Applying Research-Based Principles and Theory to Practice: The redesign of a graduate student instructor seminar

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Abstract

What do Graduate Student Instructors (GSI) expect from a seminar course on teaching and learning? The instructor of such a seminar, that prepares engineering GSIs to teach at a the Pennsylvania State University College of Engineering, asks this of GSIs during the first week of the each semester. The answers are always very similar. The GSIs want to know the "nuts and bolts", how to prepare for class, how to manage the variety of tasks, grading and feedback, how to motivate students, how to assess learning, how to answer students questions, what to do about cheating and how to teaching to a variety of learners. The instructor believes that in order for the GSIs to be holistically prepared, the practice of teaching should be taught concurrently with pedagogical theory. The challenge is to make this connection real and practical for the GSIs during 8 class meetings. The instructor decided to redesign the class to teach theory and practice concurrently. Students attend a 2 hour class meeting for the first 7 weeks of the semester and concurrently they are observed teaching by the instructor and a peer for the remaining 8 weeks of the semester. The seminar sessions involved discussion from selected chapters of the text book, a lecture on a teaching issue and an in-class activity. The textbook takes an evidence-based approach to teaching and learning, combining research evidence with practical advice. Graduate student instructors will use this book to help them understand the theory and practice of teaching in a format that is practical and applicable to them.

The graduate student seminar is a one credit course that meets for the first 8 weeks of the semester in a two hour class session. The remainder of the semester involves teaching observations by the instructor and by a peer with the class reconvening during the final week of the semester. Each of the class sessions focuses on a teaching and learning topic, 1) the first week of class – setting the tone, 2) understanding your students, 3) strategic course planning and objectives, 4) instructional methods and appropriate assessments, 5) active learning techniques, 6) multicultural awareness and ethics, and 7) peer learning techniques, practice and feedback. The instructor blended instruction each week to focus on one topic that complemented a chapter from the text book. The seven chapters of the book represent research-based principles around these key points, 1) prior knowledge, 2) organization of knowledge, 3) motivation, 4) development of mastery, 5) practice and feedback, 6) student development and course climate, and 7) self-directed learning. Each class meeting focused on one of the seven principles. Each two hour class meeting consists of presentation on a practical topic, such as, knowing your students, followed by a student-centered discussion on a complimentary chapter from the book, such as, student development and climate. The students do the reading prior to coming to class.

This paper will describe the redesign of a graduate student instructor seminar. The author will describe the experience and motive using student comments and survey data on perceptions of the course. Those who work in graduate teacher training and graduate student development may be interested in this paper.

Introduction

Many universities and colleges provide teacher training for graduate teaching assistants (GTAs). The GTAs play an important role as instructors, lecturers, laboratory and recitation teachers, graders, tutors, proctoring exams and grading homeworks. An Internet search on training manuals or programs will bring up dozens of these teaching tools for GTAs, suggesting that there are a variety of methods and strategies to prepare graduate students to teach, from one-day seminars to credit courses to online training modules, most are customized to the specific needs of college or program. Obviously many of the training programs cover similar topics, such as knowing the students, lecture and presentation skills, preparing course materials, grading, academic integrity, active learning, and assessment. However understanding pedagogy and educational theory are not as common among the topics. Many programs address the important need of what to teach, however they often lack teaching the pedagogy, theory and self-efficacy, that is to say the confidence in the capability to teach. Bandura states that self-efficacy as "the belief in one's capabilities to organize and execute the course of actions required to manage prospective situations."[1] A GTA in this course will learn pedagogy and teaching skills concurrently. The course activities include peer observations, microteaching, observations by the instructor which include a video capture of the student teaching, and reflective papers. The student skills acquired are practice and feedback, reflecting on one's own abilities and experiences, course design (writing learning objectives, selecting appropriate methods and assessments, grading), and communicating with students. Research on the effectiveness of video feedback as a training component indicates that it is effective in improving instructional quality.[2]

The learning experience for GTAs being trained to teach provides learning of the skills necessary to be successful in classroom delivery. However, knowledge of pedagogy coupled with theory provides a holistic experience for the GTAs. Learning to teach encompasses pedagogy, theory and practice. In addition, the self-efficacy of the GTA is an important component of measurement of the GTAs performance. Do the GTAs believe that they are confident and capable in their teaching practice? How does self-efficacy manifest in the GTAs teaching? The sense of efficacy is a judgment about capabilities to influence student engagement and learning, even among those students who may be difficult to motivate"[1] this can be measured in GTA training by survey and observation. Early teaching experiences can have a great impact on a GTAs efficacy in teaching as he/she moves forward. "If these new experiences are positive, GTAs will be better prepared to face disappointments and challenges."[3] The author acknowledges that the current survey does not specifically address self-efficacy. For the next offering of the course, Fall 2014, a self-efficacy survey will be included in the assessment based up Bandura's Guide for Construction Self-efficacy Scale.[4]

The course incorporates a peer learning assignment where student are required to observe a peer teacher in his/her actual classroom teaching. "One of the most effective ways that students can learn is collaborating with a peer."[5] The peer learning assignment gives the GTA an opportunity to practice observation and giving and receiving feedback. A review of the research indicates that learning a skill requires that the learner 1)"needs to remember the key components of the skill to guide their performance; 2) important to learning a skill is the

opportunity to practice and receive feedback on their performance; 3) learn to observe and modify their own learning."[6]

A GTA training seminar usually is a "just-in-time" endeavor and GTAs prefer to have this "just-in-approach". What do I as a GTA need to know in order to teach now? The incorporation of understanding instructional pedagogy gives GTAs a deeper sense of what skills and knowledge one must have to teach successfully. A study by Feldon shows that teaching actually boosts the research skills. Graduate students who taught concurrently with doing research saw an improvement in their research skills (Feldon). [7] The catch is that the graduate student instructor, while helping undergraduates think through problems helps to hone the graduate students' deductive skills (Feldon)[8]. Teacher training which incorporates a pedagogical component can provide a deeper understanding of the craft of teaching. As such the pedagogical knowledge and skills of a GTA becomes more critical given the importance of quality instruction of undergraduates regarding issues of retention in their engineering programs (Cho). [9] Shannon, Twale and Moore showed that GTAs with the most comprehensive training in pedagogical methods were rated as more effective than GTAs without pedagogical training[10]. Currently universities are addressing ways to prepare engineering GTAs, contrasting "how to teach" versus "what to teach" approaches. Courses focusing on pedagogy within engineering are desired.[11]

The course culture is a community of learners and practitioners where the GTAs have a safe environment to share their successes and challenges as they begin their first time teaching assignments. Each class session begins with a conversation where students are asked to share their teaching experiences from the previous week. The GTAs learn from their peers that their classroom teaching experiences can be very similar. Crede, Borrego and McNair in their study on "Community of Practice Theory suggests that community creates a social fabric of learning, and fosters interactions and relationships."[12]

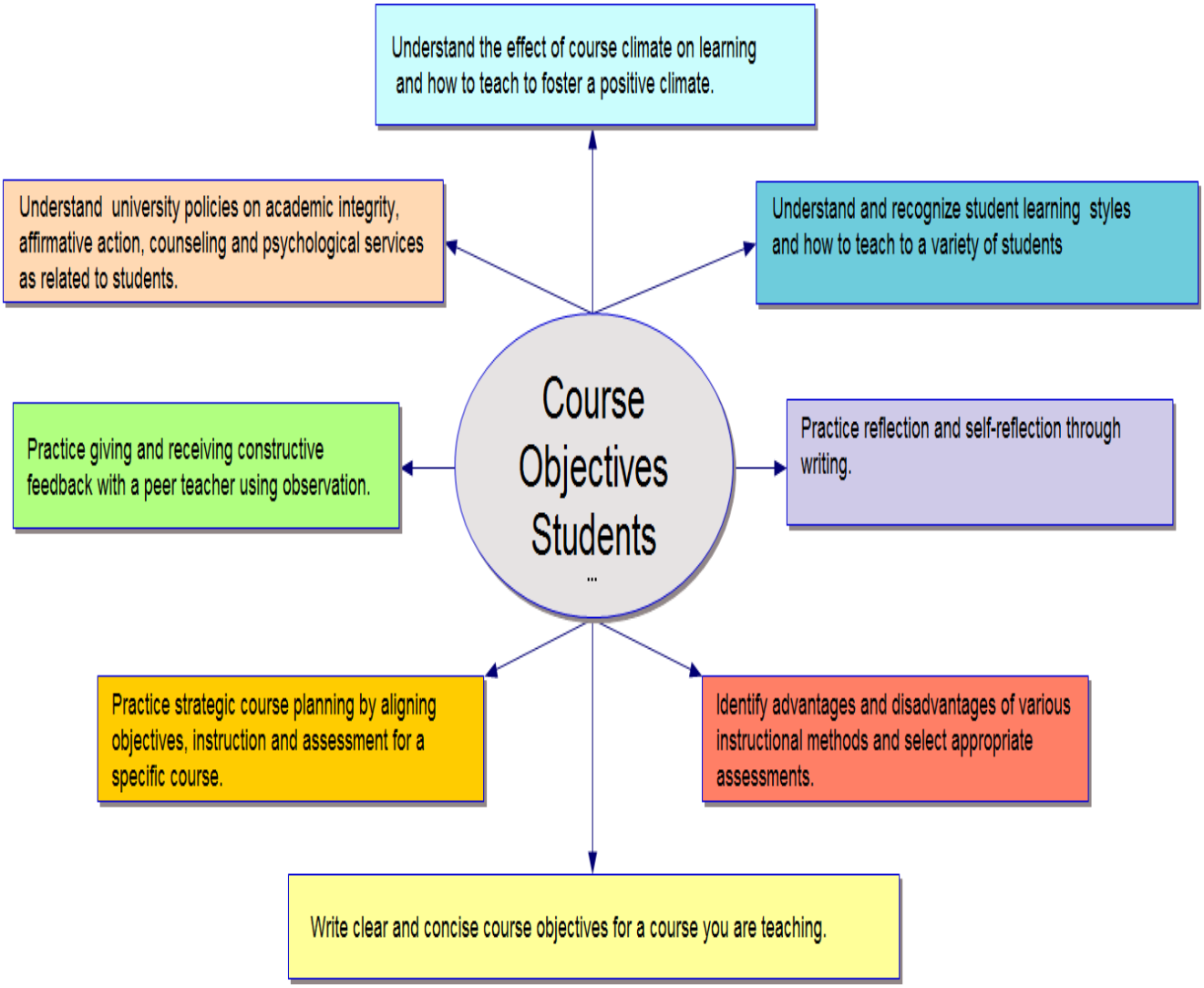
Course Context

The Seminar for Teaching Assistants in Engineering is required by the college for all graduate teaching assistants who are first-time teachers of a lecture, lab or recitation course. Students typically enroll in this seminar during the semester of their first teaching assignment so the two are done concurrently. The instructor of the seminar has the opportunity to coach as well as teach the pedagogy and practice of teaching and learning. The seminar is a one-credit course that meets for the first 7 weeks of the semester in a two-hour class session per week. The remainder of the semester is comprised of teaching observations by the instructor and peer observers. The class reconvenes during the final week of the semester. After teaching this course for 10 consecutive semesters, in the fall and spring of each year, the instructor made changes and adapted the seminar to what she believed would involve the students in the practice of and reflection on teaching. There were many readings but no specific textbook for the seminar. The instructor would recommend a teaching engineering text that was accessible online only through the university library. Although this text was relevant, it was dated in style and format. After searching a variety of possible books on teaching tips and learning to teach the instructor settled on the book "How Learning Works: 7 Research-based Principles for Smart Teaching" and decided to adopt this book for the GTA seminar.

Course Objectives

Each of the class sessions focuses on a teaching and learning topic, 1) setting the tone - class climate, 2) understanding your students - who are your students?, 3) how students learn; teaching culturally diverse students, 4) motivation, 5) strategic course planning - learning objectives, 6) instructional methods, 7) assessment of learning, peer learning techniques, practice and feedback, and 8) teaching ethics and ethical teaching. The instructor wanted to maintain these topics, so to make the use of the book valuable; the instructor redesigned the course to match a chapter with a topic. The course is divided into three themes, "Knowing Your Students", "Pedagogy – objectives, methods and Assessments", and "Teaching Practice and Feedback". The syllabus was redesigned utilizing a graphic syllabus and outcomes map approach (Nilson)[13].

Figure 1: Course objectives outcomes map. Students will:



Each class meeting focused on one of the seven principles. The seven chapters of the book represent the research-based principles around these key points, 1) prior knowledge, 2)

organization of knowledge, 3) motivation, 4) development of mastery, 5) practice and feedback, 6) student development and course climate, and 7) self-directed learning. Each two-hour class meeting consists of a presentation on a practical topic, such as, "knowing your students", followed by a student-centered discussion on a complimentary chapter from the book, such as, "student development and climate". The students do the reading prior to coming to class; and form discussion groups for the book discussion. The instructor assigns one of the two scenarios from the chapter to each group. One student in each group is selected to take notes and one student is selected to graphically map the discussion. The student facilitators are selected during the class session and there is a different student selected each week. The students are not told in advance who will be the discussion scripters and mappers. After the discussion, the instructor proceeds with a lecture/presentation and a related activity, this may be a role-play, an in-class reading with discussion, a debate or a think-pair-share problem solving activity. The two-hour class structure is described in Table 1. In addition to the formal class meetings the students who are teaching are observed once by the instructor and once by a peer teacher during their regularly scheduled class. This is ongoing throughout the semester. For the students who currently are not teaching a microteaching session is scheduled as an added class session. This gives the microteachers an opportunity to plan and conduct a class session on a topic related to their research and receive feedback from their peers.

Table 1 – Class structure

15 minutes	Class announcements and discussion on previous week's experiences in the course that you teach
45 minutes	Student-centered discussion in groups on the chapter for the week.
5 minutes	break
50- 60 minutes	Lecture/presentation on topic for the week and related class activity. End with wrap up and questions.

Course Assignments

- Reflection 1- cover letter for a TA position
- Reflection 2- textbook critique
- Pedagogy- writing objectives, methods and appropriate assessments
- Teaching Observation Reactionary Paper
- Peer Observation Project Final Paper

Textbook

How Learning Works consists of an introduction and seven chapters (one for each of the 7 principles), supplemental figures, tables and exhibits. The instructor applies the chapters as they are relevant to the weekly course topic. The chapters are not meant to be used sequentially, meaning that chapter one does not have to be read first. "Because all of these principles combine to influence learning, no one principle stands alone…the chapters can be read in any

order"[14]. The instructor of the course uses the introduction section reading as a warm up activity during the first class meeting. This gives the students an opportunity to experience the group discussion technique and learn what will be expected of them in each class session throughout the semester. The "Introduction: Bridging Learning Research and Teaching Practice" is ideal for an opening discussion on the first day of class. This immediately draws the GTA into the context of the course, which is a primarily activity-based learning environment. The instructor launches this first discussion with the opening quote from the Introduction, "Learning results from what the student does and thinks and only from what the student does and thinks. The teacher can advance learning only by influencing what the student does to learn."[15]. This is appropriate and relevant because the first three class meetings focus on knowing the student and understanding your audience. The tone is then set for the entire semester.

Each chapter of the book is consistent of the same style and format. Each begins with two real world scenarios that occurred in a classroom teaching experience; a question "what is going on in these two stories?" identification of the principle that is represented in the story; a segment on "what the research tells us about the specific principle"; and "what strategies does the research suggest?"[16]. The appendix section offers examples of instructional assessment techniques that can be used in conjunction with a chapter as a teaching strategy, such as "what are concept maps and how can we use them?"[17].

The Seven Principles, chapters 1-7[18]. The underlined words represent the related topics used in the class sessions.

1. How Does Students' Prior Knowledge Affect Their Learning?
2. How Does the Way Students Organize Knowledge Affect Their Learning?
3. What Factors Motivate Students to Learn?
4. How Do Students Develop Mastery?
5. What Kinds of Practice and Feedback Enhance Learning?
6. Why Do Student Development and Course Climate Matter for Student Learning?
7. How Do Students Become Self-Directed Learners?

Figure 2 represents the main topics per week (see Appendix 1 for the entire graphic syllabus)

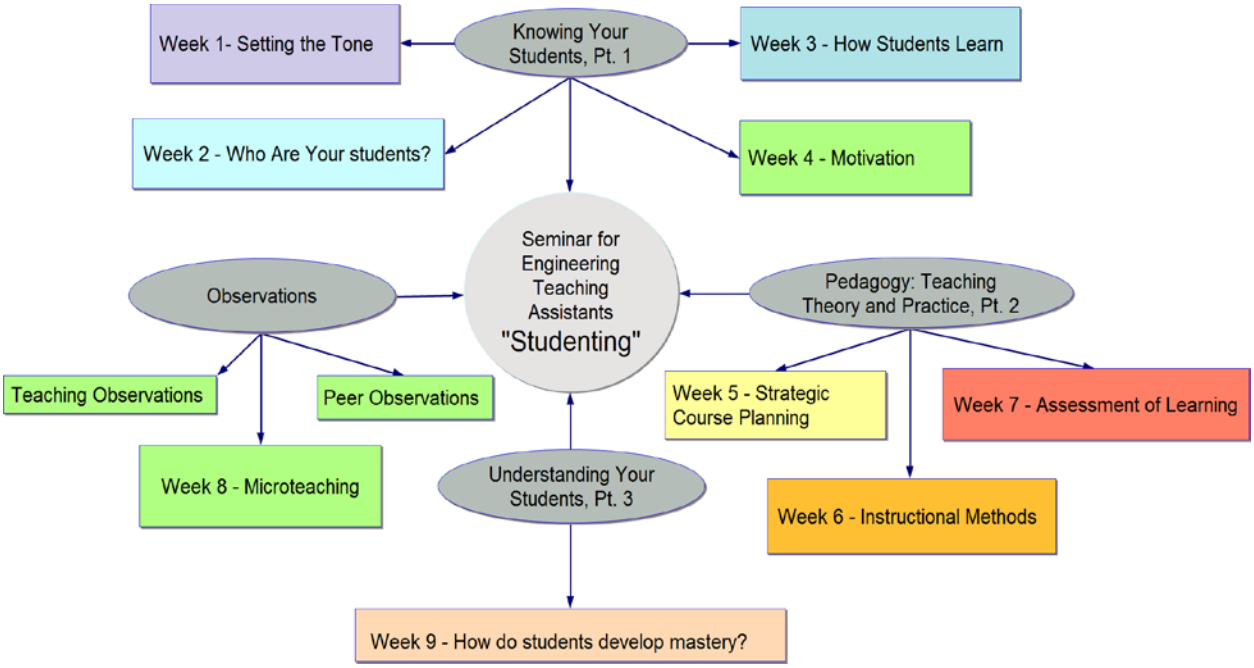


Table 2 represents the weekly class schedule:

Session	General Topics
Week 1	**Setting the Tone: Climate** Discussion on first week of class, academic integrity and ethics Activity: Reflection (read Introduction) Reading Assignment: Ambrose Ch. 6 Assignment: R1 –Cover Letter for TA Position
Week 2	**Who are your students? They are not you!** Discussion: Ch. 6 "Climate" Activity: University Services case studies Reading Assignment: Ambrose, Ch. 1
Week 3	**How Students Learn** ANGEL Q & A: Guest speaker; Discussion Ch. 1 "Prior Knowledge" Activity: Learning Styles cases Reading assignment: Ambrose, Ch. 3 Reading assignment: "Teaching Culturally Diverse Students"[19]

Week 4	**Motivation** Discussion Ch. 3 "Motivate Students" Activity: Observations logistics Reading Assignment: Ambrose, Ch. 7 Reading Assignment: "Backward Design?"
Week 5	**Strategic Course Planning** Discussion Ch. 7 "Self-Directed Learning" Activity: Writing Learning Objectives Reading Assignment: Ambrose, Ch. 2
Week 6	**Instructional Methods** Discussion: Ch. 2 "Organize Knowledge" Activity: Academic Integrity cases; teaching methods – active learning Reading Assignment: Ambrose, Ch. 5
Week 7	**Assessment of learning** Discussion: Ch. 5 "Practice and Feedback" Activity: Debate on multiple choice tests; assessment methods Reading Assignment: Ambrose, Ch. 4 Reading Assignment: "Giving Feedback to a Peer"
Week 8	**Microteaching presentations**
Week 9	**How do students develop mastery?** Discussion: Ch. 4 "Mastery" Activity: "Ethics of Teaching and the Teaching of Ethics"[20] Discussion

Assessment Methods

Participants

The participants were recruited according to the university Office of Research Protections requirements for human subjects in social science research. Consent was done during a class session. All three sections of the course consented and participated in the study totaling 33 participants. Of the 33 participants, 15 were from the United States (14 male, 1 female); 5 were from India (all male); 4 were from Iran (3 male, 1 female); 5 were from China (all male); 2 were from Iraq (all male); one female student from Taiwan and one male student from South Korea.

The instructor used formative assessment collecting quantitative and qualitative evidence. To collect data on student's perceptions of the course the instructor used a post course survey that focused on students' perceptions at the end of the semester. A mid-semester course evaluation survey was used to do a mid-semester check on course content and climate. Was the course helping the students meet their initial expectations to learn how to teach? The end of the semester course evaluations and a survey of open-ended questions assessed students'

perceptions of the course structure, content and text book. The final reflection assignment required that students write a review of the book from their perspective as a new instructor or someone who may be teaching in the future. The author acknowledges that the survey had limitations as it assessed the basic elements of the course. As data is collected in future offerings of the course, the author intends to assess deeper attitudes of the students. Survey items will be added that ask students how they applied the course content to their teaching, did the course improve the students' self-efficacy of teaching, and the peer learning experience.

Assessments

Post course survey (formative) 22 participants volunteered and completed this survey. (See Appendix 2 for items and statistical analysis). In the post course survey, when asked, "What about this course was most helpful for your learning?" Students stated "the observations", "the feedback and other opinions in the discussions", "peer/instructor evaluations", "the organized materials covered by the text book and the explanatory discussions; also the participation based way of teaching". In addition, being observed, the text book and the feedback were mentioned frequently. A student responded, "How interactive it was, because of this, you were able to get a lot of different feedback from many different avenues".

When asked, "What suggestions do you have to improve this course for future students?" several students felt that the focus for discussions should address engineering teaching examples. They felt this would contribute to the relevance of the discussions. Some students had trouble recognizing the teaching examples outside of the context of engineering topics. One student noted, "targeting engineering teaching, I believe that specific topics or distinct aspects of teaching in engineering disciplines should be covered a little bit more."

Mid-semester evaluation (formative) 15 participants completed this survey. Regarding the overall rating of the course 60% of the students agreed and 26.7 % of the students strongly agreed that the overall rating of the course was good. For the item, "my overall rating of the instructor is favorable", 13. 3% of the participants responded Neutral; 46.7% responded Agree; and 40.0% responded Strongly Agree. The results of this survey helped the instructor to evaluate the progress of the course at mid-semester. (See Appendix 3 for question items and statistical analysis).

Post course reflection assignment book review on text (formative) was submitted by 33 participants. This assignment was used as the primary measurement tool regarding the students' perceptions of the utility of using the text book for the course. Was this valuable to the students learning and did it supplement the course content? The purpose of the assignment was for students to reflect on how the text book for the course was helpful to each one personally as a new instructor or GTA. The instructor used the assignment as a form of direct assessment and feedback on the course. The students each submitted a 1-2 page paper reviewing the book from their own perspective and experience in using this book in the course as the primary learning tool. From these papers, the instructor wanted to answer three questions 1) "What did the students learn from using the textbook?" 2) "Were the discussions based upon the chapters valuable in the student learning about teaching?" and 3) "What would

the student change, if anything, for how the text is used with future students who take this course?" As the instructor read the student's papers themes and patterns surfaced. Many of the students felt that using the chapters out of sequence was most helpful to their learning. The instructor began with chapter 6, Why Do Student Development and Course Climate Matter for Student Learning? Students shared that these were issues they would never had thought about as they relate to teaching and learning. This was new information for many of the students. One student wrote, "The book covered lots of topics that I didn't even consider as a part of teaching, but are very important to consider in order to be an effective teacher. Some of these topics were course climate, how students organize information and how students become self-directed learners. These topics helped me to think about the entire classroom experience and how it can be modified to create the best conditions possible for learning".

Additionally, the concept of assessing student's prior knowledge was another theme that surfaced quite frequently throughout the papers. This resonated with many of the GTAs. The papers also showed that the GTA appreciated that the 7 principles in the text were based upon theory and research. They recognized the value in associating the principles to theory and practice. A student commented "I appreciated that the book was founded on actual research studies". Most students saw value in the summary at the end of each chapter.

Regarding suggestions for improvement of the use of the text book, the students felt that the discussions should use scenarios from engineering education. One student commented that the lack of examples directly related to engineering caused him to lose attention when reading the chapters. Contrary to this, another student commented that the text book's use of real life scenarios across disciplines were explained in a way that any professor could understand regardless of their discipline.

The major lesson that the instructor learned from the analysis of the qualitative data[21] throughout the student papers was that the students believed the book was an asset to the course. They appreciated that the seven principles were research-based. The GTAs could recognize the issues in the chapters as they would or had occurred in their own teaching and learning experiencing. The context of the book was directly applicable to them and helped them to understand their student audience.

Conclusion/Lessons Learned

The redesign of the GTAs seminar incorporated discussion on theory, evidence from research principles, and application of these principles to teaching practice. With each class session the content from the text book provided the instructor with an opportunity to engage students in regular and formal class discussions. The student discussions were successful in helping the students to think critically about the pedagogy of instruction and to reflect on their own practice. The group conversations were insightful and active. The students willingly provided feedback both formal and anecdotal throughout the semester. For example, students suggested that thought questions be given in advance to keep the discussion focused on the topic for each of the chapters. The students also wanted to see scenarios that were more specific to engineering education. The study will continue to assess the use of text, discussion, and class activities that occur concurrently while the GTAs are being observed in

teaching. The instructor will continue to collect data on The Graduate Teaching Assistant Seminar in future semesters to make comparisons; and provide well-grounded understanding of the experience and perspective of the GTA participants[22].

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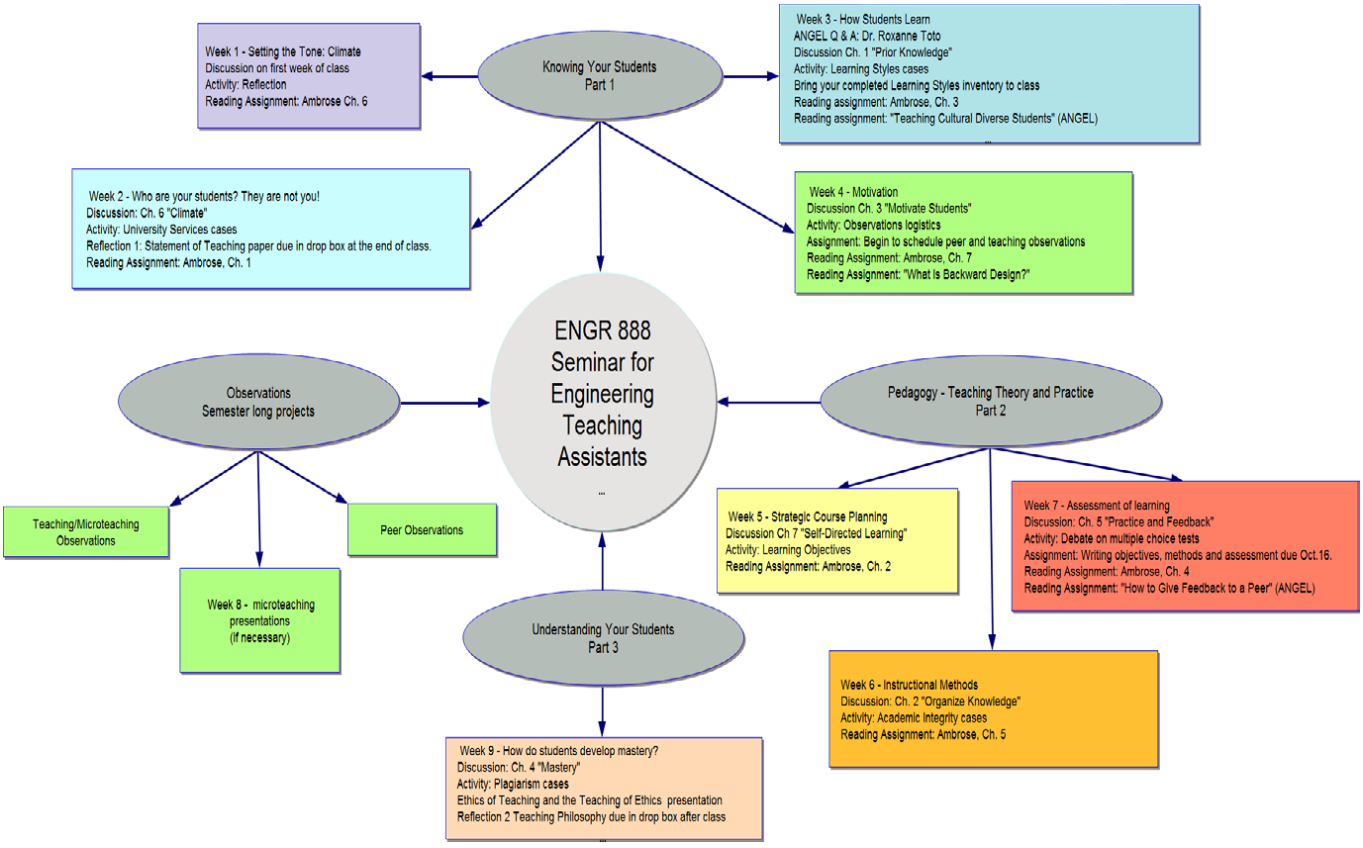
Appendix 1 –The graphic syllabus in detail



Appendix 2 – Post, end of course, survey on student's perceptions of the course

#	Question	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	N	Mean	Standard Deviation
1	The course met my initial expectations.	0	0	1	15	6	22	4.23	0.53
2	The textbook has helped me to better understand the teaching and learning process.	0	0	0	15	7	22	4.32	0.48
3	The textbook is a good match for the course content.	0	0	0	12	10	22	4.45	0.51
4	The chapter discussions in class enhanced my understanding of the lecture content.	0	3	4	5	10	22	4.00	1.11
5	The in class activities were appropriate for my learning.	1	1	3	8	9	22	4.05	1.09
6	The in class activities complimented the readings from the text.	0	0	3	12	6	21	4.14	0.65
7	The course assignments matched the course objectives	0	1	4	12	5	22	3.95	0.79
8	The number of assignments were appropriate for a 1-credit course.	1	6	3	7	5	22	3.41	1.26
9	I am more confident about teaching because of my experience in ENGR 888.	1	0	2	9	10	22	4.23	0.97
10	I would recommend this course to a peer TA.	0	3	3	9	7	22	3.91	1.02
11	The teaching/microteaching observations by the	0	0	2	8	12	22	4.45	0.67

	instructor provided feedback that helped me to improve my teaching.								
12	The peer observation project is an important component of the course.	0	2	3	10	7	22	4.00	0.93
13	The writing course objectives component was useful in my role as a TA.	1	3	7	8	3	22	3.41	1.05
14	I used the syllabus regularly to keep track of assignments and due dates.	1	1	2	9	9	22	4.09	1.06

Appendix 3 – Mid-semester evaluation of teaching effectiveness survey

#	Question	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	N	Mean	Standard Deviation
1	My overall rating of the course is good.	0/0%	1/6.7%	1/6.7%	9/60%	4/26.7%	15	4.1	.772
2	My overall rating of the instructor is favorable.	0/0%	0/0%	2/13.3%	7/46.7%	6/40%	15	4.3	.680
3	The course objectives are clear to me.	0/0%	0/0%	0/0%	7/46.7%	8/53.3%	15	4.5	.499
4	The course objectives are being met.	0/0%	0/0%	1/6.7%	7/46.7%	7/46.7%	15	4.4	.611
5	Material is well organized.	0/0%	1/6.7%	2/13.3%	9/60%	3/20%	15	3.9	.772
6	The method(s) of presenting information in class enhances my learning.	0/0%	1/6.7%	3/20%	6/40%	5/33.3%	15	4.0	.894
7	The pace of the class is appropriate for my learning.	0/0%	0/0%	2/13.3%	9/60%	4/26.7%	15	4.1	.618
8	I am able to ask questions during class in order to clarify understanding of concepts or problems.	0/0%	0/0%	0/0%	4/26.7%	11/73.3%	15	4.7	.442
9	Homework assignments	0/0%	1/6.7%	2/13.3%	7/46.7%	5/33.3%	15	4.1	.854

	help me understand material.								
#									
10	Assessment methods (e.g. tests, projects, assignments) are a fair representation of what we should learn from this course.	0/0%	1/6.7%	0.0%	9/60%	5/33.3%	15	4.2	.748
11	The course resources(e.g. textbook, workbook, or lesson notes, online materials) helps me understand new material.	0/0%	0/0%	1/6.7%	5/33.3%	9/60%	15	4.5	.618
12	The course material is relevant to my future work as an engineer.	1/6.7%	0/0%	3/20%	10/66.7%	1/6.7%	15	3.7	.869
13	There is a good match between the major elements of instruction (i.e. objectives, lessons in class, and assessment).	0/0%	0/0%	1/6.7%	9/60%	5/33.3%	15	4.3	.573
14	The instructor is enthusiastic	0/0%	0/0%	1/6.7%	3/20%	11/73.3%	15	4.7	.596

	and interested in teaching this course.								
15	The instructor has a positive attitude towards students.	0/0%	0/0%	1/6.7%	2/13.3%	12/80%	15	4.7	.573
16	The instructor is available to help during office hours or problem sessions.	0/0%	0/0%	5./33.3%	8/53.3%	2/13.3%	15	3.8	.653
17	New concepts and problem solutions are clearly explained by the instructor at a level students can comprehend.	0/0%	0/0%	2/13.3%	9/60%	4/26.7%	15	4.1	.618
18	The instructor motivated me to understand concepts and problems.	0/0%	1/6.7%	2/13.3%	10/66.7%	4/26.7%	15	3.9	.718
19	The instructor motivated me to learn how to apply new material we learned.	0/0%	1/6.7%	1/6.7%	12/80%	1/6.7%	15	3.9	.618
20	The instructor was always prepared for class.	0/0%	0/0%	0/0%	5/33.3%	10/66.7%	15	4.7	.471