

Random Thoughts . . .

MEET YOUR STUDENTS

5. Edward and Irving

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The scene is a dormitory room, shared by two senior engineering students. Irving is hunched over his computer, looking at an open manual next to the keyboard, as Edward breezes in.

Ed: "Yo, Irv—shut it down and move it out...it's party time."

Irv: (Silence)

E: "Come on, ace—the brew is losing its head...up and away!"

I: "Chill out, Eddie—I'm trying to figure out how to install this upgrade on my operating system. Why don't you go on ahead and I'll get there later?"

E: "Right—just like last week, when you were going to get there in fifteen minutes and you never showed at all."

I: "I told you I got involved with the control homework and lost track of time...anyway, you know I don't enjoy these parties—you guys are lunatics."

E: "We can't be lunatics, we're engineers—we're all nerds, we solve differential equations for kicks, most of us wear glasses...besides, I knew the campus security guard wouldn't really call the police last Friday—he just likes to blow smoke. Here, I'll bet I can figure that out...a few line commands here, a couple of mouse clicks there, and we're off for the bright lights and the beautiful..."

I: "Eddie, get your grubby hands off that machine and let me read the manual and do it right. Remember how you were going to help me program my VCR to record *Star Trek* last week, and you didn't need the instructions, and we ended up with a two-hour PBS special on pancreas transplants?"

E: "That was only because I..."

I: "And how about that physics lab where you shorted out the whole building? 'Let's just do it—lab manuals are for weenies,' he says, just before the explosion."

E: "Yeah, but don't forget whose crazy idea got a patent application on his summer job...your problem is you spend so much time studying about what you're planning to do and worrying about why it might not work

that you never get around to doing it...but it's ok, read all night if you can stand it, I'm out of here...oh, and don't forget, I asked Jake and Marty and Amy and a couple of the others to get together here tomorrow to study with us for the design test."

I: "Dammit, Eddie, why do you keep doing this to me? You know I study better alone—besides, you have an attention span of about twenty seconds, and if those jokers are over here you can forget studying or anything else but..."

E: "No way—I'm really serious this time. I just like to have people around—keeps things from getting too dull."

I: "Too dull? You..."

E: "Later, my man. I'll save some foam for you..."

I: (Low growling noise)

Ed and Irv have been best friends since elementary school, and no one was surprised when they enrolled in the same engineering school and became roommates. What was surprising was that they became friends in the first place, since their personalities are polar opposites. Ed loves big parties, and even if he doesn't know a soul when he walks in, everyone knows his life story by the time he leaves. Irv, on the other hand, doesn't like parties at all except for small quiet gatherings of people he knows well. Privacy is a sacred concept to Irv and a relatively alien one to Ed. They react much differently when faced with unfamiliar tasks or situations. "Let's try this out and see what happens," says Ed, as he dives in. "Hold on—let's think it through," responds Irv, as he dips his toe in the water.

The two of them have dramatically different approaches to schoolwork. Irv puts on some soft music, arranges his books on his desk, and immerses himself. Even when Ed is there, pattering around the room, fixing himself a snack, watching TV, or even talking directly to Irv, Irv goes right on working, occasionally mumbling responses to questions he really didn't hear. Ed sometimes tries to work like that but can't do it; he's constantly up and down, making comments about what he's reading or asking Irv questions about it, and if he hears a conversation down the hall or suspects that one might be about to start, he's off like a shot to make sure he doesn't

miss anything. He likes to see how others approach problems and to try out his solution ideas on them, and he drives Irv crazy by assembling crowds to study or work on homework assignments when Irv wants to work in solitude.

Edward is an *extravert* and Irving is an *introvert*.^{*} Although the popular ideas of these terms (the extravert is the one at the party wearing the lamp shade and the introvert is the one hiding under the couch) are exaggerations, they have some basis in reality. Extraverts tend to be gregarious and active; introverts tend to be reserved and contemplative. Extraverts are energized by being with people—the more the better—while introverts find it draining to spend much time with people they don't know well, and they may need to go off somewhere by themselves afterwards to recharge their batteries. Extraverts need to experience things to understand them; introverts want to understand them first.

Science and engineering require the strengths of both types—the thoughtfulness, capacity for sustained concentration, and desire for understanding of the introvert and the quick thinking, verbal fluency, and willingness to take risks of the extravert. Introverts may spend so much time thinking about potential difficulties that they never quite get around to trying out new ideas, while extraverts are comfortable with trial-and-error learning and will not wait too long to take action. Lacking the introverts' characteristic cautiousness, however, extraverts may get into trouble by jumping into things before thinking them through, and being less able to focus on one task for a long time, they are more likely to accept superficial problem solutions. Extraverts are well suited to jobs like technical sales and management that require strong interpersonal and communication skills and jobs like consulting and emergency troubleshooting that require quick thinking and responding, while introverts work better in areas like research and design that allow them to take information in, process it introspectively, and *then* respond.

While both extraverts and introverts can become excellent scientists and engineers, the usual way these subjects are taught—straight lectures, homework done individually, minimal hands-on experience—stacks the deck in favor of the introverts. Extraverts tend to have shorter attention spans and find it hard to maintain their focus in long lectures. They also do much of their best learning interactively—discussing, arguing, working out their ideas by bouncing them off others; if they are forced to work individually all the time,

^{*} *The degree to which one favors one or the other of these types can be determined with the Myers-Briggs Type Indicator, a personality inventory based on Jung's theory of psychological types that has been administered to over one million people, including many engineering students and professors.^[1,2] Ed and Irv are illustrative of the two types but not all extraverts are just like Ed and not all introverts are just like Irv. The two categories represent preferences, not mutually exclusive categories: the preferences may be strong or weak, and all people exhibit characteristics of both types to different degrees.*

they lose their most effective learning tool.

Several instructional techniques make classes more effective and enjoyable for both extraverts and introverts. Give students several minutes of small-group exercises during each class period—answering or generating questions, solving problems, or brainstorming. These exercises give extraverts occasions for activity and introverts opportunities to reflect on the course material. Bring experimental demonstrations—preferably hands-on—into lectures (for the extraverts) and give minilectures on interpretation of experimental results in laboratory courses (for the introverts). Use interactive computer tutorials and simulations: extraverts will enjoy the active learning they provide and introverts will get practice in trial-and-error analysis in a relatively risk-free environment. Assign some homework to teams of three or four rather than to individuals. Some introverts may complain about having to work in groups, but the extraverts will appreciate getting to function in their preferred learning mode for a change, and both types will learn the course material better while improving their interpersonal, leadership, and communication skills.^[3]

Epilogue: Ten Years Later. Following graduation, Ed went to work as a product development engineer in the polymer division of a chemical corporation and received several patents for new membrane formulations. After two years he decided that he enjoyed working with customers more than synthesis reactors and extruders, moved into marketing, and is currently associate marketing director in charge of international sales. Irv went to work for an environmental consulting firm, spent two years designing stack gas scrubbers, went back to graduate school for a PhD, and is now an associate professor at a large university not far from where Ed lives. They get together at least once a year. Ed always proposes making the rounds of his favorite bars with some drinking buddies he's sure Irv will like. Irv always looks pained, makes some reference to lunatics, and counters with a proposal to take in a chamber music concert or a poetry reading. Ed rolls his eyes in mock disgust, says something about "engineering nerds," and they compromise on dinner with their wives at a good restaurant and drinks afterwards at a quiet jazz lounge. They both thoroughly enjoy this routine and wouldn't think for a moment of changing it.

REFERENCES

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