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Failure is Not an Option: An Essay on What Legal Educators Can Learn from NASA's Signature Pedagogies to Improve Student Outcomes

Lisa T. McElroy

Christine N. Coughlin

FAILURE IS NOT AN OPTION: AN ESSAY ON WHAT LEGAL EDUCATORS CAN LEARN FROM NASA'S SIGNATURE PEDAGOGIES TO IMPROVE STUDENT OUTCOMES

LISA T. MCELROY*
CHRISTINE N. COUGHLIN**

I. INTRODUCTION[1]

THE APOLLO 13 MISSION took place in April 1970, long before most of our students were even a gleam in their parents' eyes.[2] While the Apollo 13 spacecraft was intended to land on the moon, an explosion in an oxygen tank led to the failure of multiple systems aboard, placing the astronauts in peril and leading to the second-most famous quote of the early space era: "Houston, we've had a problem here."[3]

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* Associate Professor of Law, the Earle Mack School of Law at Drexel University. J.D., *cum laude*, Harvard Law School; M.P.H., University of Michigan; A.B., Dartmouth College. Professor McElroy would like to thank Michael B. McElroy, Brandi Casey, and Zoe McElroy for their insights into all that inspires and motivates space exploration, as well as Michael Barton of the Drexel Legal Research Center for his valuable assistance with the underlying research.

** Professor of Legal Practice, Director of Legal Analysis, Writing, and Research, Wake Forest University School of Law. J.D., Wake Forest Law School and Wake Forest University Center for Bioethics, Health, and Society; B.S.B.A., Bowling Green State University. This article is dedicated to Linda Nero for her kindness and her enthusiasm for NASA, and to Dean Suzanne Reynolds and Professors Margaret Taylor and Wilson Parker for their support and consistent hope and optimism.

[1] Many of the ideas in this article were inspired by Professor McElroy's experiences at Parent-Child Space Camp at the Space and Rocket Center in Huntsville, Alabama, during the summer of 2009. A few paragraphs in this article were originally published on page 16 of the Legal Writing Institute's August 2005 edition of its bulletin, *The Second Draft*, and are reprinted with permission.

[2] *See* Jim Dumoulin, *NASA Apollo Mission Apollo-13*, KENNEDY SPACE CENTER, http://science.ksc.nasa.gov/history/apollo/apollo-13/apollo-13.html (last updated June 29, 2001).

[3] *Id.* Neil Armstrong's, "That's one small step for a man, one giant leap for mankind," upon touching down on the moon on July 20, 1969, would probably qualify as the most well-known quote (although there remains controversy about

Yes, a problem. A big one. One for which the aeronautic engineers at NASA were not prepared, despite all their theoretical planning and thinking and training before the mission ever began.[4] And it was a real problem that arose during the Apollo 13 mission, not a theoretical one at all. Like lawyers representing real clients, the aerospace professionals at Mission Control had to think creatively to save the brave men who were, quite literally, lost in space, 200,000 miles from Earth.[5] Because the astronauts knew how to fly an aircraft but not how to fix one, they were totally dependent on the Houston ground crew to get them home safely.

But the success that NASA experienced in solving these problems was due, in large part, to many years of preparation. The ground crew had worked as a team conducting multiple simulations to prepare for systems failures, and while this particular type of failure was unanticipated, in the end, they were able to use their vast preparation to achieve a positive result.[6] What's more, even as they were lost in space with little oxygen and even less computer power, the astronauts knew that Gene Kranz, Flight Director on the ground, was leading a team of intelligent, dedicated scientists who would work together to get them home.[7] And, on April 17, 1970, that's exactly what happened.[8]

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whether he said "a man" or merely "man"). *See One Small Step*, APOLLO 11 LUNAR SURFACE JOURNAL, http://history.nasa.gov/alsj/a11/a11.step.html (last revised Feb. 16, 2010).

> At the time of the mission, the world heard Neil say "That's one small step for man; one giant leap for mankind." . . . [A]fter the mission, Neil said that he had intended to say 'one small step for a man' and believed that he had done so. However, he also agreed that the 'a' didn't seem to be audible in the recordings. The important point is that the world had no problem understanding his meaning. However, over the decades, people interested in details of the mission . . . have listened repeatedly to the recordings, without hearing any convincing evidence of the 'a'. In 2006, with a great deal of attendant media attention, journalist / entrepreneur Peter Shann Ford claimed to have located the 'a' in the waveform of Neil's transmission. Subsequently, more rigorous analyses of the transmission were undertaken by people with professional experience with audio waveforms and, most importantly, audio spectrograms. None of these analyses support Ford's conclusion.

Id.

[4] *See generally* Charles Redmond, *The Flight of Apollo 13*, NASA, http://history.nasa.gov/apollo/apo13hist.html (last updated Oct. 22, 2004).

[5] *See* Dumoulin, *supra* note 2.

[6] *See* Redmond, *supra* note 4.

[7] *See id.*

[8] *See id.*

The story of the Apollo 13 mission is just one of the many inspirational stories from the space program. It was an age of exploration, of pushing boundaries, of discovering new ways of doing things, often outside of our comfort zone. As 2010 marks the anniversary of the Apollo 13 mission, we seek to honor NASA's success during that mission by examining three of NASA's signature training practices—simulation, teamwork, and optimism—and discussing how those practices could be used effectively in legal education to prepare students for the realities of practice.

Just as the Apollo 13 astronauts were a part of an age of exploration—exploration beyond the Earth, that is—today's legal educators live and work in an age of exploration all our own. Many of us are influenced by the American Bar Association Task Force on Law Schools and the Profession (the MacCrate report),[9] the report of the Carnegie Foundation for the Advancement of Teaching (the Carnegie report),[10] and the report on the Best Practices for Legal Education (Best Practices report),[11] which posit that the professions can and should again borrow effective educational practices from each other to improve students' learning, analytical synthesis, and professional outcomes. We also recognize that, like the individuals who work at Mission Control, lawyers hold clients' lives and livelihoods in their hands. Finally, we note that while law school teaches students to think theoretically—much as scientists do when contemplating a new mission—upon graduation law practice is anything but theoretical.

Significantly, collaboration, simulation, and optimism are critical whether training for space exploration or client representation. According to the landmark Best Practices report, "law schools [should] follow the lead of other professional schools and transform their programs of instruction so that the entire educational experience is focused on providing opportunities to practice solving problems under supervision in an academic en-

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[9] ROBERT MACCRATE, ABA SECTION OF LEGAL EDUCATION AND ADMISSIONS TO THE BAR, LEGAL EDUCATION AND PROFESSIONAL DEVELOPMENT—AN EDUCATIONAL CONTINUUM: REPORT OF THE TASK FORCE ON LAW SCHOOLS AND THE PROFESSION: NARROWING THE GAP (1992).

[10] WILLIAM M. SULLIVAN ET AL., EDUCATING LAWYERS: PREPARATION FOR THE PROFESSION OF LAW (2007).

[11] ROY STUCKEY ET AL., BEST PRACTICES FOR LEGAL EDUCATION: A VISION AND A ROAD MAP (2007).

vironment. This is the most effective and efficient way to develop professional competence."[12]

Using the space program as an example, then, we examine how simulation, collaboration/teamwork, and hope and optimism can lead to more effective student outcomes by helping law students achieve a deeper analytical level, bridging the gap between theory and practice, and learning, retaining, and transferring knowledge gained in the law school classroom to the practice of law.

II. PREPARATION BY SIMULATION

> *[Y]ou've got to expect . . . things are going to go wrong, and we always need to prepare ourselves for handling the unexpected. And you just hope those unexpected things aren't something that you can't cope with. So throughout Apollo, everybody I knew was always saying, "What if?" and, "Is it possible that this could happen?" And, "What will we do?" Just that process of continually questioning built your confidence in your ability to handle whatever comes along.*[13]

That individuals learn through experience is a basic tenet of educational learning theory.[14] Indeed, from the earliest days of the space program, before Apollo 11 reached the moon, simulation was a critical component of astronaut training.[15] According

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[12] *Id.* at 106; *see also id.* at 125 ("All forms of experiential education involve problem-based learning, so one of the strengths of experiential education is that it gives students opportunities to practice solving problems and to receive feedback on the quality of their efforts.").

[13] Neil A. Armstrong, *Oral History Transcript*, NASA JOHNSON SPACE CENTER ORAL HISTORY PROJECT, 105 (Sept. 19, 2001), *available at* http://www.jsc.nasa.gov/history/oral_histories//ArmstrongNA/ArmstrongNA_9-19-01.pdf.

[14] *See generally* DAVID A. KOLB, EXPERIENTIAL LEARNING: EXPERIENCE AS THE SOURCE OF LEARNING AND DEVELOPMENT (1984) (noting that reflection upon experience is critical to the learning process); *see also* Sylvia J. Hysong et al., *A Review of Training Methods and Instructional Techniques: Implications for Behavioral Skills Training in U.S. Astronauts*, NASA 9 (2007), http://ston.jsc.nasa.gov/collections/TRS/_techrep/TP-2007-213726.pdf ("[B]ecause of their fidelity, intensity, and opportunity for customized learning, simulations are a highly effective training method.").

[15] *See, e.g.*, Armstrong, *supra* note 13.

> We . . . spent a lot of time in simulations. . . . [W]e did a lot of simulations of flight characteristics and aircraft trajectories and things of that sort.
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> . . . .
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> . . . I spent a lot of time evaluating the authenticity and appropriateness of the simulation models that they were using. You'd usually find that the simulator didn't behave properly like it should in some regions of life, so it was incumbent on us to uncover the

to Astronaut Wendy Lawrence, a veteran of four space flights who has logged over 1,225 hours in space,

> One of the reasons why we take so long working through the training programs is so that we are very familiar with our procedures, so that we are not afraid of the unknown. It's easy to be afraid of the unknown, but we train to the point where everything is very well-known.[16]

Simulation training was critical to the success of the Apollo 13 mission. When Apollo 13 began experiencing issues with its power supply,[17] Astronaut Ken Mattingly (who was scrubbed from the mission because he had been exposed to measles[18]) and other technicians drew on lessons learned in simulations

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> problems that simulation had and try to make it as accurate as we could.
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> . . . [I]t was an important part of our function. . . .

Id. at 43–44.

> We had a docking simulator which was quite, quite [realistic]. We felt it was a good representation of what we could expect, and indeed it turned out to be quite similar to what we encountered in flight.
>
> I really believed that we wouldn't have any trouble with the docking, based on the simulations we did. Indeed, that turned out to be the truth.

Id. at 53 (alteration in original). "[I]n-flight simulation was our thing out at Edwards. We did lots of in-flight simulations, tried to duplicate other vehicles or duplicate trajectories or duplicate this or duplicate that, make something fly like something else." *Id.* at 68; *see also* Fred W. Haise, Jr., *Oral History Transcript*, NASA JOHNSON SPACE CENTER ORAL HISTORY PROJECT, 12-20 (Mar. 23, 1999), *available at* http://www.jsc.nasa.gov/history/oral_histories/HaiseFW/FWH_3-23-99.pdf.

> Each SIM [simulation] we conducted, no matter how short—be it a launch SIM [simulation] which didn't run that long—we would stop and evaluate what had happened, what had been done. And as you said, it often may [have] changed the mission plan, but it—and probably in more cases, it affected our procedures: How we changed the malfunction procedures or our checklist. Those sorts of things. Because we didn't leave anything unanswered. If it couldn't be answered in real time following that mission—that simulation debrief, it would be carried over and worked off line.

Id. (alteration in original).

[16] Telephone Interview by Lisa McElroy with Wendy Lawrence, Visiting Astronaut, Kennedy Space Center, in Kennedy Space Center, Florida (Dec. 11, 2009).

[17] It has been said that "[t]he Apollo computers had less processing power than a cell phone" has today. Craig Nelson, *Ten Things You Didn't Know About the Apollo 11 Moon Landing*, POPSCI (July 13, 2009, 12:09 PM), http://www.popsci.com/military-aviation-amp-space/article/2009-06/40-years-later-ten-things-you-didnt-know-about-apollo-ii-moon-landing.

[18] He never actually got measles, however. *Science: Apollo's Crew: A Case in Contrasts*, TIME (Apr. 17, 1972), http://www.time.com/time/magazine/article/0,9171,944480,00.html.

they had done in preparation for the mission to figure out how to power down non-essential systems in order to keep the essential ones—and the astronauts—alive.[19]

To some extent, law schools already utilize simulation training. Clinical education, legal writing programs, and externships traditionally have been the leading sources of experiential education within the law school curriculum.[20] As we and other scholars have written previously, however, more can and should be done through simulation and other active learning exercises to provide students a more realistic experience throughout the law school experience,[21] just as NASA guarantees that astronauts work through simulation exercises in a variety of contexts. Toward that end, law schools around the country are considering and undergoing curricular reform consistent with the recommendations in the Best Practices and Carnegie reports and developing further context-based, experiential casebook courses.[22] These courses use a variety of simulation exercises to "com-

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[19] Thomas K. Mattingly II, *Oral History Transcript*, NASA JOHNSON SPACE CENTER ORAL HISTORY PROJECT, 53 (Nov. 6, 2001), *available at* http://www.jsc.nasa.gov/history/oral_histories/MattinglyTK/MattinglyTK_11-6-01.pdf.

[20] *See, e.g.*, Erwin Chemerinsky, *Rethinking Legal Education*, 48 HARV. C.R.-C.L. L. REV. 595 (2008) (lauding the merits of such curricular methods of instruction).

[21] *See* Christine Coughlin, Lisa McElroy & Sandy Patrick, *See One, Do One, Teach One: Dissecting the Use of Medical Education's Signature Pedagogy in the Law School Curriculum*, 26 GA. ST. U. L. REV. 361 (2010); *see also* Steven A. Childress, *The Baby and the Bathwater: Salvaging a Positive Socratic Method*, 7 OKLA. CITY U. L. REV. 333 (1982) (advocating a more pure form of the Socratic method); Benjamin V. Madison, III, *The Elephant in Law School Classrooms: Overuse of the Socratic Method as an Obstacle to Teaching Modern Law Students*, 85 U. DET. MERCY L. REV. 293, 320–23 (2008) (emphasizing the need for greater diversity of teaching methods); James E. Moliterno, *Legal Education, Experiential Education, and Professional Responsibility*, 38 WM. & MARY L. REV. 71, 83–34 (1996) (describing experiential education reform at Harvard); Deborah L. Rhode, *Kicking the Socratic Method and Other Reforms of Law Schools*, CHRON. OF HIGHER EDUC., Jan. 26, 2001, at B15 (highlighting inadequacies in traditional legal education teaching methods); Ruta K. Stropus, *Mend It, Bend It, and Extend It: The Fate of Traditional Law School Methodology in the 21st Century*, 27 LOY. U. CHI. L.J. 449 (1996) (exploring the virtues of the Langdellian method and arguing for its adaptation rather than demise); Susan Sturm & Lani Guinier, *The Law School Matrix: Reforming Legal Education in a Culture of Competition and Conformity*, 60 VAND. L. REV. 515, 533 (2007) (contrasting case method applications by law, medical, and business schools).

[22] According to the 2008 survey conducted by the Association of Legal Writing Directors, in response to the Best Practices and Carnegie reports, twenty-eight schools had already undergone curricular reform and an additional eighty schools were exploring the possibilities of it. *See* Association of Legal Writing Directors, *2008 Survey Results*, LEGAL WRITING INSTITUTE, at ix (2008), http://alwd.org/surveys/survey_results/2008_Survey_Results.pdf.

bin[e] academic inquiry with actual experience"[23] to teach students how real lawyers employ legal analysis in the representation of clients:

> Other professional fields provide some well-tested instances of pedagogies that teach complex practical reasoning and judgment, blending the cognitive and practical apprenticeships . . . . In such simulations, performance can be rehearsed, criticized, and improved "off-line." This removal from the exigencies of actual practice permits the instructors to focus on particular aspects of the complex ensemble of skills they are trying to teach. The elements and sequence of skills can then be modeled and rehearsed in safety—without real-world consequences or immediate responsibility for the welfare of others. This kind of teaching makes it more likely that students will reach a basic level of competent practice from which expertise can be subsequently developed.[24]

The benefits of moving from the traditional passivity of the Socratic dialogue to adding experience to doctrinal courses via simulation exercises are myriad.[25] As one legal scholar has noted, "There is general agreement that simulation-based courses can be an important site for developing the professional skills and understandings essential for practice, including self-directed learning skills."[26] In fact, "[t]here is no more effective way to help students understand what it is like to be a lawyer than to have them . . . perform the tasks that lawyers perform or observe practicing lawyers at work."[27] The same is true when training astronauts. NASA notes in a review of its training manuals that learners absorb more through simulation because the method "allow[s] the learner to rehearse the material learned," leading to quicker learning and better retention of key skills.[28] NASA scientists have even posited that simulation exer-

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[23] STUCKEY ET AL., *supra* note 11, at 121.

[24] *Id.* at 133 (citing WILLIAM M. SULLIVAN ET AL., EDUCATING LAWYERS 112–13 (July 2006 draft)).

[25] In fact, this hypothesis has been tested empirically. *See* Stefan H. Krieger, *The Effect of Clinical Education on Law Student Reasoning: An Empirical Study*, 35 WM. MITCHELL L. REV. 359, 362–63, 393–94 (2008) (concluding that students who participated in experiential education activities in law school were better able to identify some relevant facts in a legal fact pattern, identify legal rules relevant to a client's problem, identify client interests, and consider next steps in a client representation).

[26] STUCKEY ET AL., *supra* note 11, at 133.

[27] *Id.* at 125.

[28] Hysong et al., *supra* note 14, at 7.

cises teach astronauts better judgment and decision-making skills,[29] which are critical for both lawyers and astronauts alike.

However, while implementing the recommendations set forth in Best Practices report and imitating NASA simulation training methods may sound simple, in reality initiating effective simulations realistically is a fairly complex task. As one scholar has commented:

> [I]n order to create a teaching simulation in law, the legal educator must build a *dynamic model* of a portion of the *legal process* by *abstracting, simplifying,* and *substituting* parts of the *actual legal system* so that the model presents the underlying *theories* to the learner in a clearer fashion than would another teaching model.[30]

In fact, most simulation courses in the United States, at least in the way they are currently developed, do not produce "sufficiently proficient graduates," because students are only provided one opportunity to perform the skill and get limited feedback.[31] Perhaps it is here, in the limitations of implementing simulation, that we see the stark contrast with NASA's commitment to simulating the tasks that astronauts must accomplish when launched into space.

Indeed, implementing meaningful simulation exercises requires intentionality, time, and resources. The professor must clearly explain the appropriate structure to expose students not only to theory and skill (or, in the case of space exploration, science and execution), but also to the relationship between the two, allowing them to synthesize the two lawyering components.[32] As one scholar noted, in order for simulations to work, we must "deliberately design our simulations and feedback mechanisms to help achieve the desired educational goals."[33] Similarly, NASA has noted, "Because simulators are highly controlled by the trainer/developer, they provide the opportunity to effectively use learning principles such as appropriate feedback, distributed practice, and maximized training transfer."[34]

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[29] *Id.* at 14–15.

[30] STUCKEY ET AL., *supra* note 11, at 136 (quoting Joseph D. Harbaugh, *Simulation and Gaming: A Teaching/Learning Strategy for Clinical Legal Education, in* AALS/ABA GUIDELINES FOR CLINICAL LEGAL EDUCATION 195–96 (1980)).

[31] *Id.* at 133–34.

[32] Moliterno, *supra* note 21, at 81.

[33] STUCKEY ET AL., *supra* note 11, at 135.

[34] Hysong et al., *supra* note 14, at 9.

NASA emphasizes that feedback is critical to the simulation learning process.[35]

Therefore, to thoughtfully create meaningful, effective simulation exercises that do in fact enhance students' ability to solve problems, law professors should learn from NASA in considering the following:

1. The simulation exercises should be appropriately realistic and complex for the students, and the purpose(s) and instruction for the exercise should be clear.[36]
2. Simulation exercises should be based on articulated theories of practice.[37]
3. Students should receive meaningful feedback and be debriefed following the exercise and allowed to evaluate the simulation.[38]
4. Students should be provided more than one opportunity for a simulation and have multiple contexts within which to conduct the simulation exercise.[39]
5. The school should have "sufficient facilities, equipment, and staffing to achieve the educational goals of its simulation-based courses."[40]

Simulating client representation cannot avert every problem that could arise in the courtroom or boardroom, any more than simulation could have saved the astronauts in the Apollo 1,[41]

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[35] *See id.* at 11 (noting that feedback leads to quicker learning and better retention, but also noting limitations such as class size and cost).

[36] STUCKEY ET AL., *supra* note 11, at 137. "[M]any students report that they are asked to [perform simulation exercises] in a vacuum—in other words, they are expected to simulate the work of an attorney without any informed idea of what that work would look like." Coughlin et al., *supra* note 21, at 41. "Legal education theorists note that, without detailed and individualized feedback, attempts at simulation and experiential learning in the law school classroom may fall flat because students have no way of assessing their successes and no guideposts for improving upon their work." *Id.* at 40. "Students therefore lack confidence in their abilities to parlay their analytical abilities into producing a complaint," engaging in a negotiation, or counseling a client. *Id.* at 42.

[37] *See* STUCKEY ET AL., *supra* note 11, at 136–37 ("Fidelity of the simulation to the real world analog is a critical aspect of design, because it fosters transference of learning from the exercise to the real world and motivates students to engage in the exercise and to suspend disbelief.").

[38] *Id.* at 137–38.

[39] *See* Coughlin et al., *supra* note 21, at 19.

[40] STUCKEY ET AL., *supra* note 11, at 138.

[41] Apollo 1 caught on fire on the launch pad on January 27, 1967, killing the three astronauts aboard who could not unlatch the capsule's two hatches in time to escape. *See Apollo Mission Apollo 1*, NASA, http://history.nasa.gov/Apollo204/ (last updated Jan. 27, 2010).

Columbia,[42] or Challenger[43] missions. But Apollo 13 gives us context for considering how simulation can prepare students for many types of problems and issues that arise in a professional context, particularly one that requires quick but intelligent responses. Were students to practice key lawyering skills—like interviewing, counseling, negotiation, decision-making, and problem-solving—in realistic simulations regularly scheduled throughout law school, they, like the members of the Apollo 13 team, might be better prepared to "bring their astronauts home."

III. PREPARATION BY COLLABORATION OR TEAMWORK

When thinking about the problem facing NASA on April 13, 1970, during the Apollo 13 mission crisis, law students can draw the analogy for themselves: the astronauts (the "clients") were relying completely on the expertise of the ground crew (the people in the advisory, "attorney" role).[44] The analogy is only complete, however, when we consider how the ground crew at Mission Control went about solving the problem. The only way for the astronauts to make it back to Earth was to move into another part of the spacecraft, the lunar module.[45] The ground

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[42] The space shuttle Columbia blew up on February 1, 2003, when reentering Earth's atmosphere. The explosion occurred because a piece of foam insulation broke off during launch, damaging the shuttle's thermal protection system. All seven astronauts aboard died. *See* Remembering *Columbia STS-107* Introduction, NASA, http://history.nasa.gov/columbia/Introduction.html (last updated Sept. 17, 2009).

[43] The space shuttle Challenger broke apart seventy-three seconds after launch on January 28, 1986, because of a leak in a rocket booster that ignited the shuttle's fuel tank. All seven astronauts aboard, including teacher Christa McAuliffe, died. *See* The Crew of the Challenger Shuttle Mission in 1986, NASA, http://history.nasa.gov/Biographies/challenger.html (last updated Sept. 17, 2009).

[44] For a far less dramatic, but still instructive, example of how the ground crew had to "lawyer" from the ground, see an account of the real Apollo 13 "problem":

> Another major event . . . threw a usually cool and calm astronaut into a mild panic. . . . [An Apollo 13 astronaut] forgot to file his [f]ederal [i]ncome [t]ax return [and realized it after he was already in space]. "How do I apply for an extension?" he asked. Amid laughter from Mission Control, he sought to explain: "Things kinda happened real fast down there and I need an extension. I'm really serious. Would you . . . turn it in?" Later, Flight Director Glynn Lunney said that American citizens out of the country get a 60-day extension on filing. "I assume this applies," he added.

Jerry Woodfill, *Apollo 13 "Houston, We've Got a Problem."*, NASA, Page 6, http://er.jsc.nasa.gov/SEH/pg6.htm (last modified Apr. 30, 2002).

[45] *See* Dumoulin, *supra* note 2 (referring to the lunar module as the "LM lifeboat").

crew had to use teamwork to figure out, under time pressure, how to make square carbon dioxide scrubbers on the command module side fit into the round air filter on the lunar module side, using only items on board the spacecraft.[46] In the words of the flight director in charge of the Apollo 13 mission in the 1995 film based on the event, "I suggest you gentlemen invent a way to put a square peg into a round hole. Rapidly."[47]

And the engineers responded, dumping everything available on the craft onto a conference room table.[48] "Okay, people. Listen up. The people upstairs handed us this one, and we gotta come through. We gotta find a way to make this [holding up the square cartridge] fit into the hole for this [holding up a round one] usin' nothin' but that [pouring out the usable materials]. Let's get it organized . . . Better get some coffee goin', too, someone."[49]

And they figured it out, using the cover from a flight plan, some duct tape, and some socks.[50] They saved the astronauts.[51]

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[46] *See id.* (detailing the problem of carbon dioxide removal).

[47] APOLLO 13 (Universal Pictures 1995).

[48] *Id.* (referencing actions taken from the movie).

[49] *Id.*

[50] *Id.* Here is Jim Lovell's description of what occurred:

> What happened was, in the lunar module, which we didn't think about at the time but some of the people in [Manned Spacecraft Center] Crew Systems [Division] did, that the round canisters were devised and developed to support 2 people for 2 days and that they were round and that they were lithium-hydroxide that would remove the carbon dioxide. Now they were becoming saturated. And the partial pressure of carbon dioxide was rising—something that we didn't really notice at first. But the ground started to notice it and they started to try to figure out what they could do. Now in the dead command module, they use in their environmental system *square* canisters. Had plenty of them, but you can't put a square canister in the round hole of the lunar module system. Big engineering goof. Why we had square there, we had round over there, we'll never know. So, what the Crew Systems came up with was how to jerry-rig a square canister to work in the lunar module. We did it with tape, plastic, cardboard, and a little sock. And, by gosh, it worked!

James A. Lovell, Jr., *Oral History Transcript*, NASA JOHNSON SPACE CENTER ORAL HISTORY PROJECT, 12–51 (May 25, 1999), *available at* http://www.jsc.nasa.gov/history/oral_histories/LovellJA/JAL_5-25-99.pdf.

[51] APOLLO 13, *supra* note 47. As Lovell explained it:

> Well, they—first of all they started up, you know, I—we sent down everything we could when we had the explosion. They said that we—this was after we saw the oxygen. They said, "Yeah, we got a lot of guys working on it down here. We'll help you out." I said,

As we saw from the Apollo 13 success, teamwork is what it's all about.[52] The same was certainly true for other, earlier missions,[53] both for the astronaut teams and the ground crews.[54]

"Thanks a lot!" But they—I have to tell you, that's when they started getting that teamwork together.

Lovell, *supra* note 50, at 12–47.

[52] Lovell noted:

> And essentially Jack [Swigert] and I started to build this thing. And we—just according to the instructions—the instructions were explicit and it was a great job. And, if you look at the one that the Crew Systems had made to show the people in the Control Center and you look at the one that's hanging on the lunar module wall, they're identical.

Id. at 12–52.

[53] According to astronaut Neil Armstrong:

> We were a very close team. We spent almost all our time together for months on end, getting ready for [the Gemini V mission], . . . going back and forth between Houston . . . , working with the spacecraft as it was nearing completion, and participating in the testing of that spacecraft. . . . We would spend enormous amounts of time together, working out the details.

Armstrong, *supra* note 13, at 47–48. Addressing Congress, astronaut Buzz Aldrin explained:

> [T]he footprints at Tranquility base belong to more than the crew of Apollo 11. They were put there by hundreds of thousands of people across this country, people in government, industry and universities, the teams and crews that preceded us, all who strived throughout the years with Mercury, Gemini and Apollo.

Transcript of Astronauts' Address to Congress, N.Y. TIMES, Sept. 17, 1969, at 30 (quoting Edwin E. "Buzz" Aldrin, Jr.).

[54] As Armstrong explained it:

> I was certainly aware that this was a culmination of the work of 300,000 or 400,000 people over a decade and that the nation's hopes and outward appearance largely rested on how the results came out. With those pressures, it seemed the most important thing to do was focus on our job as best we were able to and try to allow nothing to distract us from doing the very best job we could. And, you know, I have no complaints about the way my colleagues were able to step up to that.
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> . . . .
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> I can only attribute [the low component failure rate per flight] to the fact that every guy in the project, every guy at the bench building something, every assembler, every inspector, every guy that's setting up the tests, cranking the torque wrench, and so on, is saying, man or woman, "If anything goes wrong here, it's not going to be my fault, because my part is going to be better than I have to make it." And when you have hundreds of thousands of people all doing their job a little better than they have to, you get an improvement in performance. And that's the only reason we could have pulled this whole thing off.

Armstrong, *supra* note 13, at 78–79.

Because effective teamwork is critical to the success of any mission, astronaut training includes an emphasis on this all-important skill.[55] As Astronaut Wendy Lawrence has commented,

> Team-building is very important. Astronauts spend countless hours working very, very closely with the people in the Control Center who are going to support the mission. You spend hours getting to know them, because if you work that closely with somebody, you get to know how they approach a problem, and you can work together toward the goal of solving the problem.[56]

Indeed, according to NASA, a team functions as more than the sum of its parts.[57] Teamwork promotes excellent communication skills, tact, diplomacy, composure, and cooperation—skills without which lawyers would be lost in space.[58] As NASA notes in its astronaut training materials, "[R]esearch points to the development of shared mental models (i.e., the situation where everyone in the team has a common conceptualization of the task and the surrounding environment) as a means by which to enhance effective teamwork."[59]

Just as astronauts must be able to rely on Mission Control to solve potentially catastrophic mid-mission anomalies, a client must be able to rely on her attorney to know how to handle sticky situations. Each member of a representation team must be able to trust every other member to perform his individual task competently, even on a dime. In an educational setting, the concepts that Mission Control was relying on to determine the way to lead the astronauts back safely are forms of teamwork labeled "collaborative learning or cooperative learning,"[60] where "students [interact with each other to] work on a task and learn in small groups."[61]

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[55] Teamwork has been defined as "a crewmember's ability to develop cordial and effective working relationships with others." Hysong et al., *supra* note 14, at 16.

[56] *See* Telephone Interview by Lisa McElroy with Wendy Lawrence, *supra* note 16.

[57] Hysong et al., *supra* note 14, at 16.

[58] Note that the manual also emphasizes that "good communication among team members is critical to all of the aforementioned abilities, and is therefore considered in conjunction with teamwork." *Id.*

[59] *Id.*

[60] While pedagogical, slight differences exist between the two types of learning, this article treats the two as interchangeable in examining the benefits of collaboration in the law school setting. *See, e.g.*, BARBARA J. MILLIS & PHILIP G. COTTELL, JR., COOPERATIVE LEARNING FOR HIGHER EDUCATION FACULTY 5 (1998).

[61] Roberta K. Thyfault & Kathryn Fehrman, *Interactive Group Learning in the Legal Writing Classroom: An International Primer on Student Collaboration and Coopera-*

We saw clearly in the Apollo 13 example that teamwork promotes excellence in problem-solving. The same is true in the law school environment, where scholars have documented the cognitive benefits experienced in a collaborative learning environment in the law school classroom.[62] These benefits include: active engagement of the materials;[63] student hearing and consideration of diverse opinions;[64] higher levels of critical and reflective thinking;[65] better retention of material;[66] and the promotion of dispute resolution and negotiation methods[67]—all of the same results noted by NASA, where collaborative learning and performance are both expected and routine. Furthermore, in educational experiments where psychologists have presented a variety of types of problems to individuals and teams, the teams have outperformed individuals on all types and across all ages.[68] In addition, benefits have been documented "in social

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tion in Large Classrooms, 3 J. MARSHALL L. REV. 135, 139 (2009) (quoting LINDA B. NILSON, TEACHING AT ITS BEST: A RESEARCH-BASED RESOURCE FOR COLLEGE INSTRUCTORS 127 (2003)) (alteration in original).

[62] *See, e.g.*, Elizabeth A. Reilly, *Deposing the "Tyranny of Extroverts": Collaborative Learning in the Traditional Classroom Format*, 50 J. LEGAL EDUC. 593, 598–99 (2000) (detailing a "drastic cognitive leap" resulting from "effective collaborative learning"). *See generally* Clifford S. Zimmerman, *"Thinking Beyond My Own Interpretation:" Reflections on Collaborative and Cooperative Learning Theory in the Law School Curriculum*, 31 ARIZ. ST. L.J. 957 (1999) (explaining the benefits of collaborative and cooperative learning techniques in the law school environment). The benefits of student collaboration have been studied and documented extensively. To date, there have been more than 600 studies demonstrating that collaboration in education "produces higher achievement, more positive relationships among students, and psychologically healthier students." Brigette LuAnn Willauer, Comment, *The Law School Honor Code and Collaborative Learning: Can They Coexist?* 73 UMKC L. REV. 513, 515 (2004) (quoting Gerald F. Hess, *Heads and Hearts: The Teaching and Learning Environment in Law School*, 52 J. LEGAL EDUC. 75, 94 (2002) (discussing the empirical study by G. Andrew Benjamin and co-authors of psychological distress in law students)).

[63] *See* Reilly, *supra* note 62, at 599 (describing students' response to collaborative learning methods).

[64] *See* DAVID W. JOHNSON & ROGER T. JOHNSON, LEARNING TOGETHER AND ALONE: COOPERATIVE, COMPETITIVE, AND INDIVIDUALISTIC LEARNING 53–54, 57–58 (4th ed. 1994) (stating that cooperative learning promotes interpersonal trust and student-to-student interaction).

[65] Reilly, *supra* note 62, at 599, 602–03.

[66] *Id.*

[67] Elizabeth L. Inglehart, Kathleen Dillon Narko & Clifford S. Zimmerman, *From Cooperative Learning to Collaborative Writing in the Legal Writing Classroom*, 9 J. LEGAL WRITING INST. 185, 188, 194, 210 (2003); Reilly, *supra* note 62, at 603.

[68] Brigid Barron & Linda Darling-Hammond, *Powerful Learning: Studies Show Deep Understanding Derives from Collaborative Methods*, EDUTOPIA (Oct. 8, 2008), http://edutopia.org/inquiry-project-learning-research ("Results varied by how

and behavioral areas as well, including improvement in student self-concept, social interaction, time on task, and positive feelings toward peers."[69] Moreover, collaboration has been shown to lessen anxiety in the law school classroom, encourage participation, reduce competitiveness, and reduce class and social barriers among students.[70] Are not all of these goals as worthy in the training of lawyers as they are in the training of astronauts, where self-confidence, positive feelings towards peers, and positive socialization are critical?

When considering what law professors hope to achieve in the classroom, let's look back at the Apollo 13 scenario where Mission Control personnel worked together to come up with a creative solution to an impossible situation because the astronauts' lives were on the line.[71] Daily in the practice of law, lawyers are responsible for their clients' lives and livelihood. Take a death penalty case, or any legal issue for that matter, and consider which of the following two attorneys you would rather have on the case:

1. Attorney A works by herself, although in a suite shared with other attorneys. She researches, outlines, drafts, redrafts, and edits her brief [about a new legal issue] absent any review or input from her colleagues.
2. Attorney B also works in a suite of offices, but she often talks with her colleagues about legal issues. She raises each new issue with them during the course of her thinking, research, outlining, drafting, and redrafting. She incorporates the input received, which confirms some points and leads her to rethink others. Eventually, she is comfortable with the arguments, presentation, and writ-

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well defined the problems were (a single right answer versus open-ended solutions, such as writing a story) and how much they relied on language. Several experimental studies have shown that groups outperform individuals on learning tasks and that individuals who work in groups do better on later individual assessments.").

[69] *Id.* "Researchers say these social and self-concept measures were related to academic outcomes and that low-income students, urban students, and minority students benefited even more from cooperative group work, a finding repeated over several decades." *Id.*

[70] *See generally* Susan Bryant, *Collaboration in Law Practice: A Satisfying and Productive Process for a Diverse Profession*, 17 VT. L. REV. 459 (1993) (detailing the benefits of collaborative methods in both legal practice and the law school environment). *See also* JOHNSON & JOHNSON, *supra* note 64, at 53–54 (explaining that collaborative methods of instruction promote interpersonal trust, effective coping strategies, and greater psychological health).

[71] Lovell, *supra* note 50, at 12–51.

> ing style, and asks a colleague to read the draft and provide feedback on organization, clarity, and persuasiveness. As a result of the critique, Attorney B rethinks her arguments, presentation, and style, then edits and files her brief with the court.[72]

The difference in working styles between Attorneys A and B will likely be "outcome determinative."[73] Attorney A used an individual and autonomous style that is consistent with the traditional law school classroom.[74] Attorney B used a team approach that fostered creativity and promoted the best possible result for her client.[75] It is well-established that the practice of law is a social enterprise—why then would we not educate our students using techniques that produce high levels of cognitive and social results individually and will produce the best outcome for future clients?

While NASA has a history of focusing on teamwork to accomplish tasks successfully, the law school classroom has historically focused on competition, individualism, and autonomy.[76] Unlike at Mission Control, where a social environment of collaboration existed, creating "a community to organize sustained project work"[77] in law schools may be challenging. Toward that end, "[l]aw teachers must exercise some introspection and question the roles they serve and what they hope their students will achieve."[78]

And, of course, the practical lesson to take away: when we're under time pressure, when we're trying to find just the right

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[72] Zimmerman, *supra* note 62, at 961–62 (citation omitted).

[73] *Id.* at 963.

[74] *Id.* at 962; *see also* Carole Silver, *Adventures in Comparative Legal Studies: Studying Singapore*, 51 J. LEGAL EDUC. 75, 85–86 (2001) (noting that "[l]aw school still is very much an individual experience").

[75] Zimmerman, *supra* note 62, at 962–63; *see also* Dorothy H. Evenson, *To Group or Not to Group: Students' Perceptions of Collaborative Learning Activities in Law School*, 28 S. ILL. U. L.J. 343, 377 (2004) (describing collaborative environment of clinical program).

[76] *See* Willauer, *supra* note 62, at 518 (citing David W. Smit, *Some Difficulties with Collaborative Learning*, 9 JAC 45 (1989), *available at* http://www.jacweb.org/Archived_volumes/Text_articles/V9_Smit.htm); Zimmerman, *supra* note 62, at 97.

[77] Barron & Darling-Hammond, *supra* note 68. According to leading researchers in this area, there are five important elements for a successful collaborative experience: positive interdependence, individual accountability, structures that promote face-to-face interaction, social skills, and group processing. NILSON, *supra* note 61, at 127–32.

[78] Zimmerman, *supra* note 62, at 986.

analogy, when we're shouldered with the responsibility of saving a client's life and livelihood, it never hurts to "get the coffee goin.'"[79]

IV. ATTITUDE: HOPE AND OPTIMISM

"Mystery creates wonder and wonder is the basis for man's desire to understand."[80]

Let us return one last time to the story of Apollo 13, in which, on Day 2 of the mission, the electrical system and both oxygen tanks failed, putting the astronauts at a very real risk of perishing in space.[81] They were relying entirely on the engineers in Houston, who shared a common goal: they were not going to lose their astronauts. No, for the folks at Mission Control, "failure [was] not an option."[82]

Ever since President John F. Kennedy called upon NASA to reach the moon, the space program has been based on hope and optimism.[83] Reaching the moon, like making it through law school or representing clients, was never considered to be a simple task; indeed, President Kennedy told the world that the United States would go to the moon "not because [it was] easy, but because [it was] hard."[84] And yet many law students, even those who understand and embrace how rigorous the law school task will be, report that law school is based not on hope and optimism, not on teamwork, but on negativity and competition, especially in the first year.[85]

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[79] *See supra* notes 47–49.

[80] *Transcript of Astronauts' Addresses to Congress, supra* note 53 (quoting Neil A. Armstrong).

[81] Lovell, *supra* note 50, at 12–42.

[82] The quote, "Failure is not an option," has been attributed to Gene Kranz, Flight Director of the Apollo 13 mission, but it was actually written for his character in the 1999 film. OXFORD DICTIONARY OF MODERN QUOTATIONS (Elizabeth Knowles ed., 2008).

[83] President John F. Kennedy, Rice Stadium Moon Speech (Sept. 12, 1962) (transcript available at http://er.jsc.nasa.gov/seh/ricetalk.htm); *see also* Rebecca Sprague, *Moon Likely a Hub for Mars, Beyond*, NASA (Oct. 1, 2008), http://www.nasa.gov/centers/kennedy/about/history/50th_apollo.html (quoting President Kennedy).

[84] Kennedy, *supra* note 83.

[85] *See, e.g.*, Allison Martin & Kevin Rand, *The Future's So Bright, I Gotta Wear Shades: Law School Through the Lens of Hope*, 48 DUQ. L. REV. 203, 204 (explaining why "[l]aw students need hope"); *Making Docile Lawyers: An Essay on the Pacification of Law Students*, 111 HARV. L. REV. 2027, 2034–35 (1998) (documenting observations of Harvard Law School students); Kennon M. Sheldon & Lawrence S. Krieger, Note, *Does Legal Education Have Undermining Effects on Law Students? Eval-*

How can we better strive to create a law school culture in which enthusiasm for learning and excitement about the mission last beyond the first days of law school? Scholars have discussed this issue with concern for decades[86] but recognize that law schools are resistant to change.[87] Yet some also recognize that the task, while not easy, is worthwhile and suggest concrete steps toward improving attitude and approaching law school and law practice with positivity.[88] For example, according to Emily Zimmerman, professors can seek to make law-study personally meaningful for students by connecting what they are learning to their "experiences and interests outside of law school."[89]

Perhaps by harnessing the mystery and wonder with which students enter law school, we can help them navigate their studies more successfully and positively. To do so, however, we will have to make the end goal more worthwhile than earning high grades or a spot on a prestigious journal.[90] We will have to find ways to help students buy into the mission, to help them see that failure is not an option when representing clients, to help them understand that they have the tools and the smarts to make the connections they need to make to accomplish great things. Perhaps we can even do so by telling them the story of Apollo 13, by encouraging them to find a way to fit the round "filter" into the square "scrubber."[91] Here's what they will learn: you've only got what you've got, tube socks, flight plans, and all. As attorneys, we would love to have a case perfectly on point, one that says without ambiguity that our client wins. Such a case is rare, however, and we're more often in the position of having to convince

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uating Changes in Motivation, Values, and Well-Being, 22 BEHAV. SCI. & L. 261, 262–63 (2004) (detailing results of research showing increased emotional distress among law students).

[86] Emily Zimmerman has developed a paradigm through which we might discuss and measure law student enthusiasm. *See generally* Emily Zimmerman, *An Interdisciplinary Framework for Understanding and Cultivating Law Student Enthusiasm*, 58 DEPAUL L. REV. 851 (2009); *see also* Martin & Rand, *supra* note 85, at 209 (explaining the psychology and characteristics of hope and optimism and describing an empirical study supporting the notion that hope leads to greater success in the first semester of law school).

[87] *See generally* STUCKEY ET AL., *supra* note 11; SULLIVAN ET AL., *supra* note 10.

[88] *See, e.g.*, STUCKEY ET AL., *supra* note 11, at 170 (advocating positive reinforcement, acknowledgement of new ideas, and praise for worthwhile statements).

[89] Zimmerman, *supra* note 62, at 909.

[90] *See id.* at 917 ("One way to make law schools better environments for law students is by helping students develop enthusiasm for law study.").

[91] *See* Dumoulin, *supra* note 2.

the court, using available authority as well as a heavy dose of persuasion in the form of analogy and distinction, that our client can and should win. We have to make this [a somewhat helpful case] fit into this [our client's facts] usin' nothin' but that [all of our analytical and persuasive writing skills].[92]

V. CONCLUSION

"[L]ooking back, we were really very privileged to live in that thin slice of history where we changed how man looks at himself and what he might become and where he might go."[93]

On July 20, 1969, when we were very small children, our mothers propped us up in front of the television set to watch Neil Armstrong and Buzz Aldrin walk on the moon. At the time, the idea that we could send a tin can many thousands of miles into space to land on what many believed to be green cheese seemed to be an impossible one. For the next several years, we would regularly launch men into the stratosphere to learn what lay beyond. Why? Perhaps it was to beat the Russians in a race that seemed, at the time, to be an indicator of which world power would prevail.[94] Perhaps it was for adventure: because the moon was there.[95] And perhaps, as President Kennedy posited, it was to discover new landscapes, to test our mettle in achieving a truly difficult feat.[96]

But what we achieved through Apollo 13 was perhaps even more profound. In the words of Fred Haise, the mission's lunar module pilot,

> [Apollo 13] offers a graphic example and a very dramatic example . . . [of] what can happen if you do have . . . the right people, the right skill mix, that are trained and they're assembled in this team and they work together under the right leadership. You know, what a miracle can happen. And that's what was the case of Apollo 13.[97]

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[92] *See* APOLLO 13, *supra* note 47.

[93] Armstrong, *supra* note 13, at 92.

[94] *See* Steven J. Dick, *The Voyages of Apollo*, NASA (May 30, 2006), http://www.nasa.gov/exploration/whyweexplore/Why_We_20.html (addressing the space rivalry between Russia and the United States).

[95] *See* Larry Gormley, *'Because It's There'*, http://ehistory.osu.edu/world/articles/articleview.cfm?AID=11 (last visited Feb. 10, 2010) (referring to Mount Everest explorer George Mallory's rationale in 1924 for why he wanted to climb Mount Everest—"Because it's there.").

[96] Kennedy, *supra* note 83.

[97] Haise, *supra* note 15, at 12–41.

As law professors, we are really very privileged to work with law students in this thin slice of time, these three or four years, when they are learning the skills they need to represent clients. If we do it well, we may help them reach the moon; if we fall back on tradition, they may never even launch.