Recitations Transcript

Hey, I'm Raj. I am a G3 in physics. And I welcome you all to this session on Effective Recitations; and for several of you, welcome to Caltech.

Much of the material that we will be discussing in our session today has been developed over past teaching conferences - including the one that I attended when I came to Caltech two years earlier.

And the hope is that, as you learn from this conference today, you will be adding to the material as we go forward. So before we go into the material, let's just very quickly lay out the session outline and the learning outcomes for our session today.

So, we're going to be talking about what recitation sessions (or rec sessions) look like at Caltech? How to host awesome rec sessions? What not to do in your session? How to plan your session? And, how to design effective problems for your session? After all of this, we hope to achieve that you learn - how to make the material come alive? What to do before and after the lecture? How to help your students get the most out of the lecture? And, how to select your topics and problems for your rec session?

Okay, so let's go into - What do Rec Sessions even mean at Caltech?

So, for most of the core classes that undergrads take in their first two years, they have Rec Sessions. These typically involve two one hour lectures every week - led by a grad student – where undergrads work through problems and bridge the gap between the lecture material that they have been exposed to and the concept that they will need for the problem sets.

What material to cover and how you present it - is up to you. This is a serious responsibility, but one I find to be really rewarding!
Now, conducting a session like this requires an amalgamation of many skills. You need to exhibit mastery over the material, you need to speak confidently, you need to maintain eye contact - which is really really difficult over zoom.

But we will not cover any of those out here. Instead we are going to focus on what separates the best Rec Sessions from that those are just 'good enough'.

This does not imply that all of those other skills are less important. Needless to say, you should scope out the room you will be teaching in ahead of time, make sure that a computer plugs in, the projector plays, carry your own chalk or markers just in case they are not there, learn the names of students before the class, arrive early and make sure you start on time.

But these are the things you learn from experience. The session instead today will cover ways on how to add pizzaz to your teaching, encourage you to make summary sheets, and discuss how to come up with the amazing material that you will be teaching your students.

So let's go ahead and look at some of the best practices that you need to inculcate in your teaching in connection to your rec sessions. The first topic is about how to make the material come alive. And in this, we will be primarily focusing on two ideas. That is - you need to go for an active presentation over a static one. What do you mean by this? Let's take the example of the dot product. The dot product is something you would be introducing students in, typically, the first week of Physics 1 course at Caltech.

Now, you can you can give the definition that (equation above) and so on. And every time after this, when you ask somebody to calculate the dot product, they will definitely calculate it (typically correctly). And it should be good. But is it enough? I would argue that there is more that you can do to give the students perspective that you have gained over time.

For example, you could say, (and you could give the demonstration that - follow hand demonstration), what happens to A.B as B's relative angular difference changes? So it keeps increasing, increasing, Increasing and then it goes decreasing, decreasing, decreasing. So what that does is - it keep the students involved very actively involved in the class.

Even if it doesn't give some new perspective, it's still helpful in keeping the attention of the students in the class and and helps you in discussing, perhaps, far more difficult topics which they might have already lost interest in otherwise.

Apart from this, you can also use GIFs, YouTube, wolfram demonstration projects, etc. in your class to really demonstrate to students some of the concept that are very hard to imagine immediately. Now, just make sure that you have permission to use them in the classroom.

On to the next point. Now that you know how to make the rec session come alive, you need to also know how to improve your classes. And there in becomes a question - what do you do after the lecture?

And - this is an idea that was taught to us by one of the session facilitators two years ago - is that you do an autopsy or you maintain a notebook.

What does that mean? It is that, after the class when it's completely fresh or its fresh in your knowledge - what are the mistakes you made, what are the jobs that worked, what didn't work, what are the problems that were good or what you should discard - come back and write them down.

The reason you do this is because - let's say you're teaching this course the next time - you know exactly what works and what doesn't.

Even if that were the not the case - and you're not going to teach this course the next time - your teaching nonetheless improves.

That's because you slowly begin to identify - what are the areas that you are typically making mistakes in, and what are the areas which are your strong points. And it is true that that you slowly begin to improve your teaching. Nobody is an expert the first time they go to teach. You become an expert once you keep repeating this process over and over again.

The next point is, how do you really help the students get the most out of the lecture? But this one doesn't have a specific suggestion.

Instead, I'll ask you to question yourself - what were the things that your favorite teachers did? And, how do you reduce the work for your students?. This is because our role as TAs are to ensure that the students can get a perspective which perhaps took us far longer to learn

And apart from this, I can leave you with one piece of advice that I have really gained from is to build a coursemap. So a course map (typically) is something you give out and the beginning of the term where you say - 'these are the topics that we're going to cover'. And, while you're teaching the term, at different points you show them where they are on the course map and tell them how the material that you're going through now relates to topics that have gone before and how it relates to the topic sentence after.

What that allows is for the students to relate the different materials that they're learning and (typically) in my own experience, it really helps students make sense of the material. Okay, now that you've covered the best practices, let's look into some worst practices that you should avoid in the classroom. And I like to call these practices - The unforgiveable curses. Any guesses what do you think this could be? As this is asynchronous, let me go ahead and give you the answers right away.

The first thing that you need to avoid is the word 'clearly'. This is because when you use them - you're you are leading the students at that stage to an understanding that the students might not have.

The second word is 'obviously'. In 'obviously', you are again conveying that something is supposed to be easy whereas the student might be struggling with it. We do not want to undermine their confidence. Therefore, we will try to avoid words like 'obviously'

And the third one - perhaps the worst of them all and something I've experienced before - is the word 'trivially'. Again a word which should not be in the dictionary the moment you step into the classroom.

But even apart from all of this, there's something that we should be really careful about and that is expert amnesia.

The fact that we are into a grad school - have left the undergrad life behind and it's been a couple of years - makes it really difficult to at times recognize the challenges that students

might be living with. Some of them we might have experienced while some of them we might not have.

But the fact that, if we are unable to relate to those experiences and we assume that certain understanding should be there, we might leave out in that process a lot of students in the class who might be experiencing more difficulties with this. So the, the most important thing is to look out for expert amnesia and try to explain the material in the most simplest way possible - breaking it down to the simplest way by not skipping steps while problem solving and so on. This is something - again - we learn from a lot of experience, but this is something you should really really be careful about. Okay!

Having talked about the best and worst practices we still need to learn about how to plan our sessions. And for this, I come to you with the idea of learning objectives. Just like we started with Learning Outcomes for this session, you need to know what are the objectives with which you're planning your rec session.

So, in the rec session (typically) there are there are two things which we need to achieve - 1. is to bridge the gap in knowledge that the students have through their lectures and what they need in order to understand the course material properly, 2. What are the skill sets that they need to have in order to attempt their assignments. Sometimes, because of disparate backgrounds of student, they might not havesimilar number of skillsets. Some of them might not understand - lets say multivaraiable calculus - but its necessary for the assignment. Those the topics that really need to go into the TA sessions.

How you do this is completely up to you. It can be a lecture, it can be a group discussion, it can be grouped solving session.

Typically, we have learned that students respond very well to situations when they're asked to solve the problem themselves. They might struggle with it. But if you can hold their confidence and their trust (while they struggle with it) - just help them on - and that will help them learn a lot more.

So these are the learning objectives that you always need to keep in the back of your mind for any rec session that you're organizing.

Now, for this rec session once you know that these are the material I want to cover, there are a couple of things you need to you need to check that you have focused on.

For example, do try to clarify the concepts and terminology that you're using for the that rec session. That's because - let's say a student might not have gone back to the course material of the lecture after the class - and they are in your classroom. Not clarifying the concepts and terminology typically puts these students at a disadvantage. If you do that - if you provide context to the material that you're going to discuss - in the classroom, you have the whole class

of that at the same level and then you can go forward and make it far more engaging for most of the class.

And always, you should try to confirm the confidence of the students. Use positive language rather than rather than being critical. You can say - 'Okay, this looks good. But how about you think about this problem in this manner?' Using positive language is really helpful and the students begin to put in more effort as a result of the process.

And, once you have done all this planning, comes the point about how do you make sure that all of is good? In this, I ask you to go ahead and do the homework that the students are being given.

This is because, at this stage, you begin to recognize that there might be something in the homework that isn't immediately obvious to you - and then you know that probably this is going to be far more challenging for the students.

Problems that you're using in your sessions should then try to have a basis in the concepts that they are going to need for the assignments.

And always, when you're doing this, try to prepare more problems and examples than you typically need. At least maybe one per topic or more than one per topic.

In the worst case scenario, even if you don't get to teach them in the class, you always know you can put them in your rec session notes for extra practice by the students. Now you don't always have to give out rec session notes, it's just really helpful for the students if you if you do provide them.

The third, and perhaps the most important part, is that - once you're done with this plan, once you have built the rec session - go ahead and rehearse it. Rehearse it to balance for two things - the time and the space. By the time, what we mean is that we don't want to over exceed the class.

We all have seen the meme where the teacher is standing in front of the board and talking about that 'There are two minutes left but we're going to cover all the most important topics that you need for understanding the course material'. You don't want that. And you don't definitely want to exceed the time - the students may need to be elsewhere. And so the students will be rushing out of the class and you will be trying to finish it up. That doesn't really help. Instead rehearse the class as much as possible so that you know that you are finishing on time. If you finish a bit early, that's good. But try not to over exceed your time on any day. And an the extra tip that I am going to leave you with is the concept of space. Now, let's say your classroom has six boards - chalkboards or whiteboards - whatever they be.

Try to plan your material such that you do not need to erase too much. So, put up, let's say on one of the boards all the concepts and terminology that you're going to be using the class. In

another, all the examples. So, now when you work yourself through the boards, the students have all this material ready to access as they proceed through the class. And what that does is that - the students will be far more engaged because they have all the material ready. You can always point out - 'you just need to refer back to this'. And overall, it makes the learning environment are far more effective.

Great! Now, we are still left with the problem (even after all of this) - how do you select that best problem? We talked about the concepts, we talked about how to plan and rehearse. The question is, how do you choose the best problems for your class.

And in this I'll ask you to pause after this question. Think of a time when you were given a particularly challenging problem and which had a very rewarding solution. What made the problem memorable? Now just go ahead and pause before I give you my ideas.

Awesome, now that you guys are back, let me give you some of the ideas that I would use in order to frame a problem. And again, these are very subjective. You might have come up with your own ideas which are really amazing and we would love to hear from you.

So, the ideas I like to use - is to try and make the concepts more tangible. This is because students typically respond to things that that they can make sense of in the real world.

And, so if we can make these concept a little more tangible, and maybe at the end of the problem leave a question like - what do you think happens if I remove this assumptions?

These challenges then prompt some students who might be interested in the topic to go and delve deeper. Now, while you are creating this real life scenarios, you should always be cognizant about who your audience is. You should relate the material to what the students care about. Now a freshman student might care about something entirely different than what a senior cares about. And their in comes your experience where you, while interacting with the students, develop what are the things that they really want to learn. One of the things I have tried to do is - I take index cards to the first class,and pass them out, and ask students to tell me what are they really expecting out of the class. And throughout the term I drop some of the pieces of information that they were interested in. This keeps the students interested in the class for the long term.

And always, fun and interesting problem statements do have more sticking power. Sometimes it may look ridiculous and there might be a laugh here and there. But that's what you want. That's going to help them remember what problems you want to do or what are the concept that you wanted to teach.

And, the best problems that you're going to find would emphasize on certain key concepts and have different perspectives to approach them. And this is really helpful because if you have (let's say) a number of solving methods or a number of suppose perspectives to look at a problem, that allows - even if a student is struggling with a certain perspective or method - they

can always use the other one to understand the problem; which again helps them understand this one concept that they might not have been comfortable with. And, always try and avoid problems that are exactly the same as the homework but with the different numbers. I mean, does it really help the students at that stage?

Now, having given you these pieces of advice, I realize that you might be thinking - 'Oh, this is really daunting. How am I going to make sure all these problems that I choose have all these characteristics?'. Don't worry! Caltech comes with a lot of resources. And they are that - you can discuss with your co instructors and previous instructors who have taught the course, you are always welcome to reuse the problems from previous year recitations, problem sets or exams. Also, several divisions do maintain a repository of this. You just need to ask whoever is the teaching facilitator for your division.

Look for examples in textbooks or online. Just make sure that these problems that you have selected upholds the points that we spoke about earlier. And try if possible to bring in inspiration from your own area of research. Students are always very excited to learn about this cool research that grad students are doing and they have not yet been exposed to. It's really fun to include a problem here in there from your own research. Now, before I take away more of a time, let me just leave you with a couple of final tips.

One of the very helpful tools we can use in the classroom is: Think-Pair-Share. I know that this is a little more difficult in the zoom era. But, what you typically do is that you ask the students a question, you ask them to pair, and share the solutions with each other (or what to think about the problem). You may solve it for everyone at the end. But what that allows for, is it forces the audience to question the different problems that you're discussing and ask them to assess what their current understanding is about it; rather than just getting the answer right away.

The second tip is learn to enjoy the pause. This is, again, especially difficult for the zoom era. What happens when there is this awkward silence? We've all dealt with awkward silence. We often want to just break it and talk about something - maybe go into the solution. However, it is in this pause that the students are learning the most. As you go through the term you'll begin to see that the students have began to enjoy that pause too. So give them that time - and, if you feel it's getting really awkward - bring it back with a joke.

Try to work through solutions and avoid skipping steps when possible. I know this again comes back to the question of expert amnesia, and we want to keep repeating it again and again. This is something we should be really, really worried about. Try to avoid skipping steps whenever possible. As you proceed through the term, you will realize that there are certain steps which everybody is comfortable with. At this stage you can make a prudent choice and say - 'These are the steps I am going to leave'. But overall, you shouldn't be trying to skip steps.

The fourth one again is a repetition of something we already mentioned - Plan rehearse and repeat. Do this over and over again. There is nothing better.

In the first year of my teaching, there was this TA Mentor that I worked with. We used to just to conduct every class in at full length before the class just to ensure that everything was going to go perfect. It helps!

And the last tip that I have for you is - be as authentic as possible. Now what that means is - let's say you make a mistake while solving - it's nothing to worry about. Tell the students - 'I think I made a mistake here. Let me go back and correct it'. Trust me, I've made those mistakes several times and it doesn't really make the interaction awkward. Because as long as you're being authentic - 'there was a problem here and I am going to go back and look at it. I'm going to let you know. I don't have this answer yet. Let me think about it and I'm going to shoot you an email'. All of these help. Because the students actually came from the fact that even you are trying to understand the material. You don't really have to be 'The' expert, per se. What you are there for is to help them learn and there is nothing better than to know that the person in front of you is learning along with you as the courses progress.

I can only say that as you create these rec sessions and you're putting your effort into it there are resources that are always available to you in the form of CTLO. You can visit the links on the screen and also feel free to reach out to the senior TAs or people who have TA-ed earlier.

You are also always welcome to shoot me an email and we can discuss about something which you might have in mind. Thank you so much for attending this session and, as again, welcome to Caltech albeit virtually at this point.

You're going to have a fun time teaching here. Thank you. Take care.