

Adopting ASCE ExCEED Model for Engineering Education: Lessons Learned and Implementation Strategies

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Abstract

The American Society of Civil Engineers (ASCE) Excellence in Civil Engineering Education (ExCEED) Teaching Workshop provides engineering educators with evidence-based teaching strategies and methods. The great majority of participants strongly agree that the information presented at ExCEED can fundamentally improve teaching effectiveness. However, some graduates are hesitant to adopt the ExCEED model and model instructional strategy, either because they are overwhelmed with the amount of information presented in the six-day practicum or because they are afraid that implementing the model could be too time consuming and/or cumbersome. Each author has engaged with the ExCEED in differing capacities (one guru, two assistant mentors, and two recent graduates) and over differing durations (from many years to a few months). The first-hand experience of the authors illustrates the range of participant's response to and implementation of the ExCEED Teaching Workshop. Together, the authors outline short-term and long-term strategies for effective and efficient implementation of the ExCEED model and model instructional strategy, particularly for recent graduates from the ExCEED Teaching Workshop.

Keywords

ASCE ExCEED, Teaching Workshop, Engineering Education

Introduction

Year 2019 marks the beginning of the third decade of The American Society of Civil Engineering's Excellence in Civil Engineering Education (ExCEED) Teaching Workshop. Over the past two decades more than 900 faculty members at major colleges and universities have graduated from the intense six-day long ExCEED Teaching Workshop (ETW). Currently, priority is for early career civil engineering educators to attend the workshop (Estes and Ressler 2001). However, the ETW's evidence-based approach to teaching and most of the workshop content are applicable to virtually any field and may benefit educators at any stage of their career (Riley et. al. 2018). The ETW includes thirteen seminars, three demo classes and five labs as summarized in Table 1 (Welch et. al. 2016). The seminars provide theoretical background and effective strategies related to preparation, delivering, and assessment of a class, as well as communicating and building rapport with students. In the demo classes, highly accomplished educators demonstrate application of the theories and teaching hints presented in the seminars using a model instructional strategy and the ExCEED Teaching Model. Finally, in small group labs, the

participants can practice what they learned and receive feedback from their mentors and peers (Estes et. al. 2005; Estes et. al. 2008).

The great majority of participants strongly agree that the information presented at ExCEED can fundamentally improve teaching effectiveness. However, some graduates are hesitant to adopt the ExCEED model and model instructional strategy, either because they are overwhelmed with the amount of information presented in the six-day practicum or because they are afraid that implementing the model could be too time consuming and/or cumbersome. The authors of this paper have engaged with the ExCEED in differing capacities and over different durations (Table 2). This reflection on the ExCEED experience highlights the challenges faced in implementing ExCEED model and describes how ExCEED has affected teaching effectiveness as measured by student feedback and evaluation of instruction. Ultimately, an outline of short-term and long-term strategies should facilitate an effective and efficient implementation of the ExCEED model and model instructional strategy, particularly for recent graduates from the ExCEED Teaching Workshop.

Table 1: The ExCEED workshop content

Seminars	1. Learning to Teach	8. Communication Skills III - Questioning
	2. Principles of Effective Teaching	9. Teaching Assessment
	3. Learning Styles	10. Developing Interpersonal Rapport with Students
	4. Organizing a Class I: Learning Objectives	11. Communication Skills IV – Nonverbal Communication
	5. Organizing a Class II: Planning a Class	12. Organizing a Class III – Systematic Design of Instruction
	6. Communication Skills I - Writing	13. Making It Work at Your Institution
	7. Communication Skills II - Speaking	
Demo Classes	1. Truss Analysis I	3. Truss Analysis III
	2. Truss Analysis II	
Labs	1. Team Building: Dinner & Ice-Breaker Activity	4. Practice Class Teaching Assessment by Other Participants
	2. Writing Learning Objectives and Preparing for First Practice Class	5. Practice Class Teaching Self-Assessment
	3. Practice Class Teaching Assessment by Mentors	

Impacts of ExCEED on Teaching Effectiveness

Implementing the ExCEED model had positive impacts on teaching effectiveness of all five authors. The range of impact varied based on the teaching style of the respondent before attending ExCEED workshop. Two authors who switched from majority PowerPoint lectures to using more board notes have experienced greatest improvement in students' feedback. For

example, one of the authors received following comments before attending ETW “I felt like [the instructor’s] power points and presentations could have been better organized”, “[The professor] moved extremely fast through the material so it was hard to keep up and understand what was going on.”, and “Notes on board could be better organized”. After the ETW the same instructor received the following comment: “The professor displayed an improvement from previous semesters in communication of material. [The professor] did a better job displaying and properly going through examples to be able [to] help students.” Another author taught four courses in the year before attending ETW and two courses in the semester after ETW to the same group of nine students. A survey of students showed that the students unanimously noticed and liked two significant changes in the instructor’s teaching style: 1) using learning objectives, and 2) using board notes. The authors who used board notes and learning objectives before attending ETW experienced less significant, but steady improvement in their student evaluation as they perfected to the use of the ExCEED model in its entirety.

Table 2: The authors’ experience with ExCEED

Author	Years of Adopting ExCEED	Experience/Roles in ExCEED Workshops
1	< 1	- One Time Participant in a 2-day mini-ExCEED - One Time Participant in ExCEED
2	3	- Taught by ExCEED trained faculty in graduate school - One Time Participant in a 2-day mini-ExCEED - Taught Demo Lecture II at one Mini-ExCEED workshop - One Time Participant in ExCEED - One Time Assistant Mentor at ExCEED
3	4	- One Time Participant in a 2-day mini-ExCEED - One Time Participant in ExCEED - One Time Assistant Mentor at ExCEED
4	2	- One Time Participant in a 2-day mini-ExCEED - One Time Participant in ExCEED
5	28	- Attended the 6-week version at West Point before ExCEED actually existed - Active participant in development of ExCEED - Many times ExCEED Mentor - Created and presented mini-ExCEED workshops

Challenges for Implementing ExCEED Model

Each ETW participant faces unique challenges for implementing the ExCEED model, depending on the topics they teach and their experience as an educator (Retherford and Palomino 2018). In this section, we summarize some of the main challenges that our team faced with for implementing the ExCEED model.

Preparation Time

Based on the common experience of the authors, the initial preparation time for delivering a class in accordance with the ExCEED model was longer than their preparation before implementing ExCEED. The key time-consuming elements of preparation were board note development, practicing the board notes, and creating physical models and visual aids for active-learning in-class activities. One of the authors tried using board notes for all lectures immediately after attending ETW, but after a few trials, gave up on using board notes mainly due to concerns about deviating from the preplanned notes in delivering the lecture. Another author aimed to develop a strong first draft of board notes and drastically improved them the second time he taught the course. The three other authors took a more gradual approach to convert their course material into ExCEED-style color-coded board notes. Experience shows that initial preparation of board notes requires additional time investment, but once all the board notes have been completed, the ExCEED model can significantly reduce time spent on preparation of assignments and assessments and makes it easier to refine the course content and prepare for delivering the content in class.

Class Pacing

Implementing the ExCEED model had a wide variety of impacts on the amount of course content that the authors covered in class. For example, one author, who tends to write slowly, initially found it challenging to cover all planned material in class while writing on the board. On the other hand, one of the authors who speaks fast, realized that writing on the board helped students to better follow the class pace. Though the other three authors did not switch to board notes as primary instruction, the focused learning objectives and organized class notes of the ExCEED model helped them cover more meaningful material.

Technical/Logistics Issues

The most common technical and logistics issues for implementing the ExCEED model was having limited board space. Two of the authors asked their department to change the classroom assigned to a course they teach because the original classroom did not have adequate white board or chalk board space. One author, switched back to PowerPoint lectures for several class sessions until he noticed he could use a different room with more white board space. Another technical challenge was the use of overhead projectors that take long time to warmup and start, which made it difficult in some lectures to switch between supplementary slides or visual aids, and the board notes. Finally, some physical models were not readily available and/or were expensive. For example, one author spent significant amount of his startup funds to buy an Augmented Reality Sand Box to use in his geospatial representation class.

Customizing ExCEED Model to Non-Design Courses

Two of the authors applied the ExCEED model to both dense numerical analysis classes (e.g. statics, mechanics of materials, dynamics) and non-design, discussion-based classes (e.g. Introduction to Civil Engineering, Quality Management, and Project Management). Both authors found it more challenging to implement the ExCEED model when the course is structured as a discussion. Nonetheless, all authors believe the ExCEED model can help with all types of classes,

with the only difference being the amount and type of preparation needed for discussion-based as opposed to engineering and design courses.

Suggestions for Successful Implementation of ExCEED Model

The following suggestions collectively help overcome the challenges faced in implementing the ExCEED model. Table 3 summarizes the short-term and long-term strategies for effective and efficient implementation of the ExCEED model and model instructional strategy, particularly for recent graduates from the ExCEED Teaching Workshop.

Table 3: Suggestions to Overcome the Challenges in Implementing ExCEED Model

Challenge	Suggestions to Overcome the Challenge
Preparation Time	<ul style="list-style-type: none"> - Work on time management - Connect learning objectives, assignments, and assessments - Apply the Law of the Vital Few
Class Pacing	<ul style="list-style-type: none"> - Present content in an irreducible minimum format - Practice speaking and writing simultaneously - Take advantage of the material that is well presented in the textbook
Technical/Logistics Issue	<ul style="list-style-type: none"> - Plan for the use of technology - Ask for technology improvements - Find alternatives
Customizing ExCEED Model to Non-Design Courses	<ul style="list-style-type: none"> - Focus on the default questioning - Appeal to all learning styles

Preparation Time

We suggest three actions to overcome the hurdle of preparation time for implementing ExCEED model:

i) Work on time management: Preparation for ExCEED-style instruction is a “time investment” rather than “time consumption”. While initial preparation of learning objectives, board notes, and physical instructional aids in ExCEED model may take longer than non-ExCEED preparation time, refining the course material and preparation in future iterations of the course in the ExCEED model take substantially less time.

ii) Connect learning objectives with assignments, and assessments: preparing the assignments and assessments in parallel to learning objectives, may help to reduce the amount of time spent for creating and/or refining the assignments and assessments. A good learning objective in the ExCEED model starts with an action verb, therefore, a leaning objective makes an ideal question for homework assignments and exams.

iii) Apply the law of the vital few: Perfection in the use of the ExCEED model may take a long time for recent ETW graduates. We suggest that the ETW graduates should create a strong first draft whenever they teach a course for the first time by adopting a few vital elements of ExCEED model. These few vitals include 1) Lesson learning objectives feeding into course

objectives, 2) board notes to force organization of bite-sized pieces of content, 3) at least one thought provoking question per board, and 4) appealing to all learning styles. The first draft of the course can continually be improved by adding other elements of ExCEED model such as refined/increased questioning and active classroom activities while continuing to cover the same content in an irreducible minimum format, adding one new physical model per instruction block each time it is taught, and improved non-verbal communication.

Class Pacing

We found the following three strategies very effective in improving the class pace using the ExCEED model:

i) Present content in an irreducible minimum format: Board notes considering the irreducible minimum reduces wasted time and allows the instructor to increase his/her interaction with the students to focus on what matters the most.

ii) Practice speaking and writing simultaneously: The extended silence time when an instructor is writing on the board, not only wastes valuable class time, but also may trigger students' distraction. Providing students with supplemental verbal information while the instructor is writing key course notes on the board, significantly improves class efficiency. This strategy particularly helps those educators who tend to write slowly on the board.

iii) Take advantage of the material that is well presented in the textbook: The instructors should find a proper balance between the in-class instruction and activities, and the reading assignments and at home practice by students. In most courses, some material is presented incredibly well in the text. In these cases, problem-based learning methods and a flipped classroom (where students are initially introduced to new topics outside of the classroom) may use class time more efficiently to explore topics in greater depth and create meaningful learning (Bishop and Verleger, 2013).

Technical/Logistics Issue

The following suggestions address some of the technical/logistical challenges for implementing the ExCEED model:

i) Plan for the use of technology: Practice with the classroom technology multiple times prior to a course to ensure it does not detract from the course nor waste valuable class time. Without proper planning and adequate practice, things as simple as switching between white boards and PowerPoint when white/chalkboard is behind the screen, can cause serious disruptions in the class flow, waste time when the transitions do not work as expected and harm teaching effectiveness.

ii) Ask for technology improvements: Work with the department head and/or facilities manager to customize the rooms the ExCEED teach method. Most higher education institutions welcome the improvement of classroom technology if justified.

iii) Find alternatives: Implementing the ExCEED model does not necessarily need sophisticated technology and/or specific classroom conditions. Try to find feasible alternatives to implement the ExCEED model. For example, in a classroom with little or no white/chalk board space and where installing more boards on the walls is not feasible, roll-away boards and sticky easel pads can provide space to deliver board notes. If the overhead projector takes a long time to warm up, plan the class to minimize the number of transitions between screen and board, place a black slide in the slide deck, or use the “AV Mute” feature to write on the white/chalkboard behind the screen.

Customizing ExCEED Model to Non-Design Courses

Two ExCEED techniques are particularly important for successful implementation of the ExCEED model to non-design and discussion-intensive Courses:

i) Focus on the default questioning: The default questioning in ExCEED terminology is a type of questioning in which the instructor asks a question, pauses for a few seconds, and then calls on a student to answer. Proper use of default questioning is particularly important in discussion-intensive courses to keep students engaged and provoke critical thinking. Questioning can pull much if not most of the content from the students while insuring each student is asked question each lesson or at least every other lesson for larger classes.

ii) Appeal to all learning styles: In non-design courses, much of the discussions naturally shape around ideas, insights, and memories presented in the spoken/verbal form. Therefore, the course delivery may be overly focused on intuitive and verbal learning while easily neglecting the sensory and visual learners. Instructors can reach these students through the presentation of pictures, diagrams, graphs, demonstrations, sounds, and physical sensations throughout the discussion, and using the white/chalkboard to outline a bulleted list or sketch concept maps of answers to default type questions.

Concluding Remarks: Breaking Out of Old Habits

The ETW is an extraordinary teaching workshop that has great potential to transform teaching methods in a positive way. The biggest challenge to implementing the ExCEED model is to break away from old habits and personal preferences and keep an open mind to trying new pedagogies in class instruction. The key to success is willingness to change and flexibility to stretch outside established comfort zones. The students’ learning styles differ widely and are typically far different from the professor; the professor should facilitate student learning rather than delivering a lecture in a the most convenient/familiar way for the professor. As a teacher, the faculty member becomes an actor on the stage. As the leader in the classroom, professors must show clear that they care about them students’ learning and success. Almost any effort beyond just lecturing will be well-received by the students even if it does not work as well as intended the first time.

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