Dialog on Jargon

Alf: Say, Prof, can we bother you for a few minutes to talk about thermo?

Prof: Sure. I can always make time to talk about thermo. What's the problem?

Bette: I'm not sure we have a specific problem—it's more a general uneasiness about what we've done so far in class. We seem to be spending a lot of time defining terms without really getting anywhere.

Alf: Yeah—we've seen most of those terms before in other courses. We want to get to something useful.

Prof: Useful, eh? Well, I certainly don't intend to waste your time. So, you feel you already know the jargon we've introduced?

Alf: Like I said, we've had this stuff before.

Prof: Good. So tell me, Alf, what is a closed system?

Alf: Oh, that's when nothing can cross the boundary.

Prof: Do you agree Bette?

Bette: I think so—that sounds about right.

Prof: Ah. But you see, in engineering, the difference between "right" and "about right" can be the difference between success and failure.

Alf: I don't get it.

Prof: Can you use a 5/8-inch box-end wrench to tighten a 3/4-inch bolt?

Alf: No.

Prof: But the 5/8 wrench is "about right". In this case, the difference between "right" and "about right" is only an eighth of an inch.

Alf: You can't do it; the wrench is too small. But so what? If I pick up the wrong wrench, I see it doesn't fit, so I put it back and pick up the right wrench.

Prof: Ah—so in practice, if you make a mistake, you get feedback, and you make a correction.

Bette: Hey, I like that—feedback—yeah.

Prof: Ok, here's your feedback: When nothing can cross the boundary, the system is *isolated*. A *closed* system is something else.

Alf: Really? So what is a closed system?

Prof: No, no. To close the feedback loop, *you* have to make the correction, not me. I'm playing the role of the bolt (or the dolt or the nut, if you like). Does the bolt tell you it's 3/4-inch? Nope, you have to find out for yourself.

Bette: But how are we supposed to know?

Prof: Now Bette, you told me earlier that you'd seen this stuff before.

Bette: I guess we've sorta forgotten some of the terms.

Prof: So perhaps it's worth our time to go through the jargon so you can identify terms that are only "about right" in your mind? Then you can do something about them—implement a feedback loop.

Alf: Ok, Prof, but can't we just pick up the jargon as we go along? I mean, this stuff is boring.

Prof: We could. But I don't think that would be an efficient approach. You see, I am, in fact, trying to take advantage of your having seen this stuff before.

Bette: What do you mean?

Prof: If all these terms were alien to you then, at this point, you would feel overwhelmed—too much new information fed to you too quickly. In that case, the instructor should feed you new information in chunks you can digest; as you say, so you can pick it up as we go. But that doesn't seem to be the case here. What I hear you saying is that you're getting too much old information too slowly.

Alf: Mind-numbing, Prof.

Prof: Fair enough. Then, it would seem that picking it up as we go would merely prolong the agony. Worse, my experience is that many students fail to pick up the jargon as we go along, unless I can impress on them the importance of assimilating the jargon.

Bette: Impress, Prof?

Prof: Sure Bette. We've spent about a week on jargon, right? So I expect you to get the message that understanding jargon will contribute to your success in the course. After all, we will be encountering other new terms as we go along, so if you develop the habit of paying attention to jargon, things will go easier for you later.

Alf: Front-end loading, eh Prof?

Prof: Exactly. But if you don't get the old jargon under control now, you're going to have difficulties later. For example, if the class is having a discussion about the behavior of a closed system, but Alf is sitting in class thinking "isolated system", then he is either going to misunderstand or be confused.

Alf: Ok, Prof, you sold me.

Bette: But it's still not very interesting.

Prof: Maybe it's not the material that's uninteresting, but your approach to it. So tell me, Bette, what are you doing to study the jargon?

Bette: Well, I've started a clean notebook, like you suggested, and I'm writing definitions of terms in a glossary in the notebook.

Prof: Great! What else?

Bette: What else? That's all, I guess.

Prof: A glossary is a good first step, so keep it up, but it's not enough. You want to avoid the trap of writing definitions that merely trade one abstract word for another abstraction. So after you write a definition, try to interpret it in concrete terms.

Bette: What do you mean?

Prof: Let's take the isolated system as an example. Let this room be our system; it's boundaries are the walls, floor, and ceiling. Is our system isolated, Alf?

Alf: No.

Prof: Good. So, here's where the concreteness comes: what would you have to do to make this room into an isolated system?

Alf: Close the door.

Bette: And the windows.

Prof: Good. Anything else?

Alf: What's that in the ceiling? Looks like an air-conditioning duct; we'd have to block that.

Prof: Good. Can you generalize your actions thus far?

Bette: What do you mean?

Prof: Can you put one label to the three actions you've listed: close door, close window, block a/c duct?

Alf: Sure—prevent mass transfer.

Bette: Oh.

Prof: Good. So part of the definition of an isolated system is that no mass can cross the boundary.

Alf: Nothing can cross.

Prof: Ok, have you blocked all mass transfer?

Bette: Are we going to be picky?

Prof: Do you want to be right or merely "about right"?

Bette: Ok, then we're going to have to seal those cracks between the door and the floor and between the door and the wall above.

Prof: Good, otherwise, we could still have mass transfer; for example, a cockroach could waltz under that closed door.

Bette: Oh, Professor—

Prof: Just trying to create an image in your mind, Bette. So we could say that an isolated system does not exchange cockroaches with its environment, true?

Alf: Nothing crosses the boundary, Prof.

Prof: Ok, Alf, Ok. Now, let's say we've got to the point of blocking all mass transfer, is the system now isolated?

Alf: I don't think so . . .

Bette: Not yet! We've got to consider energy.

Prof: Great. So how could energy get into or out of this room?

Bette: Well, now that we've blocked the air conditioning, and with the sun shining on that window, this room's going get warm.

Prof: Ok, so how do we prevent heat transfer?

Alf: Insulate.

Prof: So we take sheets of polyurethane and cover all the walls, the door, the window, the ceiling, and the floor. Now, have we isolated the room?

Alf: I'm not sure . . .

Prof: Ok; the question is whether there are ways, other than heat, for energy to cross the boundary.

Bette: Well, there's work.

Prof: There is work; so, what work modes should we consider?

Alf: I'm not sure . . .

Prof: What can cross the boundary of an isolated system?

Alf: Nothing.

Prof: Ok, so which work modes should we consider?

Alf: All of them?

Prof: Right.

Bette: Gee, this is getting complicated.

Prof: So, pick a work mode.

Alf: Well, you told us that PV work is the most important one.

Prof: I hope I didn't say exactly that; I hope I said that the PV mode will usually be the one of most interest to us as engineers. But the most important one always depends on the problem situation. Nevertheless, let's consider PV work. What happens to the system when PV work is done on or by it?

Alf: The volume changes.

Prof: Good. So can we change the volume of this room?

Bette: I don't see how.

Prof: Can you imagine how it would be possible to change the volume?

Alf: I'm not sure . . .

Prof: Ok, do your remember when Luke, Han, and Leia trapped themselves in the garbage compactor on the Death Star? What happened?

Bette: Oh! A wall starting moving.

Prof: Was it an expansion or a compression?

Bette: A compression—you mean that's PV work?

Prof: Sure. Some device was exerting a pressure on the wall, pushing it into the room, and decreasing the volume.

Alf: That can't happen here.

Prof: I hope not. The jargon is that our system (this room) has *rigid* boundaries—that means we can't move the boundaries relative to one another nor can we deform them. Hence, the system volume is constant; hence, no PV work mode.

Alf: Hey Prof, that means the garbage compactor on the Death Star was not an isolated system.

Prof: Right, Alf. Now for homework, you and Bette decide whether the compactor was a closed system.

Alf: Well, there was no way for mass transfer, I mean, Luke and Han and Leia couldn't get out.

Prof: Be careful, Alf, how did they get in?

Alf: Oh.

Prof: But that's for you to talk about later. Now we've got our problem to finish. Let's remember where we are: our system is this room. To isolate it, we've stopped all possibilities for mass transfer. That means we closed the door, the window, the a/c duct, and the cracks around the door. To prevent heat transfer, we insulated the whole thing. We've agreed there is no possibility of a PV work mode. So are we done? Is the system now isolated?

Bette: I'd say no, or else you still wouldn't be talking about it.

Prof: Ok, Bette, the question is, are there still other work modes by which energy could get into or out of this room?

Bette: I don't think so.

Prof: Ok, what do you see on the ceiling?

Bette: Lights. Oh! We need energy to make the lights work. You mean electricity is work?

Prof: Electrical energy is provided by a work mode, yes.

Alf: So we've got to turn off the lights, turn off the computer, stop the clock on the wall.

Prof: That may not be good enough, Alf; some electrical devices continue to draw power even when they're turned "off".

Bette: Yeah, that's right, my VCR shows the time, even when its off.

Alf: So what do we do?

Prof: I'm afraid we'll have to cut all the wires.

Alf: Even the telephone wire?

Prof: Is it carrying energy?

Alf: I guess so. Gosh, this room really would be isolated.

Prof: True; this is a case in which the name (isolated) implies the meaning. So, now are we done? Is the room now isolated?

Bette: If not, we must be close.

Prof: Indeed, we are. What's still worrying me is Alf's cell phone.

Alf: This? I need it for my part-time job. Oh, you don't mean we would have to cut the wires in my cell phone?

Prof: No Alf, we wouldn't have to hurt your phone, but we have to prevent any energy from getting into or out of this room. So, Alf, how does that phone send and receive signals without wires?

Alf: I think it uses microwaves.

Prof: Actually, the signals are probably in a part of the electromagnetic spectrum called the broadcast band; but in any case, the signals are electromagnetic, and electromagnetic waves carry energy. In fact, other parts of that spectrum, such as infrared, are also crossing the system boundary. We've got to stop all radiation. That means shielding—in other words, wrap the whole room in aluminum foil.

Bette: That sounds like a big job.

Prof: Actually, polyurethane sheets used for insulation often have one side covered with aluminum foil, to block infrared.

Bette: Oh.

Prof: So I think we would have to do all those things to convert this room into an isolated system.

Alf: You know, Prof, we've now spent a fair amount of time talking about one piece of jargon: an isolated system.

Prof: That's my point, Alf. Let's say you write in a notebook: An isolated system is one in which nothing crosses its boundaries. That merely trades one word for some other words—all are abstract—and you haven't really learned anything. If that's all you do, then you're cheating yourself.

Bette: What do you mean, Prof?

Prof: I mean, you deny yourselves the opportunities to explore the material, to exercise your learning skills, and to grow as professionals.

Alf: But we've had a lot of jargon already; it would take a lot of time to do this exercise for every special word we've had.

Prof: Indeed, Alf, learning takes time and commitment. But there is this saving grace about this particular exercise: it works better if you do it with someone else. You and Bette should go away and have conversations about thermodynamic jargon.

Bette: Now Prof, I've never had a conversation about thermo in my life.

Prof: Sure you have, Bette, we just had one. And I've given you some starting points: What is a closed system? How would you make your bedroom into a closed system? Was the garbage compactor on the Death Star a closed system? If not, what kind of system was it?

Bette: Oh, look at the time, I've got to run. Thanks Prof, see you in class.

Prof: So long, Bette.

Alf: Ok, Prof, I get it. This won't be easy, though.

Prof: Oh, it shouldn't be so bad at this stage, once you get started. For some people, the hard part is finding someone to work with.

Alf: What about three or four people?

Prof: No, I think pairs are better for this. More people means more signals to interpret, so you end up wasting time interpreting other people rather than finding out what you yourself know and don't know. Remember, you're using the other person to help you close a feedback loop, just as you're helping close the loop for your partner. For this to work, there has to be a relationship built on trust. Pairs are best.

Alf: Ok, Prof, thanks. I'll be back.

Prof: Sure Alf, I'm counting on it.