

DS 7374 Business Analytics

Welcome to Business Analytics

Welcome to DS 7374, Business Analytics.

Course Overview

Through a combination of lectures and case analyses, students will learn how to practically implement and apply a proven, best practice methodology that illustrates how best to integrate analytics into corporate strategy. In addition, students will gain experience in enabling businesses to solve real-world problems, some of which were previously intractable, using the models, methods, and techniques they have studied previously. Moreover, students will extend their data science capabilities to handle challenges requiring prescriptive analytics through a brief yet thorough two-week introduction to optimization. Students will not only learn from a professor who was formerly the director of analytics for two of America's largest airlines (American and Southwest) but will also gain the experience and expertise described above through a balanced combination of lectures and interviews with several practicing and senior-level data scientists from a variety of industries.

Course Designers

Douglas A. Gray (SMU Cox EMBA '06) is an entrepreneur and executive with 30-plus years of experience as VP and CTO in data and analytics, IT/software, and consulting. He has worked for Fortune 50–500, start-up, and early-stage companies in industries including airlines, travel distribution, financial services, health care insurance, ecommerce, and commercial software. Most recently, he led enterprise data and analytics in technology at Southwest Airlines. Doug's organization at Southwest Airlines won the following industry awards: Teradata EPIC Award (Customer Data Warehouse), Alteryx Best Business ROI Award (2), Drexel LeBow 50 Analytics Award (2) (Fuel Supply Chain Optimization-TOP 5 Designation and Crew Open-Time Forecasting), FICO Decision Management Innovation Award, and AGIFORS Operations Best Innovation Award (Airline Irregular Operations Recovery Optimizer).

Through his own company, Blueprint Technology Advisors, LLC, dba, Optima Analytics, he advises executive leadership teams on best practices of applying technology and analytics to corporate strategy and digital transformation and implementing technology and analytics organizations and capabilities.

As a consulting professional, he has taught executive education seminars in analytics since 2009. He has taught BA6057 Business Analytics at SMU's Cox School of Business EMBA Program since 2016, through which his students' real-world case analysis projects routinely deliver six- to eight-figure (\$M) tangible, measurable business value and economic impact benefits. As of 2018, he is the primary instructor for DS6057 Business Analytics in SMU's MS in Data Science program.

He holds an MBA from SMU's Cox School of Business (Beta Gamma Sigma), an MS in operations research from the Georgia Institute of Technology's Stewart School of Industrial & Systems Engineering (Omega Rho—Qualified), and a BS cum laude in mathematical sciences (statistics) from Loyola University Maryland (Pi Mu Epsilon).

Doug is a recognized analytics expert of the International Institute for Analytics (IIA). He has published several articles and academic papers on analytics applications and been an invited keynote and guest speaker and panel discussion participant at industry conferences and universities worldwide, including Gartner, IIA, Alteryx, SMU, NC State, University of Dallas, and Georgia Tech.

Doug considers himself a “transplanted Texan,” having lived in North Texas for over 20 years. He is married to his wife, Sonja, and has two sons, Nathan and Ryan, and a wheaten terrier–Lhasa apso rescue, Charlie. He lives in Allen.

Course Student Learning Outcomes

Learning outcomes, or learning goals, are what you are able to do as a result of the videos, readings, instruction, course assignments, and other activities that you participate in and complete during this course. The primary learning outcomes of this course are

1. Evaluate business problems and determine appropriate method for analysis
2. Deploy course methods and models, both individually and in concert, to solve complex business problems
3. Present business analysis in a professional environment
4. Describe how and why specific methods are applied in specific industries
5. Identify challenges related to applying Big Data and emerging approaches in industry
6. Assess and use third-party software and data sources used for business analytics
7. Describe the political implications of developing and deploying models for business
8. Be able to apply methods aimed at optimizing systems

This course supports, through its various synchronous, asynchronous, and other activities, broad general learning outcomes that are supported by the Master of Science in Data Science program, including

1. An ability to frame real-world business problems using the methods used in the program thus far
2. An ability to design and conduct experiments that yield relevant and reproducible data
3. An ability to manage and clean data sets
4. An ability to apply knowledge of data analytics to explore and identify relevant information contained within a data set
5. An ability to function on teams using data science tools and technologies
6. An ability to identify, formulate, and solve data science problems based on a fundamental understanding of concepts of data science
7. An ability to communicate effectively both in oral and written form
8. Knowledge of the broad foundational data science education necessary to understand the impact of data science solutions in a global, economic, environmental, and social context
9. Knowledge of contemporary issues in data science
10. An ability to use the techniques, skills, and modern data science tools necessary for data science practice

Course Instruction Using Synchronous and Asynchronous Sessions

The course uses a combination of synchronous class sessions and asynchronous material and activities to teach students the course material and guide them through the learning process. Synchronous class sessions occur once per week during the course of the term. These sessions consist of lectures, discussions, interviews, problem-solving, inclass assignments, and quizzes based on the asynchronous material, including the course video lectures, assigned activities and work, and any readings assigned. It is expected that all asynchronous material will be completed (e.g., videos viewed, assigned readings read, and assigned work completed and turned in) prior to the synchronous session associated with that material.

Course Prerequisite

A student taking DS 7374 must be enrolled in the Master of Science in Data Science program at SMU and must have completed the DS 6372 course with a grade of C– or better.

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Course Textbook and Other Course Material

Thomas H. Davenport, *Competing on Analytics: The New Science of Winning* (with a new introduction) (Harvard Business Review Press, 2017).

Technology Requirements

DS 7374 is a course taught online with both synchronous and asynchronous portions requiring the transfer of video. Students are expected to have access to a computer with reliable, high-speed internet access. Students are expected to have access to a computer with a web camera with the computer capable of running the required software to access the learning management system, read online documents, watch course videos, and participate in the synchronous classes (including being on camera). Students are also expected to have access to a reliable phone connection participate in the synchronous classes.

DS 7374 course utilizes R and/or Python and/or SAS to complete assignments. A local copy of RStudio and knowledge of RMarkdown is assumed.

All students enrolled in SMU have an SMU email account. Notifications from the learning management system and from the course instructor use your SMU email account. Students are encouraged to check this email account regularly.

Course Access

This course is accessible to registered students in the SMU MSDS program only. Course asynchronous material, course information, and course communications occur through the 2DS learning management system. Access to the 2DS learning management system is available at <https://2ds.data science.smu.edu/>.

Students who experience technical issues with the learning management system or the Zoom classroom should contact technical support as described below.

Students will have access to only those courses and course sections in which they are currently enrolled or have been enrolled in previous terms. Access to other sections is at the discretion of the section instructor. Access to recordings of synchronous sections where the student did not participate or was not an enrolled student is prohibited to protect the privacy of the students who do attend and participate.

Communication and Technical Support

Direct communications with the instructor should be made in the manner indicated by the instructor. General questions and questions that are relevant to multiple students—that is, questions that are not specific to an individual and involve that individual's private information—should be posted on the course wall.

Technical support for the learning management system and the online classroom may be reached 24 hours a day, seven days a week via

- *Chat Support:* Click **Live Support** in the lower-right corner of the 2DS screen after logging in to the system to chat with a technical support representative. Chat support generally responds and engages in five minutes or less.
- *Phone:* Students should call 1-844-768-5637 (toll-free) to speak with a technical support representative.
- *Email:* studentsupport@datascience.smu.edu to initiate a support request with a technical support representative.

For other questions or concerns, please contact the appropriate SMU department for your questions or concerns or send an email to datascience@smu.edu.

It is the student's responsibility to ensure that all communications are received or acted upon.

Course Procedures and Policies

This course has a number of policies and procedures that students should understand and follow if appropriate. The following sections present the general course policies and procedures that students must follow. Additional policies and procedures may be given by the instructor. Please discuss as early in the term as possible with the instructor any questions or concerns that you may have regarding the course procedures and policies as defined herein or any additions made by the instructor to the course procedures and policies.

Course Grading Policy

This course consists of a number of assignments and projects that are to be completed throughout the term. Every submitted assignment is graded on a scale of 0–100 and contributes to the cumulative percentage for the course. Individual percentage breakdowns for each type of assignment are below. Questions regarding the grading of any assignments should be directed to the course instructor as soon as possible and in accordance with any regrading policy instituted by the instructor. This course is not graded on a curve. The required cumulative percentage needed to earn each letter grade is given in table 1.

Table 1: Cumulative Percentage Required to Reach Each Letter Grade

Cumulative Percentage	Earned Grade
[100–93]	A
(93–90]	A–
(90–88]	B+
(88–83]	B
(83–80]	B–
(80–78]	C+
(78–73]	C
(73–70]	C–
(70–60]	D
< 60	F

The cumulative percentage for the course is determined by the course assignment components with their corresponding percentages defined in table 2.

Table 2: Grade Components and Weightings of the Cumulative Percentage

Percentage of Cumulative Percentage	Component
10 percent	Asynchronous Video Response Questions and Discussions
30 percent	For Live Session Assignments
10 percent	Project Question
10 percent	Project Framing (DELTA and FACE)
20 percent	Final Project PowerPoint
20 percent	Final Project Presentation (TED Talk)

Asynchronous Video Response Questions and Discussions (10 percent): Throughout the videos are various concept-check questions to make sure the student understands the material before moving on to learn new material. These questions are often in the form of multiple-choice or matching questions. These questions may also be discussion questions in which the student will respond to a prompt and then be able to see all other students' responses after they submit their response. At that point, it is our hope that a discussion will ensue. The student has the option to keep the conversation going by responding to their peers' responses. The instructor will be checking for participation in these discussions and may even participate in the discussion themselves. Given the fact that most of the material in this course builds on the material presented before it, participation in the concept-check questions and the discussions must be completed during the week they are assigned.

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For Live Session Assignments (30 percent): This is really where a lot of the “doing” is done. It is critical to practice using, applying, and interpreting the models presented in this course, and these assignments are a big part of that practice. Each week you will have a list of assignments to complete before the live session. These assignments will be completed and presented in a PowerPoint deck and submitted to the course website. They will be given a completion grade based on the thoroughness of the student’s responses. In addition, the student will present their work to their peers in a breakout session, and the instructor will answer questions, facilitate discussion, and present their solution/approach to the assignment. To get full credit each week, the PowerPoint deck must be completed and submitted to the class website (no later than one hour prior to that live session, verified by time stamp) AND must be presented in the live session. See table 3 below for due dates.

Project Question (10 percent): The student will submit the specific question of interest he or she will be analyzing. This will be written in Word format and submitted on 2DS. This should be no longer than a page, should be written with no typos or grammar mistakes, and should address the following questions/statements:

1. What is/are the central question(s) of interest?
2. Why are these questions of interest important? (Who/what will they affect?)
3. Where will the data come from?
4. Are there any special challenges with respect to the data?

Project Framing (DELTA and FACE) (10 percent): The student will frame the question with DELTA and FACE. No analysis needs to be completed at this stage. The framing shall be completed in Word format and submitted in 2DS.

Final Project PowerPoint Deck (20 percent): The student will submit a PowerPoint deck to 2DS that will fully address the question(s) of interest. The deck should address all the stages of the data science pipeline and should address all challenges encountered in the analysis.

Final Project Presentation (20 percent): The student will record a presentation of the analysis of their question(s) of interest. This will require the student to record a presentation of their PowerPoint presentation (not to exceed 10 minutes) with screen capture software. The presentation must be uploaded to the student’s YouTube account (an account must be created if it does not already exist) and made available for at least one week after the due date of the project.

A course grade of Incomplete (I) will be given only in the case of extraordinary circumstances that prevent the student from finishing the semester. Students must have completed at least 50 percent of the course with a passing grade to be eligible for an Incomplete grade.

Course Synchronous Session Schedule

Table 3: Course Schedule for Each Week of the Course

Week/Unit	Topic	Deliverable	Readings (Complete Before Unit’s Videos)
1	Introduction Business Analytics	Live session assignment 1 due one hour before live session 1	Read: Introduction, chapters 1–3 of <i>Competing on Analytics</i> Watch: <i>Moneyball</i> and <i>The Big Short</i>
2	Methodologies	Live session assignment 2 due one hour before live session 2	Read: Chapters 4, 6, and 7 of <i>Competing on Analytics</i>

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3	Case Studies	Live session assignment 3 due one hour before live session 3	<p>Case Study 1: Target http://www.forbes.com/sites/kashmirhill/2012/02/16/howtarget-figured-out-a-teen-girl-was-pregnant-before-herfather-did/ https://www.nytimes.com/2012/02/19/magazine/shoppinghabits.html?pagewanted=1&_r=1&hp</p> <p>Case Study 2: Amazon http://www.wired.com/2015/10/get-used-to-amazon-being-a-profitable-company/</p> <p>You will also be directed to find an additional article or paper on Amazon to read and research.</p>
4	Airline Analytics	Live session assignment 4 due one hour before live session 4	
5	Predicting On-Time Performance	Live session assignment 5 due one hour before live session 5	
6	Predicting Open Time	Live session assignment 6 due one hour before live session 6	
7	Optimization	Live session assignment 7 due one hour before live session 7	
8	Applications of Optimization	Live session assignment 8 due one hour before live session 8	
9	Health Care Analytics, Part 1	Live session assignment 9 due one hour before live session 9	<p>CIGNA: https://www.cigna.com/assets/docs/employersand-organizations/Collaborative-Care-White-Paper.pdf</p>
10	Health Care Analytics, Part 2	Live session assignment 10 due one hour before live session 10	<p>Logistic regression vs. artificial neural network: <i>This reading is available in the Readings and Resources section of the Toolbox:</i> “Comparison of logistic regression and neural network models . . .”</p> <p>Predicting when a patient will return to work: <i>This reading is available in the Readings and Resources section of the Toolbox:</i> “Return-to-Work Outcomes Among”</p> <p>IBM Watson and health care: https://www.computerworld.com/article/3321138/did-ibm-put-too-much-stock-in-watson-health-too-soon.html</p>

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11	Revenue Management	Live session assignment 11 due one hour before live session 11	Saving Harrah's from bankruptcy: <i>These readings are available in the Readings and Resources section of the Toolbox:</i> “The ‘Killer Application’ of Revenue Management . . .” “Loveman Plays New Game at Harrah’s . . .”
12	H2O.ai	Live session assignment 12 due one hour before live session 12	
13	Big Data and AI	Live session assignment 13 due one hour before live session 13	Read: Chapters 8 and 9 of <i>Competing on Analytics</i>
14	Project Work Week	No deliverables for this week/as usual live session attendance required	
15	Project Presentation	Final project PowerPoint and YouTube presentation due one hour before live session 15	

Grade Grievance Policy

Students are responsible for saving all graded materials as evidence in case of a discrepancy with the assigned grades. Students are responsible for ensuring that all grades are correctly reflected on the grade store. Any identified discrepancies should be brought to the attention of the instructor as soon as the discrepancy is found.

Refer to the university catalogue for the university policy and process for grade grievances.

Assignment and Collaboration Policy

Data science is an inherently collaborative subject, and learning often occurs best when subjects are taught both to and from peers. Collaboration is expected to occur both in learning the course material and in performing the course work. However, each student must hand in their own work performed by themselves unless explicitly allowed by written directions given by the instructor. Collaboration means helping one another learn the material. Collaboration does not mean copying answers from one another. A good process is to ask questions and have discussions in groups and to always write up answers alone.

Assignment submissions that contain substantially the same answers shall receive a grade of zero on the first instance and a course grade of F upon a second instance. In order to mitigate potential issues and questions of similarity, peers with whom a student collaborates should be clearly identified by that student in their submissions.

Scholarly Expectations

Work submitted at the graduate level is expected to demonstrate critical and creative thinking skills and be of significantly higher quality than work produced at the undergraduate level. To achieve this expectation, all students are responsible for giving and receiving peer feedback of their work. Students are also expected to resolve technical issues, be active problem-solvers, and embrace challenges as positive learning opportunities. Data science professionals must be able to teach themselves and teach others to fill in any gaps in their knowledge or to find a way of learning new material that is most conducive to their learning style. Data science professionals must also be able to work cooperatively and collaboratively with others—skills that students are expected to practice in this course. Students are expected to ask questions and ask for help when they need it and to offer help when others are in need.

Absent questions or requests for assistance, instructors must assume that students understand the material being covered and are able to complete the assignments. It is primarily through your questions that the instructor learns where the students are struggling to understand and on which topics more time needs to be spent for the students' benefit.

Timeliness

Because a 15-week term goes by quickly, assignments must be submitted by the designated due dates. Full credit cannot be earned by late or incomplete assignments. Assignments may lose up to 10 percent of their possible value each day late if submitted after the posted due date/time (e.g., assignments can lose all of their value at 10 days past due). When a project incorporates peer review, it is imperative that all projects be available at the beginning of the review period and that reviews are completed by the end of the review period so that others may incorporate feedback into project revisions. You will have plenty of notification and time to complete course assignments. If you know you are going to be out of town, involved in a special event/project, or unable to access a computer, please plan ahead. Also ensure that you have a backup plan ready in the event you lose power, internet access, or your available technology.

Time Commitment

For this technical graduate-level course, it is expected that students will spend between three and four hours beyond course instruction for each hour spent in instruction. MSDS courses are designed to have approximately three hours of course instruction, or contact hours, per week of the course. Therefore, it is expected that students will spend between 12 and 15 hours per week on this course. **IMPORTANT: The prereading for units 1, 2, and 13 are especially large. Moreover, the prereading/watchings for unit 1 are fun but will take an estimated six to eight hours to complete. Because they are for unit 1, it is strongly suggested that students start well before they do the videos for that unit.**

Attendance Policy

Attendance and on-camera participation at the weekly synchronous sessions in this course are mandatory. Students with more than three unexcused absences will receive a final grade of F for this course. It is the student's responsibility to notify the instructor if a synchronous session will be missed for either an excused or unexcused reason at least 24 hours, or as soon as reasonably possible, prior to the synchronous session.

Drop Policy

Refer to the university drop policy for a complete description of the drop and withdrawal policies for this course.

Campus Concealed Carry

Concealed handguns are prohibited on the Southern Methodist University campus. Pursuant to section 30.06, Penal Code (Trespass by License Holder with a Concealed Handgun), a person licensed under subchapter H, chapter 411, Government Code (Handgun License Law), may not enter SMU property with a concealed handgun. Report violations to the Southern Methodist University Police Department by dialing 9-1-1 or 214-768-3388 (nonemergency) or 214-768-3333 (emergency).

Americans with Disabilities Act

Disability Accommodations: Students needing academic accommodations for a disability must first be registered with Disability Accommodations & Success Strategies (DASS) to verify the disability and to establish eligibility for accommodations. Students may call 214-768-1470 or visit <http://www.smu.edu/alec/dass> to begin the process. Once registered, students should then schedule an appointment with the professor to make appropriate arrangements. (See University Policy No. 2.4.)

Religious Observance

Religiously observant students wishing to be absent on holidays that require missing class should notify their professors in writing at the beginning of the semester and should discuss with them, in advance, acceptable ways of making up any work missed because of the absence. (See University Policy No. 1.9.) Failure to notify your professor prior to your absence will result in an unexcused absence and possibly a grade of zero for any assignments.

Excused Absences for University Extracurricular Activities

Students participating in an officially sanctioned, scheduled University extracurricular activity should be given the opportunity to make up class assignments or other graded assignments missed as a result of their participation. It is the responsibility of the student to make arrangements with the instructor prior to any missed scheduled examination or other missed assignment for making up the work.

Academic Integrity

It is the philosophy of Southern Methodist University that academic dishonesty is a completely unacceptable mode of conduct and will not be tolerated in any form. All persons involved in academic dishonesty will be disciplined in accordance with University regulations and procedures. Discipline may include suspension or expulsion from the University.

Scholastic dishonesty includes but is not limited to cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or in part to another person, taking an examination for another person, any act designed to give unfair advantage to a student, or the attempt to commit such acts. Example of academic dishonesty: In this course, students who have taken the course before or students from past cohorts may have the answers to some homework problems. It is considered academically dishonest to share solutions with anyone who is currently taking the course before the instructor posts the solutions for those students. It is also academically dishonest to accept solutions before a student's instructor makes them available. This falls under the category of presenting someone else's work as your own and is not only a serious violation of the SMU Honor Code but severely detrimental to the student's understanding of the material. In general, if it feels the slightest bit wrong, it probably is. The safest thing to do is to consult your instructor with any questions before action is taken.

Students caught being academically dishonest shall receive a grade of F for this course and will be referred to the SMU Honor Council for a hearing and possible sanctions including a three-year mark on the student's transcript or expulsion. On a more positive note, our overwhelmingly main goal is to facilitate and foster each student's educational experience to enable them to achieve their academic and professional goals as a data scientist. Furthermore, these measures are aimed at "protecting your degree" in order to ensure that those with a master of science in data science from SMU have the utmost respect throughout academic and industry fields. This is our passion, and it is an amazing experience when everyone is working together and working hard. Let's get to it!

University Honor Code

When you signed your letter of intent to enroll in the MSDS program, you initialed the following statement:

"I have read and agree to abide by the SMU Honor Code available online at <https://www.smu.edu/StudentAffairs/StudentLife/StudentHandbook/HonorCode>"

The Honor Code is taken seriously at all levels within the university. Students who are found to have violated the honor code will be disciplined, which often includes expulsion from the university.

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Plagiarism

Plagiarism is the “practice of taking someone else’s work or ideas and passing them off as one’s own” (this definition is from Google Dictionary). An example of plagiarism is as follows:

A regression is a statistical analysis assessing the association between two variables. It is used to find the relationship between two variables.

The following is NOT plagiarism:

“A regression is a statistical analysis assessing the association between two variables. It is used to find the relationship between two variables” (<https://www.easycalculation.com/statistics/learn-regression.php>).

The difference is in the punctuation and the attribution. Note that one can self-plagiarize. If you are using something that you wrote (e.g., a blog or a previously published article), please reference yourself.

DO NOT PLAGIARIZE. If you have any question as to what is and what is not plagiarism, ask your instructor. As a general rule, always use your own words and cite your source.

The consequence for being caught plagiarizing is to earn at least a zero on the identified assignment and may include earning a course grade of F and a referral to the SMU Honor Council for your Honor Code violation.

Best Practices for Success in the Course

Attendance. Take responsibility for your commitment. Attendance means not only being there for synchronous sessions but also participating in asynchronous work.

Citizenship. You need to be actively engaged to succeed in this class. Talking on cell phones, texting, “Facebooking,” tweeting, or leisure web browsing are prohibited in class. I consider these a disruption (not to mention rude).

Integrity. A lot of the graded work occurs outside of class, so I expect honesty and integrity in what you submit for evaluation. Evidence of academic dishonesty will minimally result in zeros for all involved parties and perhaps University-level disciplinary action. Don’t risk your career.

Humility. Don’t get lost! Ask questions in class. If something isn’t clear to you, it probably isn’t clear to others either. Questions may arise because I haven’t made a connection clear or have inadvertently left out an important point. Your question gives me a chance to explain more clearly. Don’t be proud or shy.

Organization. Don’t procrastinate! This is a technology-driven course. Count on your computer failing or your wireless connection breaking the night before a due date. Start early, and give yourself a chance to succeed.

Deadlines. You will generally have a week to complete an assignment. Due dates and times will be clearly indicated. Late submissions will be penalized, but it is much better to turn in work late than not at all (or to turn in incomplete/sloppy work). Work turned in after solutions have been posted to the course website will receive no credit.

Getting help. If questions arise while doing assignments/exams, do your best to resolve these questions before the assignment is due, first by taking time to seek answers yourself, next by asking questions on the wall, and finally via email to your instructor or other students. I encourage you and expect you to seek help. For questions during exams, please email the live session instructor directly.

Collaboration. I encourage the formation of study groups and collaboration with your fellow students in tackling the assignments. Working together in groups on homework is permitted, even encouraged. However, every student

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should write up and complete their homework independently. Talking about problems with other people does help in learning, but just copying the solutions from one another doesn't help!

Looks do matter! All assignments must be NEATLY executed and organized. You risk a zero on any assignment submitted in a sloppy manner. See submission guidelines for more detail.

Have fun! Learning is meant to be a fun activity. Although it can be difficult, time consuming, frustrating, and sometimes disappointing, always seek to find the fun in what you are doing and learning. The gratification from learning complex concepts and applying them to solve hard problems is what we are all striving to achieve. Having fun while we are learning and teaching others just makes the learning easier and friendships better.