Esmaeil Nadimi
Mærsk Mc-Kinney Møller Instituttet
SDU Applied AI and Data Science
KI, OUH, CAI-X Centre for Clinical AI (Odense)
E-mail: esi@mmmi.sdu.dk
Telefon: +4565507928

Introduction

The current teaching portfolio is prepared as a developmental process for reflecting on and improving my teaching skills; and as an evaluative product for personnel decisions i.e. tenure. The benefit I expect to gain from this portfolio is to have a different source of evidence of teaching performance.
As a teacher, I have often relied primarily on student evaluations for feedback about my teaching. Although such student reviews contribute important information about teaching performance, they sometimes reflect personal feelings expressed in just a few moments at one of the final classes of a semester. The variety of sources of feedback especially from the mentor in this portfolio provides a more comprehensive view of how I should handle different responsibilities of teaching. By writing this portfolio, I expect to find the opportunity to think about my own teaching, to change priorities or teaching strategies as needed to reflect about future teaching goals and finally enhance my teaching performance.

Teaching Philosophy and goals

Students should derive long-term benefits from their time in my classes by continuing to grow and develop rather than supply students with static facts. I believe that I will serve them better by teaching them how to define a problem, how to decide what they need to solve it, how to find and evaluate new information, how to recognize their limits, and how to be prepared both for change and to change. I prefer to involve the students in a creative thinking process. A difficult teaching issue, but an important aspect of engineering practice, is the ambiguous, uncertain, and sometimes contradictory nature of engineering problems. I continue to learn from experience and from the literature about the dynamics of teaching and about my discipline so I can improve my effectiveness as an instructor.
As mentioned above, the instructing in this context is the process of teaching the students how to define a problem and make the decision regarding the method they need to implement to solve the problem rather than providing them the solution. I believe that acting as an instructor within the defined context promotes creative thinking process and prevents dulling their mind; however it can be really frustrating for the students at the beginning of this journey.
The following eight principles based on the "Belief System" developed by Professor Emeritus R. Mason Bunker provide fundamental structure for me as teacher and a learner [1] and [2]. They support a strategic filter through which I shape my career including courses preparation, advising the students and supervision of master and PhD students, writing and publishing articles and research, and other faculty activities such as examiner of faculty courses. They help maintain my professional direction as they cover most of my needs to form a successful career as an instructor and a researcher. They guide me toward forming a concrete structure for teaching (points 1-8) and a strong block for researching (points 1, 3, 4 and 5).
1.Growth requires time and patience.
2.Teachers must focus on strengths of the students and use positive feedback to help learners grow academically and socially.
3.Critical thinking helps students internalize learning.
4.Structure and shared decision making are significant to the learning process.
5.Success stimulates further success.
6.Teachers must strive to meet learner needs and be keenly aware of social, emotional, and physical variables that affect the learning process.
7.Teachers and learners must value diversity and seek unity in a multicultural nation.
8.All teachers must seek continuous renewal and growth.
My goals in teaching are not just to promote learning of the subject matter. I also try to help the students learn to think logically, learn problem-solving methods and techniques, and improve writing skills (writing clearly and concisely, explaining step-by-step processes, providing valid reasons for logical arguments). In addition, I try to help students see the course material in a holistic context by requiring them to synthesize the various concepts of the course by applying them together. This discipline is always objected and disputed by the students throughout the semester as learning of the subject matter and especially learning to think logically is a long term process which cannot and will not be achieved during the first few classes. This discipline is often disputed by two groups of students with stronger and weaker background, as the students with the stronger background feel frustrated and discouraged when they find out they are not capable of solving the problems they are supposed to which is sort of a new feeling to them. Furthermore, the students with weaker background might easily give up challenging the problem when they feel neither they nor the students with stronger background are capable of solving the problems.
The results of the implication of this discipline, as stated above, will be seen and felt in a long run, and it is crucial to inform the students about that. My strategy to argue why the students need to learn the subject matter and to think logically rather than a set of pure equations is based on presenting real world problems and applications that could only be solved by learning how to think logically. For example, instead of asking them to find the eigenvalues of a matrix (which is pure

boring math that they probably forget at the end of the semester), I provide them a physical system (e.g. a car, a bridge, a piano or etc.) in which studying the property of the introduced system requires calculating the eigenvalues of that system. The success of the implication of this discipline has been acknowledged by my colleagues at the faculty of Engineering (SDU) mentioning that the level of mathematics and the skills toward solving real world applications of these students have a clear difference compared to other students.
My teaching philosophy is aimed at maximizing the learning activity, which includes not only acquiring new or improved knowledge; but also developing skills and strategies for analyzing and solving problems. All learning activities involve some kind of experience or some kind of dialogue [1]. The two main kinds of dialogue are 'Dialogue with Self' (e.g. the student thinks reflectively about a topic) and 'Dialogue with Others' (e.g. the student reads a textbook or listen to a lecture, the teacher creates a small group discussion on a topic). The two main kinds of experience are 'Observing' (e.g. observing the teacher doing something, listening to other professionals perform, or observing the phenomena being studied) and 'Doing' (e.g. the learner actually does something: calculates, designs, conduct an experiment, makes an oral presentation, communication, etc.).

Teaching Responsibilities and Strategies

My teaching responsibilities are focused on the graduate and undergraduate education.
My teaching assignments are centered broadly on mathematics and physics, control system theory and wireless communication (wireless sensor networks). Courses are framed on a knowledge/research base, and I use a blend of lecture, discussion, and problem solving (including hands on sessions in the computer lab) in my classes. Students are actively encouraged to contribute to discussions and learning activities. I base my teaching on the belief that the only way to learn mathematics is to do mathematics. While the process of reading examples and proofs in textbooks and from lecture notes is valuable, the real learning comes through one's own efforts at solving mathematical problems, either computational, theoretical, or both. This is achieved mostly through class assignments, but also through in-class discussions and exercises. I view my role as a facilitator for this process. I must design the framework in which learning can take place, and then stimulate and nurture the students' development, giving help in terms of knowledge, techniques, and encouragement.
My teaching strategy can be summarized in planning, acting on the plans and evaluation of the results and outcome of the course. Using these outcomes and the feedbacks received from the students, I improve the quality of the course, course syllabi, examples and the exam for the next semester. All my classes utilize some form of the Socratic dialogue — a method of argument and proof using a question-and answer approach. Substantial use of videotapes, slides, and computer graphics serves to stimulate discussion. I make frequent use of learning projects in which students are grouped to explore issues. In addition, I designed case studies to use frequently in the foundation courses and the controversial issues course to generate debate and encourage critical thinking skills. These multifaceted case studies focus on contemporary problems to which students can easily relate. Given their rich, diverse backgrounds (i.e. international ERASMUS students); students bring unique perspectives and insights to class which create a fertile environment to explore the various issues represented in the case studies.
Courses taughtI have taught the following undergraduate courses (the first four are key courses):
•Regulation techniques / Control system theory (II) of the chemical processes (9th semester students) 5 ECTS focusing on control system theory and design process of controllers mainly PID and MPC (model predictive controller) controllers
•Regulation techniques / Control system theory (I) of the chemical processes (5th semester students) 5 ECTS focusing on control system theory and design process of PLC (programmable logic control) controllers
•Advanced numerical methods (II) (7th semester students) 5 ECTS focusing on numerical methods to solve ordinary and partial differential equations using MATLAB software
•Kalman filter for robotic design (9th semester students) 10 ECTS focusing on the design process of Kalman Filter for robots (summer course)
•Computational Fluid Dynamics (CFD) (7th semester students) 5 ECTS focusing on the concept of fluid dynamics and the governing equations using Fluent software
•Mathematics & Physics (II) (2nd semester students) 5 ECTS focusing on basic mathematics and physics and solving real world problems
•Mathematics & Physics (I) (1st semester students) 5 ECTS focusing on basic mathematics and physics and solving real world problems
During my work as an Assistant Professor, I have experienced that all four actions (i.e., learn to think logically, learn problem-solving methods and techniques, improve writing skills and dialogue) are very important during the learning process, and that each student or group of students can find each of these dialogues or experiences differently effective. During my activities as a lecturer, I focus on maximizing the learning activity by optimizing the time dedicated to each of the different kinds of experiences and dialogues, according to the students' characteristics, abilities or interests. For example, the intensity of the lecture may limit the time that the students have for doing deep thinking. The 'Dialogue with Self' can be enhanced by creating opportunities for reflection. The experience on 'Doing' can be achieved by adopting teaching techniques specifically designed to encourage students to see themselves as active thinkers and problem-solvers. In my opinion, it is especially important that the students relate the subject matter to their own experience. In this way it is possible to stimulate their interest and facilitate the learning process (as learning consists of 'building connections'). As an example, during one of the lectures describing a physical system comprising a mass, spring and a damper (in physics known as mass-spring-damper, MSD), the students learnt the response of such a system to different input signals (mainly a force). Afterwards, the students were required to design an MSD system with specific system responses. In order to provide real world applications that could attract the students and show them how an MSD is deployed in the daily life, the boys in the class were asked to design an active suspension system (ASS) based on an MSD system for their own cars while the girls were asked to design their own bed using the concept of an MSD system

such that they feel comfortable when they jump on it and at the same time, not hit the ceiling. Keeping this in mind, I am aware that to ensure efficient learning, teaching is more related to coaching, directing, instructing, and training a person or group as a way to achieve learning goals rather than providing sets of equations and converting mathematics into a boring subject in which each individual student is supposed to work and solve sets of equations without finding them useful in the real world applications.

1.Grading

Assessment-grading is a huge topic in everyday classroom tests. In order to grapple with what seems to be an over use of testing, educators should frame their view of testing as assessment and that assessment is information. The more information we have about students, the clearer the picture we have about achievement or where gaps may occur [6]. In order to keep a balanced assessment system in my course grading, both summative and formative assessments are an integral part of information gathering. Depending too much on one or the other could result in vagueness in the reality of student achievement in the classroom [4] and [5].

Summative Assessments in my courses are given periodically to determine at a particular point in time what students know and do not know. Summative assessment at the classroom level is an accountability measure that is generally used as part of the grading process. Here are two examples of summative assessments I include in the courses I teach:•End-of-unit or chapter tests•End-of-term or semester examsThe key is to think of summative assessment as a means to gauge, at a particular point in time, student learning relative to content standards. Although the information that is gleaned from this type of assessment is important, it can only help in evaluating certain aspects of the learning process. Because they are spread out and occur after instruction every few weeks or months. Summative assessments happen too far down the learning path to provide information at the classroom level and to make instructional adjustments and interventions during the learning process. It takes formative assessment to accomplish this [4], [5], [6], [7], [8] and [9].

Formative Assessment is part of the instructional process. When incorporated into classroom practice, it provides the information needed to adjust teaching and learning while they are happening. In this sense, formative assessment informs both teachers and students about student understanding at a point when timely adjustments can be made. Although formative assessment strategies appear in a variety of formats, there are some distinct ways to distinguish them from summative assessments [6], [7] and [8].Formative assessment helps me determine next steps during the learning process as the instruction approaches the summative assessment of student learning. Before the final semester exam, each student receives a grade every time they pass an exam or deliver the assignments. The final grade for the course is the weighted average (with a forgetting factor) of all of the grades the students received while participating in the class, delivering the assignments and the weekly exams. Because of the initial low grades the students might receive during the process of learning the subject at the beginning of the course (as mentioned, due to the attempt I make to teach them how to learn logically, the beginning of the course is the period which the lowest grades are gained), using the average value as a final grade would not accurately reflect the students' ability and therefore, weighted average is used in my courses. The final grade at the end of the semester, or the summative assessment, would be the accountability measure that establishes whether or not the student has the skills necessary for passing the course together with a reflection of all the exams and exercises that lead to it. Another distinction that underpins formative assessment is student involvement. If students are not involved in the assessment process, formative assessment is not practiced or implemented to its full effectiveness. Students need to be involved both as assessors of their own learning and as resources to other students. To fulfill this, the students are often assigned as the evaluator of each other's work and assignments. In fact, I observed that the involvement in and ownership of their work increases students' motivation to learn. I view the purpose of grading midterm-weekly exams-assignments as mostly motivational and judgmental. By requiring students to demonstrate knowledge of course material, this motivates them to do the necessary work required to learn mathematics. I do not grade on a strict curve. I usually curve each exam and also the total assignment scores and quiz scores. The curve is based on a mixture of class performance, percentage correct, and comparison with past classes' performances on the same material. Thus, it is possible for everyone in the class to get a good grade, or the opposite. It is rare for a student who attends class regularly and does all of the class work to receive a low grade. On the other hand, to receive a 12 (the highest grade in the 7-scale Danish grading system), one must score consistently high marks on exams and assignments. I generally have high expectations from my students. When grading midterm exams, I try to strike a balance: be fairly strict while at the same time avoid discouraging the students. I believe this strategy is useful as first of all, this gives a signal to students who are not doing the work, or for whom the course material is too difficult, so that they can either drop the course or make the decision to devote more time and effort to the course. Second, it gives students a good idea of where they stand in the course, so that there are no surprises at the end. And finally, it allows me to take other factors into account when I make up final grades, resulting in increases for some students at the end of the course. I spend quite a lot of time in the process of figuring and deliberating final grades. As a result, I rarely have any student who thinks that his or her final grade is unfair or unexpected. Other information related to grading is included in the Exams and Homework sections below.

2.Feedback

The central idea behind a feedback is that when different views collide; you will have a very efficient teaching. Giving feedback is more important for learning, than just getting feedback. The instructor and the student should know that they learn twice as much by giving feedback than by only getting feedback as it can also help breaking the loneliness of the students. In order to get a good feedback and at the same time a good assessment, I usually give the students revision skills i.e., by raising questions such as "Do you think I can use a comment like this?" as I strongly believe that it takes at least 2 persons to assess a students' work. The assessment of an effective feedback should answer 3 central questions [6], [7] and [8]:•Where am I going? (What are the goals?) FEED UP•How am I doing? (What progress is being made?) FEED BACK•Where to next? (What activities do I need to do to improve?) FEED FORWARDI also believe in order to have a good feedback, requirements below should be fulfilled:•How many times during the semester: during each class•When: at the beginning and at the end of each class•Be constructive and supportive•Understandable•Goal

related•Relevant•Concrete and specific•Not too much•Encouraging tone•Involves both praise and constructive criticism•Helps closing the gap between expectation & performance•Tailor feedback differently for high and low ability students
I have tried to increase communication and feedback both to and from my students. I encourage the use of office hours, and I make myself available at other hours as well. Blackboard webpage allows students access to all sorts of class information (see the Course Syllabi and Information section below) which also includes a feedback form for students to submit suggestions and comments. I collect the email addresses of all students at the beginning of the class so that I can quickly notify them of changes or hints on assignments, temporary changes in office hours, etc. I also publish this class list on the class Web page so that the students can contact each other for notes and group study. Also, in each course, I have a small conference with each student about midway through the semester. I tell them how I view their work so far and try to give them suggestions for areas in which to improve, and I find out from them about any problems they are having (formative assessment).
3.Availability
I always hold one office hour per week, and I make myself available at other times as well. I tell my students they are welcome to come by my office at other times, and unless I have an immediate deadline or meeting or class, I will be able to help them. Furthermore, the students are always capable of reaching me via email.

Teaching methods

1.Class sessions
lecture and discussion
I try to begin each class with a brief summary of the previous class session, and a reminder of where we are in the topic we are currently working on. At this point I usually ask if there are any questions from the reading, homework, or previous class. After this discussion, I usually give a lecture on new material. I try to begin the lecture with a brief outline and a list of objectives, and I try to always include examples during the lecture. I always encourage questions and pause in the lecture to answer them. Depending on the time and topic, I may then have an in-class exercise, probably involving cooperative learning (see the next topic), with a follow-up discussion to end the class. In each class, lecture and discussion and in-class exercises are incorporated. In theory classes, rather than simply writing out a proof on the board, I try to first motivate the proof (see if the result seems to be intuitively true, look at some examples), and then have the class participate in the writing of the proof (provide the next step, fill in details, etc.). I also have found that group problem-solving (i.e., proof-writing) sessions are very effective in these types of courses. As much as possible, I try to present course material in analytical, numerical, and graphical contexts. This approach of course depends on the particular topic, but it is particularly valuable in calculus, control system theory and computational fluid dynamic courses. I am especially conscious of using pictures and graphs to help illustrate different concepts, as most students can then at least intuitively understand the concepts even if they have trouble understanding the analysis.
The most significant step in the development of my career as a teacher has been the evolution of my teaching method from an old traditional teacher-oriented method to a teacher and student-oriented method. I have learnt that teaching is not monologue in which the teacher teaches and the students learn but it is rather a dialogue in which both teacher and the students are involved in the process of learning. As it is explained in Appendix A, teaching in academic environments in which both methods (i.e., the educational system in Iran which is based on the old traditional French system and the educational system in Denmark) enables me to cope the difficulties faced by many of my colleagues which have been experiencing one of these two academic environments.
Cooperative learning
For many years I have assigned group projects in some of my classes (see the next topic). And in the past several years, I have incorporated more cooperative learning techniques into the class sessions. These techniques usually involve working in pairs or groups of three on a short problem, with specific instructions on how to share ideas and come up with a common solution. While the groups are working, I can move around the classroom to help various groups, and at the end we compare and discuss the various groups' solutions. Sometimes I have a more complex group exercise (usually a sequence of connected problems) that takes up most of the class session. In order to learn more about cooperative learning techniques, I have participated in a workshop and a seminar series on cooperative learning, and have also read extensively about these techniques [6], [7], [8] and [9].
There are however advantages and disadvantages when cooperative learning is implemented in the class.
Advantages: cooperative learning groups work best when they meet the following criteria:
•Groups should be heterogeneous and, at least at the beginning, should be small, perhaps limited to two to six members [9]. In order to form heterogeneous groups, I conduct questionnaires (Appendix B and C)
•Research shows that cooperative learning promotes both intellectual and emotional growth [9]
1) Students achieve higher achievement, especially for math in the elementary grades
2) Students have higher levels of self-esteem and greater motivation to learn
3) Students can sense the positive regard they have for one another
4) Understanding and cooperating among students from different racial and ethnic backgrounds are enhanced [9]
In order to benefit from the advantages of the cooperative learning and the team work, I follow the following steps to establish fruitful cooperative learning with my students:
•I often Start with cooperative learning projects that are short and simple
•I make sure students understand how important it is to work cooperatively with other people
•I don’t assume that students know how to work in groups, I teach and help them understand what cooperative learning is all about
•I praise students when they use skillful social behaviors.

•I use group roles to help students develop social skills. For example, if I have a student who dominates group discussions, I assign that person the role of observer for a few classes
Disadvantages: Research [9] also shows that cooperative learning can be a hardship to students when a group is not well developed. There is a great burden placed on the students in the cooperative learning group. The great burden is making them responsible for each other's learning apart from themselves. For obvious reasons the cooperative learning group produces better results when the group is heterogeneous, basically because there should always be someone in the group that can learn the lesson and teach it to others. Therefore, the high achievers of the group will understand the material better than anyone in the group as they explain it to others. It is not only the smart students that suffer , "one study showed
2.Homework
level of difficulty, projects, group work:
As stated at the beginning of this document, I believe that the only way to learn mathematics is to do mathematics. For this reason, I usually assign a lot of homework. The advantages of assigning a lot of homework is that give the students an opportunity to get the most practice out of the subject while the main disadvantage is limiting their time span for other courses. I try to assign a mixture of routine and challenging problems so that I can stimulate the more advanced students but still enable the poorer students to at least learn the basics of the course material. In small classes, usually at 9th semester, I try to grade as much of the homework as possible. However, in large classes, usually first, second and 5th semester, it is not possible to grade all of the routine assignments. In the latter classes, students can check their work on routine assignments by using solutions manuals, the help room, and posted solutions, and by asking questions in class. In my classes, I also assign more involved projects, and I always grade these. The projects involve a writing component, and also often involve the use computers (see the next topic), but not always. Usually they are completed in groups of two. After several assignments, I usually mix up the groups, and at this time I ask the members of the old groups to rate each other. This will help prevent one group member from just coasting on the work of the others. Overall, I have had good success with group projects. I am able to assign more challenging and interesting problems, and the students help teach each other through working together. Also, the students often find the group experience more enjoyable than individual work, and I have consequently received mostly positive comments about group projects.
Exams:
When I create an exam, I try to follow several guidelines. First, I try to test over a reasonable range of class material, and I try to stress the important concepts. I don't include unimportant items or problems which require some "trick" that the students may have only seen once. I also include problems of varying difficulty. However, I usually do not include trivial problems. Before each exam, I spend some time in class discussing what topics will be covered and which are most important. I usually give more detail for undergraduate courses, especially the lower level courses. I also try to be careful not to make the exams too long, but I sometimes fail in this regard. I find this is especially hard in higher level theory courses, where it is very hard to judge how long it will take students to do the creative thinking necessary to come up with a correct proof. Consequently, in these courses I do not expect students to solve all of the problems on the exam. I always keep old exams, and I notate them if they are too long or if a certain problem was not worded well or was not a good question for this particular class (i.e., if most of the class missed it). When I teach the same course again, I do not usually ask the same questions, but I often ask similar ones. So in this way, I keep some uniformity when I teach the class again, and the exams should get better, in theory at least. I also keep the exam aligned with the course curriculum and what has been taught during the course.
Uses of technology:
I use computer program for teaching purposes in many courses. In the computer-enhanced sections, I assign several group projects which require the use of MATLAB. Students use the computer to help with in-class exercises and homework. Some of the homework assignments are designed to be solved with the help of a computer. Programming and use of numerical software (MATLAB and Simulink) is a large component of the regulation techniques II and advanced numerical methods courses. Most assignments are designed to be completed using MATLAB. In addition, a working knowledge of Step 7 Siemens on regulation techniques I is needed. All courses make use of the World Wide Web for informational purposes and some distribution of class materials (BlackBoard).
Representative Course Syllabi and information
At the first class meeting, I hand out a syllabus provided together with all the colleagues that are involved in teaching the course which gives the student basic information for the course (e.g., Appendix D). It lists ways to contact me and other colleagues involved in the course: office number and email address, and also the address of the homepage for the class. It also informs the students about the prerequisites, text, topics to be covered, the number of exams and quizzes, information on homework assignments (approximate number, types of problems, grading policy, possibilities for revision of incorrect solutions, etc.), and grading policy. As my classes require use of a computer, the syllabus includes a section describing how they will be used in the class and what learning goals will be expected from the students in the areas of programming and computer expertise. Finally, the syllabus also includes a section on use of the class Web page. I do not give out a list of all homework assignments for the semester as some instructors do. I prefer the flexibility of changing the problems and due dates during the semester as I get to know the strengths and weaknesses of the students. This allows me to tailor the assignments to the needs of the class. Each of my classes has a section in the World Wide Web page (Blackboard) which allows students access to all sorts of class information. The syllabus and class list is available here, as well as lists of homework assignments and reading assignments (updated as they are assigned), and a list of materials. There is also an anonymous feedback form for students' suggestions, compliments, and criticisms provided using Google Documents. Additional information is available depending on the class. For example, for numerical analysis classes I have included a lot of helpful information on computer use (open source lecture notes from Massachusetts Institute of Technology).