-line instrument.		

Read the endnotes that follow.

August 09, 2013

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i. I used to call this a due date (*due* means *deadline to submit*, not assigned, not *do*. I hope *dead line* more clearly describes that whatever is called for must be done before this deadline. Note, that late work will not be graded. Activity to accomplish the assignment and meet the deadline must necessarily take place before the deadline. See the syllabus supplement for more about deadlines, grading, and other rules and issues.

For on-campus students, unless stated otherwise, the deadline for work that has to be submitted is **the beginning of class for the date listed**. Lecture, discussion, and other activities take place across all scheduled class days that week.

For web students, unless stated otherwise, the deadline for work that has to be submitted is **midnight of the date listed** (the end of the day listed). Reading, viewing slide shows, and other activities that are substituted in lieu of live discussion must be accomplished before work is submitted.

The student may have to perform and submit work in advance of a due date to accommodate work, school, or other commitments. See the syllabus and assignment instructions for details on submitting work. Each one of the assignments in this class will take you 10 or more hours to complete. Please don't wait until the day or weekend before they are due to work on them. You need to spread the work out to learn the most.

Most things you can do early to accommodate work, home, etc. schedules. Late work is not evaluated.

ii. For on-campus sections, various documents at the course site, including slide shows, will be used or referred to in class, e.g., as part of a lecture or discussion. On campus students can refer to these materials more in-depth out of class.

Web students need to read all the materials tied to an assignment and search for other pertinent materials at the course site or on the web. On-campus students should not be passive learners, e.g., merely show up for class and half-way participate in discussion. Web student cannot be passive learners; they have to actively follow the instructions and all that entails or they will do poorly in the class.

iii. There is no doubt that it would be ideal to have read and completely understand the R&D book before doing any assignments. For many students' schedules this is unrealistic. This is a high reading-level book and takes significant time to read. The best advice I have is to try to read about 100 pages a week. I would read the whole book in order, jumping ahead if I had to for certain assignments. We are not going to cover any math in the book so you can read those parts with less vigor.

Don't forget about the course documents area as a source of information, e.g., there is content there that is just as important as the text book. I am not going to tell you every page and document to read at the course documents area. Use your judgment to read what you need to when you need to (this assumes you know what is there).

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iv. There is a quiz for every chapter in the R&D text. The quizzes are best taken in conjunction with reading the chapter. There is no one best strategy about quizzes. Some students like to take the quiz first, then read the chapter, then take the quiz again. It is up to you to find what helps you learn best. One thing that will not work well is to wait until the latter part of the semester to take quizzes.

There is no quiz deadline except that the quizzes will be shut off at the end of study week. However, it is best to take a quiz shortly after reading that chapter in the book.

v. Note that there are PowerPoint slides at the course documents area based on the text book chapters. By themselves, they will not teach you much but they can organize your thinking and help you take notes. Various slide shows are also tied to some assignments. For on-campus students, the slide shows will be used in class as part of lecture-discussion. Distance students need to do view these slides and read other documents on their own.

vi. For on or off-campus students, it is important to understand the requirements of the course and the project; if the student wants to drop the course, they need to do so before the drop/add period is over.

vii. Read everything up to and including chapter 1 in the text book. View the associated slides found in the Course Documents area. Take the associated quiz.