

IMPACT STUDY

THE IMPACT OF
MIT SLOAN
ACTION LEARNING
ON THE STUDENT EXPERIENCE



Contents

1	Executive Summary
7	Introduction
11	What is MIT Sloan Action Learning?
14	How We Learn
19	Hypotheses
20	Methodology
21	Survey
24	Database Analysis
25	Results and Findings
29	Discussion
32	Implications for Hosts
34	Conclusion and Next Steps
36	Research Contributions
37	References
39	Data Analysis Tables
46	Data Analysis Figures
53	Appendix 1: Depth Interview Guide
57	Appendix 2a: Student Survey
62	Appendix 2b: Alumni Survey
67	Appendix 3: Anatomy of a Resume
68	Appendix 4: Success Stories

Executive Summary

MIT Sloan Action Learning (AL) courses, in which student teams apply classroom theory to business and management challenges at real-world organizations, have been offered at MIT Sloan for more than two decades and have emerged as significant components of students' portfolios. In mid-2016, the School's Action Learning team embarked on what would become an 18-month investigation into the personal and professional benefits that MIT students and alumni attributed to their experiences with these courses. The goal was to shed light on AL's value as a teaching tool – not relative to other methods, but rather in relation to our pedagogical and institutional goals.

Where past evidence in this area has been largely anecdotal, our study was systematic and grounded in neurological and psychological research. This methodological approach lends ballast to our conclusions. The results may be of interest to parties including students and alumni, professors and administrators, donors, corporate partners, prospective students, and other educators.

Background

The core of any business school's mission, not least that of MIT Sloan, is to provide students with both theoretical knowledge and the ability to apply it in real-life settings. A multitude of tools exist to support this pedagogical objective, from traditional lectures to simulations, case-study analyses, and internships. Some critics of management education argue that, in sum, these approaches place too much emphasis on scientific analysis, techniques, and theories, rather than instilling in students the sorts of skills they need for on-the-job problem solving. "Most MBA curricula have emphasized knowing at the expense of

doing and being," write the authors of a 2010 critique of business school practices (Datar et al., 2010, p. 104). One pedagogical tool takes an active approach to ensuring that students learn how to dynamically integrate "knowing" and "doing." Action learning, a term introduced in the 1970s by Reginald Revans, a British professor of industrial administration, acknowledges that these two components of successful problem solving should be deeply intertwined, with each feeding off the other. Revans also set this process in a context of group work and group feedback.

Revans’s ideas soon caught on in both corporate leadership training programs and academia. At MIT’s Sloan School of Management, Revans’s ideas were reflected as early as 1964 in a course taught by Professor Ed Roberts, in which students worked with local companies to build system dynamics models of specific problems. In 1992, the school embraced AL more formally, with the launch of Entrepreneurship Lab (E-Lab), which matched teams of management, science, and engineering students with high-tech start-ups in and around Boston. In the 25 years since, more than 9,000 students have participated in MIT Sloan’s Action Learning lab courses, and demand for AL opportunities has grown across the School’s seven degree programs. The portfolio of AL lab offerings ranges between 15 and 20 in any academic year and spans diverse interdisciplinary topics. (Please see “What is MIT Sloan Action Learning?” on page 11 for further detail.)

The resources that AL requires when undertaken seriously are significant: for example, administration of a typical AL course at MIT Sloan runs anywhere from two to 20 times that of a typical lecture-based course. That AL has nonetheless endured and expanded underscores the magnitude of its potential benefits students, the Institute, and organiza-

tions around the world.

Our goals

Anecdotal evidence suggests that AL as embodied at MIT Sloan provides a rich and broad range of benefits to those who have experienced it, from improved critical thinking skills to a broad global perspective, high levels of creativity, and a strong sense for ethical and moral boundaries. But no rigorous, systematic study has previously looked at questions that should be of keen interest to business schools – namely, how AL affects student learning and personal and professional growth among alumni. In MIT’s spirit of scientific inquiry, MIT Sloan’s Action Learning staff has attempted to fill this gap.

We first analyzed the degree to which AL at MIT Sloan creates a supportive environment for optimal learning. What goes into such an environment is of keen interest to researchers in psychology, neurology, and, of course, pedagogy; current thinking identifies about a half-dozen factors, ranging from where students learn (with an emphasis on diverse spaces and temporal spacing) to why (with a focus on relevant material that engages students) and how (mixing materials, in close contact with a mentor, and in a safe setting that encourages intellectual risk-taking). This



THE METHODOLOGIES BEHIND ACTION LEARNING ARE DEEPLY INTERTWINED WITH MIT’S MOTTO, *MENS ET MANUS*, OR MIND AND HAND. NOW, AFTER PRACTICING OUR ACTION LEARNING PEDAGOGY FOR SEVERAL DECADES, MIT SLOAN IS A DISTINCTIVE LEADER IN THIS IMMERSIVE, HANDS-ON APPROACH TO MANAGEMENT EDUCATION.

DAVID SCHMITTLEIN, JOHN C HEAD III DEAN

analysis suggests that, in terms of pedagogical inputs, AL performs well, providing students with learning opportunities that support all the key factors for success. (Please see “How We Learn” on page 14 for further detail.)

The next goal was to measure outputs. To do this, we developed a framework for understanding the benefits that AL might bring to students and alumni. The framework, derived in part from intensive interviews with students and alumni, recognized the “knowing” versus “doing” dichotomy discussed above, categorizing professional benefits as related to either conceptualization or implementation skills. (Career-building benefits were considered

database analysis, examining 502 resumes of MIT Sloan graduates to measure the content devoted to project-based experiences.¹ This latter approach is relatively novel in the field: codifying information from an objective historical record to gain insights into how individuals, at the time it matters, use different experiences to represent their value to potential employers. (Please see “Methodology: Database Analysis” on page 24 for further detail.)

We used factor analysis to sort into meaningful categories the variety of responses we received, and t-tests and chi-squared tests to ensure as much as possible that our conclusions were based on statistically significant findings.



VALUE ACTION LEARNING IN TOP 3 EXPERIENCES

as well.) But the framework also complicated this division by examining benefits that do not fit neatly into either category – what one might call personal-growth benefits, including self-reliance, global awareness, and the ability to adapt to unexpected changes. (Please see the “Methodology: Survey” section on page 21 for further detail.)

We then created a detailed written survey to investigate the degree to which students and alumni attributed certain skills to their AL experiences. The survey yielded 288 responses. We supplemented this with

Findings

Our results strongly suggest that MIT Sloan Action Learning is valued by its participants. Students and alumni alike reported that AL had contributed significantly to both their learning at MIT Sloan and their capabilities not just as professionals, but as thinkers and actors in the world.

More than a fifth of students and a quarter of alumni named AL when asked to identify, unaided, the three experiences they valued most from their time at MIT Sloan (Figures 5a and 5b). When survey respondents were asked to select the three most valuable components of their learning

¹Because students rarely referred directly to AL on their resumes, instead discussing specific projects undertaken for companies (which include a handful of non-AL projects), we talk about “project-based experiences” rather than AL in our discussion of the resume analysis methods and findings.

This began a trend, continued in other findings, wherein alumni demonstrated a deeper appreciation for the impact of AL than did their student counterparts.

experience from a list of 10 (Figures 6a and 6b), AL performed even better – but more so among alumni, with four in 10 respondents ranking AL in one of the top three spots (compared with one in four students).

Students and alumni also appeared to value different aspects of their AL experiences. When we probed what areas in particular they felt AL had benefited, students tended to focus on practical skills (for example, communication and managing projects), while alumni more often named skills related to conceptualization (for example, developing structured approaches to problems or applying theoretical frameworks to real-life situations). See Figure 7 for a representation of this trend.

One way we thought about this split was in terms of quick-release versus long-term benefits. AL tries to prepare participants for the sorts of challenges that might feel particularly daunting to someone at the start of a career, such as working in groups or managing projects. It makes sense that students with graduation on the horizon would most appreciate this aspect. But AL is also meant to prime people for big, multifaceted, and complex problems – the sorts of challenges that tend to arise later in a career. It makes sense that

alumni, whose careers almost by definition will have been longer than students', recognize the value of this other aspect.

As for personal benefits, students and alumni alike indicated that AL had had a strong positive influence on skills related to operating in a group setting – no surprise, perhaps, given the intensity with which AL participants must work with fellow students, professors, and their real-world partners.

Perhaps more interestingly, the second-highest ranked personal benefit among both students and alumni was AL's positive impact on their ability to deal with ambiguity (Tables 8a and 8b). This is encouraging for two reasons. One is straightforward: this skill aligns strongly with MIT's mission of teaching students to solve complex, often ambiguous problems. The other reason is that this result suggests AL is often greater than the sum of its parts: no one aspect of the course offerings – and no one learning success factor – points specifically to dealing with ambiguity, and yet for many participants it is a key benefit.

Both students and alumni appeared to see career advancement as a secondary benefit of AL, after the knowledge and skills it imparts. Further, AL does not appear to be the pivot

for moving from one functional specialty or industry to another – perhaps simply because the number of MIT Sloan students who change careers after graduation is already extremely high; uncovering a factor that pushes it even higher might be difficult. Although this ceiling effect means the finding should be viewed as preliminary, the trend was backed up by our database analysis.

The database analysis additionally suggests that students may see AL as an opportunity to make up for a lack of practical experience: there was a correlation between mentioning project-based experiences on resumes and shorter-than-average “Work Experience” and “Skills/Activities” sections (Table 10a). Separately, the database analysis supports the finding that students value AL: When included on resumes, project-based experiences tended to take priority over other elements of the “Education” sections, including coursework, extracurricular activities, and leadership (Table 10b).

Next steps

Our study leads to two parallel (though sometimes intersecting) pathways: an intellectual, research-driven journey; and a series of presentations, meetings, and informal conversations to share what has been learned and discuss how one might apply these lessons practically.

Future research

While our work has gone some way to providing methodologically sound evidence for the benefits of AL, it also suggests avenues for further research. Because we investigated the experiences of students and alumni from just one institution, the degree to which we can generalize our findings is limited. AL at MIT

Sloan has been carefully designed to promote many of the learning factors discussed. For example, the approach focuses intensely on ensuring that projects are congruent in content with the corresponding AL course; this may not be true at other business schools, plausibly leading to very different benefits (or a lack of benefits) being reported by students of similar programs elsewhere.

Our study might seem to hold AL to standards rarely applied to other pedagogical methods. In fact, we consciously avoided comparing AL with other teaching tools, declining to ask students or alumni to link professional and personal benefits with approaches such as case study analysis, class projects, or traditional lectures. Future projects might consider taking some of the analytical approaches and frameworks developed in this study and applying them to other pedagogies.

We are also curious whether certain groups of students or alumni – male vs female, younger vs older, American vs international – extract different benefits from AL. The relationship between identity-based factors and how a person responds to a learning experience has, of course, been probed in educational research, but not applied to AL in particular.

While our report considers the impact of AL on host organizations, measuring this did not fall within the scope of the study. Feedback from companies and other organizations that have participated in AL projects could do with the sort of systematic collection and analysis methods applied here to student and alumni feedback. The teaching method’s impact on institutions that later employ AL learners is also a rich vein for methodological, or even quantitative, investigation.

(Please see “Implications for Hosts” on page 32 for further detail.)

Sharing insights

In terms of practical implications of our work, for some MIT Sloan stakeholders the take-aways are clear and immediate. Sharing our results with students might help them in planning their coursework. Alumni might gain a language for reflecting on their experiences at business school or even be prompted to further develop a skill they first grasped through AL.

The lessons multiply when examining our study from an institutional perspective. For any university providing AL experiences, value-for-money calculations are a fact of life. But this research suggests administrators might also think about how AL – and other pedagogical tools, for that matter – are framed. How should students be guided about an appropriate balance of the “knowing” and “doing” aspects that underlie a solid business school education? Similarly, if a university has decided that AL instills

mission-critical skills in participants, should it communicate this to hiring managers? The more these ideas and the findings they are based on are shared and discussed, the greater their potential impact on AL and the institutions that engage with it.

Finally, managers at host organizations are important stakeholders who might not see obvious ways our results feed into their decision-making. In fact, direct links exist: the extent to which AL affects student learning will influence the solutions these students devise for hosts and the effectiveness with which they communicate them. Similarly, the benefits extracted from AL by individual participants should, logically, extend to their future employers – in the corporate world or otherwise.

The nature of AL’s potential impact on organizations is not an after-thought. In considering this, we enter ambitious but important territory: how the way we learn shapes the way our societies run.

Students and alumni alike reported that AL had contributed significantly to both their learning at MIT Sloan and their capabilities, not just as professionals, but as thinkers and actors in the world.

Introduction

Since its founding in 1865, MIT has been committed to educating students through a blend of theory and practice. A “learning by doing” approach permeates the Institute, and management education at MIT has held steady with this tradition. In 1914, Course XV (Engineering Administration) was created and became the bedrock of the Sloan School of Management. Sloan, launched in 1952, was designed to teach students how to solve the complex problems of modern industry and management through the application of a scientific and technical approach (Kochan and Schmalensee, 2003). This mission was not dreamt up in a bubble: the business world was clear about its need for individuals with both a firm grounding in theory and the ability to apply it.

Less clear is how to inculcate these skills in students. MIT Sloan Action Learning (AL), where student teams apply classroom theory to real-world management challenges, is an important part of our pedagogical tool kit. Today, a majority of Sloan students graduate not only with a good understanding of management principles and a facility for analyzing business challenges in the classroom, but also with hands-on experience working with a team of peers to help a company, non-profit, NGO, or government organization grapple with a pressing challenge. AL labs set this experience within the pedagogical framework of a course, guided by MIT faculty, thus avoiding time wasted on experiences that feel either superficial or transactional, and supporting the mechanisms by which AL can deepen an individual’s existing knowledge and promote reflection to integrate theory

with practice.

MIT Sloan is not alone among its peers in complementing other teaching formats – lectures, simulations, cases – with the intensive integration of academic learning and real-life settings that AL labs provide. Despite the resource-intensive nature of AL (administration of a typical MIT Sloan AL course costs between two and 20 times that of a typical lecture-based course), business schools around the world are increasingly incorporating action learning into their programs. A survey by the MBA Roundtable (MBA Roundtable, 2016) found 92 percent of full-time MBA programs offered at least one company-sponsored learning opportunity to its students; all of the top 25 U.S. business schools did so.

Industry embraced action learning even earlier, with many companies adopting the

concept for executive training programs soon after it emerged in the mid-20th century (Leonard and Marquardt, 2010). Today, 73 percent of businesses claim to use action learning in leadership development (Pedler and Trehan, 2010), and companies such as AT&T, Coca-Cola, Exxon, Ikea, Siemens, and Volvo have adopted action learning in one form or another (Boshyk, 2010).

Not surprisingly, given the increasing ubiquity of action learning, anecdotes of the approach's positive effects abound. Stories from the front lines suggest that learners engaged in action learning are effective at critical thinking, at framing problems, and at working with incomplete information; that they have a global perspective and are powerful communicators; that they are creative and innovative, able to assess risk, and attuned to ethical and moral boundaries. However, rigorous, comprehensive research into the benefits of action learning has been limited. A review conducted in 2010 of 21 papers suggested action learning improved various leadership and problem-solving skills in people who had experienced it (Leonard and Marquardt, 2010). But no systematic study has looked at questions that should be

of keen interest to business schools – namely, how action learning affects student learning; alumni experiences (finding jobs, on the job, and elsewhere); or, by extension, the organizations that host AL projects or hire individuals who have AL experiences.

In MIT's spirit of scientific inquiry, MIT Sloan's Action Learning staff has attempted to fill this gap. We used intensive interviews, alongside neurological and psychological research into the ways people learn, to develop a framework for understanding the benefits AL might bring to students and alumni – two core stakeholder groups. These benefits should, logically, extend to the companies that work with AL students; those companies are a third core stakeholder. We then created a detailed written survey to evaluate the degree to which students and alumni attributed certain personal and professional skills to their AL experiences; the survey yielded 288 responses. We supplemented the survey with database analysis, examining 502 resumes of MIT Sloan graduates to measure the space devoted to project-based experience.

Our study is the first to produce data on the perceived value of action learning – a



THE WAY MIT DOES ACTION LEARNING ALLOWS YOU TO GO REALLY DEEP AND WORK ON A PROJECT YOU'RE EXCITED ABOUT.

STUDENT INTERVIEWEE

MBA 2017

Both stakeholder groups saw career advancement as a secondary benefit of AL, placing primary emphasis on the ways it enhanced their knowledge and skillsets.

strong measure of AL's actual value. And yet by analyzing AL at MIT Sloan so intensively, we may seem in danger of putting a higher burden on AL than on other tools, such as lectures, to justify its place in the pedagogical repertoire. In this context, it is worth pointing out that our goal has been to assess the benefits students and alumni derive from AL participation in relation to our AL pedagogical goals (Figure 1), not as a comparison with other teaching methods – and that such an exercise might tell us as much about those pedagogical goals as about the method (AL or otherwise) being examined.

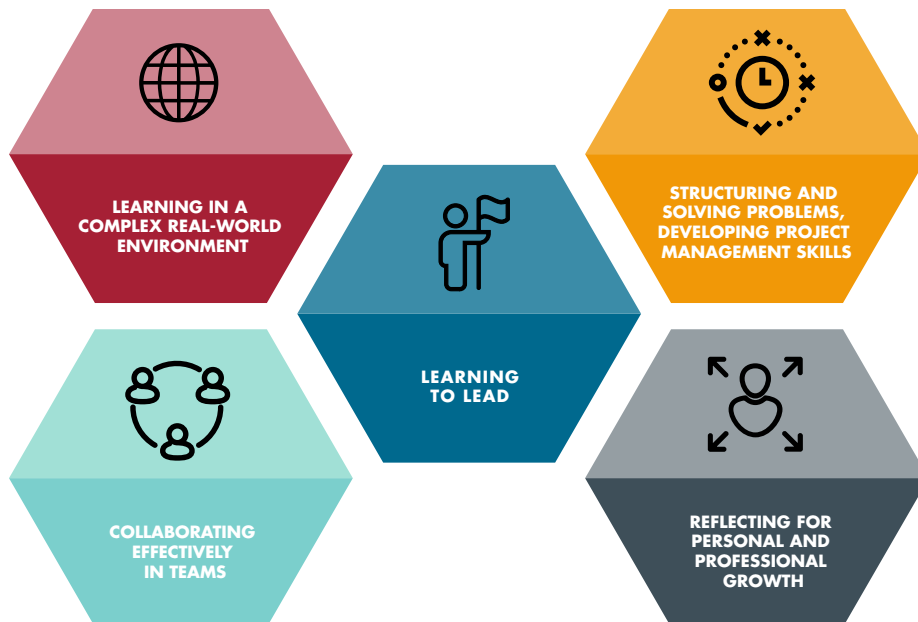
The results should be of interest to multiple audiences. To scholars of pedagogy, psychology, and neuroscience, they complement theories of how people learn. To current and prospective students, they give guidance in terms of course and program selection. To alumni, they draw lines between educational experiences and the skills needed for success in work-life. To university administrators, they provide material to support evidence-based funding decisions. And to companies and potential host organizations, they begin to offer a more systematic demonstration of what was previously anecdotal or more narrowly focused evidence.

Our results show clearly that MIT Sloan

Action Learning is valued by its participants: More than a fifth of students and a quarter of alumni had AL top-of-mind when listing, unaided, what they valued most about their MIT Sloan learning experience. When forced to make a trade-off between components of the learning experience, AL's ranking increased for both groups, but much more significantly for alumni. This began a trend, continued in other findings, wherein alumni demonstrated a deeper appreciation for the impact of AL than did their student counterparts.

The two groups also appeared to value different aspects of their AL experiences, with **students focused on practical skills** (for example, communication and managing projects) and **alumni on skills related to conceptualization** (for example, developing structured approaches to problems or applying theoretical frameworks to real-life situations). Both stakeholder groups saw career advancement as a secondary benefit of AL, placing primary emphasis on the ways it enhanced their knowledge and skill sets. This is an encouraging result in that it aligns with MIT Sloan AL's goal of engendering capability development. It is an interesting result in its departure from earlier ideas of action learning as the province of industry or a mere stepping stone to a job.

Figure 1. Goals of Action Learning: Pedagogical Objectives



What is MIT Sloan Action Learning?

The concept of action learning emerged in the mid-20th century with the work of Reginald Revans, a Briton who studied at Cambridge's esteemed Cavendish Laboratory and coined the term in 1972 as a professor of Industrial Administration at the University of Manchester (Barker, 2010). He described action learning as multilayered – not just, say, learning on the job. “It is rather learning to learn by doing with and from others who are also learning-to-learn by doing,” he wrote (Revans, 1980, p. 288). In other words, it is academically relevant, group-centered, and hands-on.

In industry, this idea of action learning was quickly adapted into leadership development programs, though with varying degrees of faithfulness to Revans's original concept (Kozubaska and MacKenzie, 2012; Marsick and O'Neil, 1999). Soon thereafter, action learning was adopted within academia, first at Southern Methodist University, and then at other universities, where AL aims to bridge the gap between theory and practice. This addresses the critique of management education as placing excessive emphasis on scientific analyses, techniques, and theories at the expense of managerial competencies and skills needed to address complex real-world business challenges (Datar, Garvin and Cullen, 2010); Mintzberg, 2004). This sentiment is reflected in the 2010 critique of business school practices: “...most MBA curricula have emphasized knowing at the expense of doing and being” (Datar et al., p. 104). At MIT Sloan, AL has become in part defined by what it is not: distinct from the more well-known case-study approach to business school education, and different from the traditional summer or semester-long

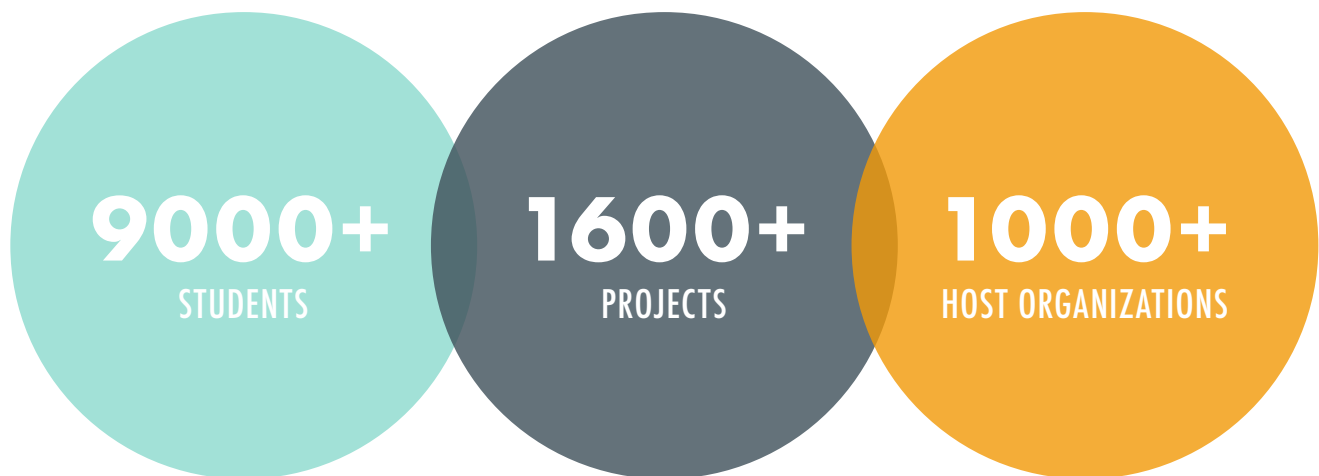
internship in terms of the care with which in-company project work is selected and the degree to which it is aligned with students' academic programs. These contrasts notwithstanding, AL labs are typically a complement to other pedagogical methods, and often to traditional internships, rather than a substitute for either. Revans had been influenced by MIT's Norbert Wiener, father of cybernetics, and some of his ideas were applied at the Sloan School of Management as early as 1964 by Professor Ed Roberts, who created a course in which student teams worked with local companies to build system dynamics models of specific problems. The school embraced AL more formally in 1992, with the launch of Entrepreneurship Lab (E-Lab), an elective offered in partnership with MIT's Entrepreneurship Center (now the Martin Trust Center for MIT Entrepreneurship). The course was designed to provide teams of students in management, science, and engineering with an intensive, on-site experience working on critical business challenges for high-tech start-ups in and around Boston.

In the years since, more than 9,000 students have participated in MIT Sloan's Action Learning lab courses, and demand for AL opportunities has grown across the school's seven degree programs. (See Figure 2 for a summary of the evolution of Action Learning at MIT Sloan.)

Rather than strictly adhering to Revans's definition or other prescriptions, AL at MIT Sloan is a flexible, iterative approach that facilitates high levels of student learning and seeks to meet the School's pedagogical goals. The portfolio of AL lab courses ranges between 15 and 20 in any academic year and spans diverse interdisciplinary topics from global entrepreneurship to intrapreneurship to health-care to analytics. The MIT Sloan approach to AL, in both the breadth of opportunities and the pedagogical framework, has been a key differentiator among peer business schools.

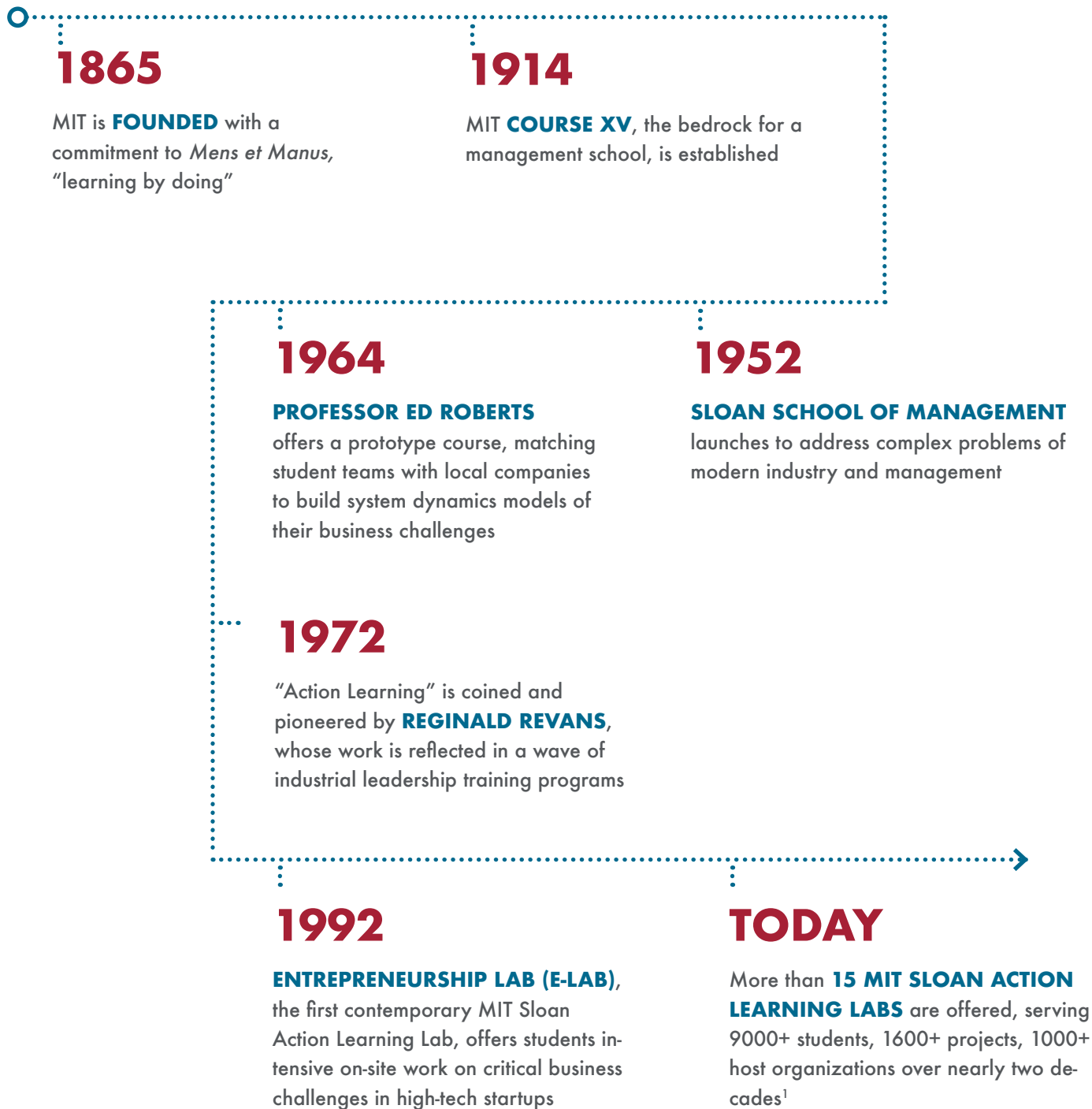
For each AL project, faculty and staff work closely with host organizations to ensure that the work assigned to students will promote learning, and with the student teams to ensure that the work they produce meets high

standards of quality and professionalism. Students engage with organizations that range from small, family-owned start-ups to multinational corporations. The objectives of the projects are in-step with the pedagogical goals of the AL courses, providing opportunities for students to deepen and solidify their theoretical knowledge. Students are in turn coached to take a holistic approach to problems, such that their solutions are creative, applicable, and sound. To do this, they conduct database research; visit project sites; brainstorm ideas with company representatives; and interview stakeholders on the front lines, from executives to line workers, vendors, customers, and investors. Students may conduct surveys or statistical tests, design tools, or develop models. Their learning informs their actions, and their actions reinforce their learning.



OVER THE PAST TWO DECADES

Figure 2. Timeline for the Evolution of MIT Sloan Action Learning



¹ Data for academic years 1999-2018

How We Learn

Recent research in psychology and neurology has informed our analysis of how different pedagogical tools align with success factors in learning. Learning typically involves three steps: information acquisition, information retention, and information retrieval (Thomson, 2012). The degree to which individuals are successful in each of these steps can be influenced by a range of factors, from where they learn to when to why. Though research is still evolving when it comes to the relative importance of different learning success factors, a review of the literature reveals something approaching consensus on a half-dozen or so key factors. Merging some concepts and splitting others, we have identified seven factors that represent this consensus: engagement, diversity of space, diversity of materials, relevance, safe space, mentoring, and the nature of recall opportunities.

Table 1 summarizes our assessment of how six pedagogical approaches – lecture, discussion, role play, case study, class project, and simulation – promote (or not) the seven success factors. Our assessment of AL’s impact on these success factors is discussed following Table 1.

Table 1: Low, Medium, High indicate the level of success factors as produced by different pedagogical tools or modalities. Source: Subjective analysis by research team

	LECTURE	DISCUSSION	ROLE PLAY	CASE STUDY	CLASS PROJECT	SIMULATIONS
Engagement	Low	Med/High	Med/High	Med/High	Med/High	Med/High
Diversity of Space	Low	Low	Medium	Low	Med/High	Medium
Diversity of Materials	Low	Medium	Medium	Medium	Med/High	Med/High
Relevance	Low/Med	Low/Med	Medium	Medium	Medium	Medium
Safe space	High	Medium	Medium	Medium	Medium	Medium
Mentors	NOT APPLICABLE					
Recall activities	Low	Medium	Medium	Med/High	Med/High	Med/High

Our first factor, **engagement**, defined as becoming highly involved in or captivated by something, is widely recognized as contributing to enhanced learning (Hake, 1998; Van Dam, 2013). In a study of 6,500 students in 62 introductory physics courses, Hake (1998) found that courses employing interactive engagement strategies increased conceptual understanding in students by approximately two standard deviations over courses that were primarily lecture-based – irrespective of whether lecturers were deemed particularly talented or popular. The emerging field of educational neuroscience supports this observation, and Van Dam (2013) notes that “the adult’s brain changes following the acquisition of new skills” (pg 34). However, he says, “changes in neural connections, which are fundamental for learning to take place in the brain, do not seem to occur when learning experiences are not active” (pg 32). He cites numerous studies suggesting that “active engagement is a prerequisite for changes in the brain” (pg 32).

Compared with traditional classroom activities, AL labs would appear to involve more active engagement with concepts, frameworks, and skills: students must become highly involved with conceptual knowledge in order to apply it to specific business challenges.

Our second factor, **diversity of space**, taps into two concepts: environmental context and temporal spacing.

Studies consistently demonstrate that location affects memory (Smith and Vela, 2001). In a seminal 1978 paper, researchers showed that subjects who had studied a list of vocabulary words in two different rooms performed significantly better when tested than students who had studied the words twice in the same room (Smith, Glenberg, and Bjork, 1978).

The brain appears to make connections not only with material but also with setting, increasing the number of associations and thereby boosting retention (Carey, 2010). Increased numbers of associations lead to more possible paths to the information, in turn improving information access and retrieval (Thomson, 2012). Time matters, too. Spreading the use of study materials over time – or spacing – has been shown to enhance recall (Carey, 2010; Dunlosky et al., 2013; Thomson, 2012). Doing so can mean forgetting some of the information, but, Kornell (2010) argues, “forgetting is the friend of learning.” It requires the learner to relearn, and, according to Carey (2010), “when the neural suitcase is packed carefully and gradually, it holds its contents for far longer.”

AL students at MIT Sloan bounce from classroom to study room, faculty office, factory floor, host company headquarters, and various interview sites – to name just a handful of the spaces frequented. Given students are solving problems in real time, with all the delays and wait times this involves, and that AL lab work is often just one part of a busy semester, the degree of temporal spacing is also high.

Retention is further boosted by diversifying the skills and concepts being studied, what we term **diversity of materials** (Kornell and Bjork, 2008; Kornell, Castel, Eich, & Bjork, 2010; Taylor and Rohrer, 2010). Kornell (2010) advises learners not only to space study sessions temporally but also to mix topics – studying, say, Spanish, then math, then Spanish again. A 2008 study asked subjects to identify the artists of a set of paintings; those subjects who prepared for this task by looking at collections of paintings from a mix of artists performed significantly better than

those who were shown a collection of paintings from one artist followed by a collection of paintings from the next artist, and so on (Kornell and Bjork, 2008). Kornell and Bjork argue that, in addition to contributing to temporal separation, a diversity of materials may trigger the brain to process information at a deeper level by focusing on both similarities and differences rather than only looking for similarities.

Successfully executing an AL project demands that students draw on multiple concepts and methods learned in their coursework. With its emphasis on a structured approach to problem solving, AL not only involves revisiting materials repeatedly, but also discriminating between frameworks and tools that might be helpful for particular situations and those that would not be – in other words, a focus on contrasts as well as similarities.

Educating students in how to address real-life challenges, or **relevance**, is considered important for learning (Willis, 2007). “Superior learning takes place when classroom experiences are enjoyable and relevant to students’ lives, interests, and experiences,” Willis writes (2007). Relevant content helps students connect newly acquired knowledge to their existing neural networks, facilitating learning. In the absence of relevant material,

learning becomes challenging, as no existing neural pathways exist with which to form connections (Bernard, 2010).

AL lab projects often have consequences, as host organizations frequently implement students’ recommendations. This leads to a greater sense of accountability in students and a strong feeling that what they are doing is relevant. That feeling is underscored over time, as students hear of or witness companies returning to MIT to request follow-up projects that build on the research, reports, and models that emerged from previous AL work.

Emotion, at the right pitch, also appears to contribute to learning. Positive emotion has been well established as a facilitator of learning (Immordino-Yang and Damasio, 2007; Thomson, 2012; Van Dam, 2013). Negative emotion can do the opposite. Citing neuroimaging and neurochemical research, Willis (2007) recommends reducing stress and anxiety; high levels of emotion are associated with a stress response (Taylor and Statler, 2013; Wolfe, 2006). Cognitive psychology studies suggest stress and anxiety impact learning negatively (Christianson, 1992). Stress obstructs information flow to higher cognitive networks, in turn suppressing learning (Willis, 2007). **Creating a safe**



I TRIED TO DO AS MANY LABS AS POSSIBLE BECAUSE I REALLY LIKED THE HANDS-ON EXPERIENCE AND WORKING WITH REAL COMPANIES AND WORKING IN A SMALL TEAM, BUT DOING SOMETHING THAT HAS AN IMPACT ACTUALLY, AND IS NOT JUST ACADEMIC.

STUDENT INTERVIEWEE

MBA 2017

environment for learners therefore becomes critical (Holmer, 2013; Johnson, 2006; Leonard and Marquardt, 2010; Wolfe, 2006). Perceived threats such as a threat to self-esteem or feelings of shame may trigger defense mechanisms that can hinder learning (Holmer, 2013). Feeling psychologically safe becomes an imperative for adult learning (Wolfe, 2006). Trust can counteract these dangers (Holmer, 2013; Johnson, 2006), and educators can be central in building trusting relationships, empowering learners to take risks and share ideas that may not be fully vetted (Wolfe, 2006). It is this kind of idea-generation and exploration that should enable learners to blossom and attain high levels of learning (Caine and Nummela Caine, 2006).

The AL lab is a safe space – populated with fellow students and under the guidance of a faculty mentor – in which students can test themselves at complex problem solving. Students are prepared well for the task at hand during the project scoping process, through their coursework and research, and through the team and faculty support system.

Mentors greatly facilitate learning. Neuroscience research has identified “mirror neurons” that are considered the neurological basis of empathy, and which help explain human interdependence and the powerful role mentors can play in learning – whereby learners mimic mentors’ thoughts and actions (Freedman 2013). Other cognitive neuroscience and social cognitive neuroscience studies show aspects of the mentor-learner relationship – such as trust, emotional harmony, and interaction – leading to changes in the brain (Johnson, 2006). Johnson says, “The discovery that a trusting relationship with a mentor is connected to brain reorganization, growth,

and learning underscores what adult educators have long held true: If the mentor creates a safe, trusting relationship and holding environment, learners are much more able to reorganize their thinking and move through the progressive stages of the developmental journey” (pg 65).

Mentors are an integral component of AL at MIT Sloan. Each student team is assigned a faculty mentor, with each mentor coaching and advising up to four teams, allowing for personal attention in learning and aiding the development of trust. These relationships can often extend beyond the academic term, underscoring the depth of the original connections.

Finally, research has unequivocally established the vital part that specific **recall opportunities** play in learning (Carey, 2010; Dunlosky et al., 2013; Karpicke and Blunt, 2011; Karpicke and Roediger III, 2008; Thomson, 2012). Karpicke and Roediger III (2008), while examining students’ process of learning words, found that repeated study sessions after first learning the words did not help the students remember the words later; however, repeated testing had a highly positive effect. The results, argued the authors, demonstrate the critical role of recall practice in strengthening learning. Karpicke and Blunt (2011) identify the mechanism behind this phenomenon as the need to identify relevant information when addressing a question, as opposed to a simple regurgitation of stored information. This ability to discriminate between relevant and irrelevant information during problem solving helps generate linkages and insights, leading to powerful self-generated learning.

When working on AL projects, students draw on concepts and tools learned in classes across disciplines, as well as in past professional experiences; they cannot, of course, apply every bit of this knowledge to the very specific problems they are trying to solve – requiring that they engage in the sort of discrimination that promotes learning. Similar discrimination takes place in the reflection portion of any AL lab when students discuss or write about their learnings vis-à-vis their goals for the specific AL lab.

Hypotheses

Given that neurological and psychological research suggests that AL should be as good a pedagogical method as traditional teaching tools, it should come as no surprise that business schools have embraced the practice. However, our analysis of the research focused on inputs: which conditions and practices best support learning? Another way to look at pedagogical approaches is to attempt to understand their outputs. To do this, we developed five hypotheses built on the premise that an individual's perception of his or her AL experience is a strong measure of AL's value as a teaching tool. Hypotheses 1-3 investigate student and alumni perceptions of AL at MIT Sloan with regard to professional and personal growth. Hypotheses 4-5 probe students' perception of the value companies and other potential employers ascribe to AL.

H1

AL courses provide memorable and valuable experiences to (a) students and (b) alumni.

H2

AL courses are perceived by (a) students and (b) alumni as developing the ability to apply theory in a real-world context.

H3

AL courses are perceived by (a) students and (b) alumni as developing the personal facets of problem solving.

H4

AL courses are perceived by students as helping with launching careers.

H5

AL courses help (a) students and (b) alumni make career transitions.

Methodology

We used a mixed-methods research approach to gain insight into how action learning affects the learning and growth of students and alumni. Our primary research comprised depth interviews and surveys of students and alumni. The results offered insights into the degree to which both populations attributed key skills and benefits to AL. We supplemented this work with an analysis of student resumes, providing a more objective understanding of how, near the time of graduation, students represented their Sloan experience to potential employers.



Survey

In summer 2016, the Action Learning office worked with MIT Sloan Alumni Board members to develop a guide for depth interviews of students and alumni about their AL experiences (Appendix 1).

These interviews, alongside research into the personal and professional benefits of AL in a corporate context, in turn informed a survey to test our five hypotheses.

The interviews and research review helped us identify 12 key professional benefits and nine key personal benefits of AL in a higher-education context. We divided the professional benefits into three categories (Table 2): Conceptualization benefits are those traditionally associated with academic training, and they require a strong theoretical or analytical understanding to apply in a real-world context; implementation benefits are associated with experienced practitioners and require strong interpersonal abilities important for successful problem solving; and career benefits describe direct job or career boosts.

We also divided personal benefits into three categories (Table 3): self-awareness benefits enhance a student's sense of self and their consciousness, composing a core anchor for the student and affecting both individual and group actions; teaming benefits describe qualities that enhance how students engage in a group setting – a translation of internal attributes to external presentation; and sense-making benefits describe qualities that allow students to solve problems and engage with challenges outside of themselves and the groups with which they work.



IT'S GOING TO BE TWO YEARS UNTIL I BECOME A PROJECT LEADER, BUT I'M ALREADY STARTING TO PREPARE AND THINK ABOUT WHAT IT TAKES TO GET THERE, AND IN THAT SENSE, ALL THE LABS GAVE ME AN EXCELLENT OPPORTUNITY TO TRY MY PROJECT MANAGEMENT SKILLS AND DIFFERENT APPROACHES WITH CLIENTS, DIFFERENT APPROACHES WITH MY TEAMS.

STUDENT INTERVIEWEE

MBA 2017

Table 2: Action Learning’s potential professional benefits

	Conceptualization	Implementation	Career
ABILITY TO	Apply theoretical frameworks in real-life situations	Collaborate effectively in teams	Develop professional connections
	Develop a structured approach to problem solving	Communicate persuasively	Support career transition into a new function or industry
	Manage in a complex, real-world environment	Lead teams without having formal authority	
		Make decisions and be held accountable	
		Manage client interactions effectively	
		Manage projects	
		Take initiative to drive outcomes	

Table 3: Action Learning’s potential personal benefits

	Self-awareness	Teaming	Sense-making
ABILITY TO	Enhance self-reliance	Bond with classmates through shared experiences	Adapt to unexpected changes
	Grow personally through reflection and feedback	Develop interpersonal skills	Deal with ambiguity
	Strengthen value system	Expand worldview and global awareness.	Persevere in the face of obstacles.

The survey's questions were designed to probe the degree to which respondents felt these benefits could be attributed to their AL experience. Again, our study is based on the premise that the more students and alumni attribute their growth to AL, the higher the learning impact of AL. It is also worth noting that the above-mentioned dimensions of professional and personal growth are in line with MIT's broad mission as an educational institution, making their achievement an important measure of AL's effectiveness in the specific MIT Sloan context.

We conducted our surveys in April 2017 (see Appendices 2a and 2b). Three slight variations were produced to account for differences among the alumni, current MBA/Master of Science in Management Studies (MSMS) students, and current Sloan Fellows. Public links to the student surveys were made available to students via program-specific newsletters (total audience of approximately 500 students). Data was analyzed between May and June.

We received 209 responses from Sloan students – 83 first-year MBA students, 86 MBA second-year students, 37 Sloan Fellows, and three MSMS students (Figure 3a). Of the student respondents, 52 percent had participated in at least one AL lab (Figure 4a).

We received 79 alumni responses – 58 MBA graduates, 4 MSMS graduates, and 17 former Sloan Fellows – who graduated between 1998 and 2016 (Figure 3b). Of the alumni respondents, 66 percent had participated in at least one AL lab (Figure 4b).

Comparison of student and alumni responses allowed us to infer the evolution of perceived benefits of AL by participants over time.

This in turn provides insights into perceived benefits in the short term versus the long term. Given our desire to understand perceived benefits of AL participation, we did not ask non-AL lab participants to provide this data; non-AL students often engage in several activities in the MIT ecosystem that partially mimic AL labs -- such as Sloan Entrepreneurs for International Development (SEID) and entrepreneurial ventures -- making a comparison of the differences between the two groups suspect. Moreover, our goal was to assess the perceived professional and personal benefits derived from AL participation vis-à-vis our AL pedagogical goals rather than in comparison with other pedagogical tools.

We compared early respondents to late respondents to ensure they were similar in profile and responses. Among alumni, there were no demographic differences between early and late respondents. Among students, Sloan Fellows were more likely to respond late when compared to the combined group of Leaders for Global Operations, MBA and MSMS students. We also looked at rating and ranking data for the benefits of AL, in addition to overall satisfaction with MIT Sloan and likelihood of respondents referring family and friends to MIT Sloan. There was no difference between mean ratings or rankings of early and late alumni and student respondents.

Database Analysis

To supplement survey data, we used both resume analysis methodologies and internal MIT Sloan student data to draw inferences about AL's impact on learning. Data sources included student registrations, employment records, basic demographics, and parsed and coded resumes.

The resume template that MIT Sloan students are required to use provides very limited real estate through which an applicant can communicate his or her strengths. We were interested in understanding how students valued AL when applying for jobs, and what trade-offs (if any) were made so that AL could be included. We made two key assumptions in conducting this investigation:

The more lines dedicated to a topic on a resume (length), the more the student valued that topic.

Students mention topics in order of importance (rank).

We analyzed 502 resumes from students who were second-year MBAs in 2009, 2011, 2013, and 2015. As per guidelines from the MIT Sloan Career Development Office, resumes follow a consistent three-section structure: "Education," "Work Experience," and "Skills/Activities." Students who choose to mention Action Learning do so in the "Education" section; however, they rarely mention AL by name, instead describing real-life challenges they helped address for sponsoring companies. We refer to these as "project-based experiences."

To assess the space devoted to project-based experiences versus other activities, as well as where project-based experiences ranked, we first manually coded each line of each

resume's Education section using one or more of the following labels²:

- Academic Track/Certificate
- Leadership
- Award/Honor
- GPA/Test Score
- Club/Activity
- Coursework (excluding AL)
- Compensated Experience
- Project-based Experience (including AL)

We then counted all the lines directly below a degree heading (for example, "Master of Business with a specialty in Finance") and noted how many lines with other labels fell above or below those labeled "Project-based Experience." We focused on coding only the MIT Sloan block. See Appendix 3 for an example of a coded resume.

We also cross-referenced students' resumes with records of those students' MIT coursework, personal backgrounds, and other details, to test which factors, if any, led students to include project-based experiences on their resumes, and at what length and rank.

²A line could be coded with multiple labels – for example, a degree specification and GPA were often co-located.

Results and Findings

Students and alumni had been asked to list and rank the three components of their time at MIT Sloan that were most valuable to their learning experiences. One in five students (21 percent) and one in four alumni (27 percent) included AL in this list. The percentages rose when respondents, rather than being asked to generate the components themselves, were asked to identify and rank the top three components of a 10-item list, including Classroom Experience, Entrepreneurial Culture, and Program Structure. Here, 26 percent of students and 40 percent of alumni included AL in their top three. For comparison, a greater portion of respondents ranked Classroom Experience in their top three (43 percent of students and 68 percent of alumni), while a smaller portion placed, as one example, Social Engagement in those top ranks (see Figures 5a, 5b, 6a and 6b for further detail.)

Respondents were also asked to evaluate the degree to which the 10 components affected their learning experience on a seven-point scale, where 1 represented “low impact” and 7 “high impact.” AL’s average rating among students was 5.14, and among alumni 5.89. Performing a paired t-test comparing each component to AL put AL in the top five most-valued learning experiences for students and the top three for alumni. (See Tables 6a and 6b for each component’s mean rating.)

This analysis supports our first hypothesis (H1), that AL courses provide memorable and valuable experiences to (a) students and (b) alumni.

Students and alumni were also asked to estimate the degree to which AL helped them develop a series of 12 professional benefits. Respondents rated the influence of AL on each benefit using a 1-7 scale, where 1 represented “low influence” and 7 “high influence”. Factor analysis on responses revealed two groups of benefits that clustered together in terms of AL’s influence (Tables 7a and 7b): (1) capability development benefits, which covered the conceptualization and implementation benefits of our earlier framework, and (2) career advancement benefits, which covered career benefits in the framework (Table 4).

Table 4: Professional benefits from AL (grouped into categories)

Capability Development		Career Advancement
Conceptualization	Implementation	Career
Apply theoretical frameworks in real-life situations	Collaborate effectively in teams	Develop professional connections
Develop a structured approach to problem solving	Communicate persuasively	Support career transition into a new function or industry
Manage in a complex, real-world environment	Lead teams without having formal authority	
	Make decisions and be held accountable	
	Manage client interactions effectively	
	Manage projects	
	Take initiative to drive outcomes	

The possible professional benefits driven by Action Learning, as listed in Table 2, and organized into the two categories that emerged from factor analysis of the responses: capability development and career advancement.

Students and alumni alike tended to give higher ratings to AL’s influence on capability development benefits (with an average rating of 5.07 for students and 5.50 for alumni) than on career advancement benefits (with an average rating of 4.00 for students and 4.43 for alumni). The differences were statistically significant for both students – paired $t(105) = 9.15, p < 0.01$ – and alumni – paired $t(51) = 5.24, p < 0.01$.

To return to the categories we created in our framework, among students, conceptualization-related benefits were rated lower (mean: 4.87) than implementation benefits (mean: 5.10) [statistical significance: paired $t(104) = -2.57, p = 0.01$]. Among alumni, we saw a reversal, with conceptualization benefits rated marginally higher than implementation benefits [relative means: 5.61 and 5.45; paired $t(51) = 1.88, p = 0.07$] (Figure 7).

These responses provide support for H2, that AL courses are perceived by (a) students and (b) alumni as developing the ability to apply theory in a real-world context.

Factor analysis on personal benefit ratings did not reveal any themes. Using our hypothesized themes (Table 3), we found that, among students:

- 1) Teaming benefits received higher ratings (mean: 5.19) than both sense-making benefits (mean: 4.72) and self-awareness benefits (mean: 4.28) [statistical significance: paired $t(107) = 4.34, p < 0.01$ and paired $t(107) = 8.30, p < 0.01$;
- 2) Sense-making benefits received higher ratings than self-awareness benefits [paired $t(107) = 4.11, p < 0.01$]; and
- 3) Self-awareness benefits received the lowest ratings.

Table 5. Components of the MIT Sloan learning experience

Action Learning	Safe Space
Classroom Experience	Sloan Culture
Entrepreneurial Culture	Social Engagement
MIT Ecosystem	(e.g., C-functions, dinners)
MIT Mission	Student-led Experiences
Program Structure	(e.g., clubs, treks)

Among alumni,

- 1) Teaming benefits received higher ratings (mean: 5.40) than both sense-making benefits (mean: 5.02) and self-awareness benefits (mean: 4.90) [statistical significance: paired $t(51) = 2.29$, $p = 0.03$ and paired $t(51) = 3.42$, $p < 0.01$]; and
- 2) There was no statistical difference between the ratings of sense-making and self-awareness benefits [paired $t(51) = 0.87$, $p = 0.39$].

This suggests support for H3, that AL courses are perceived by (a) students and (b) alumni as developing the personal facets of problem-solving. See Tables 8a and 8b for personal benefit ratings.

Our database analysis, rather than the survey results, shed the most light on H4, that AL courses are perceived by students as helping launch careers. It found no correlation between participating in AL labs and mentioning project-based experiences on a resume (Table 9a). Looking at students' areas of expertise and industries in which they worked

before entering MIT, compared with their first jobs upon graduation, the inclusion of project-based experiences in a resume does not correlate with the type of career changes the students made (Table 9b). One relationship worth noting is that, among individuals who had taken AL courses with projects at U.S. organizations, there was a correlation between mentioning AL and being a student from the U.S., as opposed to being an international student (Table 9c).

When project-based experiences are mentioned, they do not correlate with a longer resume but do correlate with shorter "Work Experience" and "Skills and Activities" sections (Table 10a). Mentioning project-based experiences also correlates with mentioning coursework, extracurricular activities, and leadership later in the "Education" section (Table 10b).

This analysis provides partial support for H4; the average AL student does not use AL for improving his or her recruitment prospects, but some particular groups of students do.

The surveys also probed career changes, asking students and alumni to name their industry or area of expertise upon entering Sloan, and the industry in which they got their first job after graduation (or first summer internship for first-year students). There was no correlation between taking AL courses and making a career change either for students [$\chi^2(3, N=209)=1.34, p=0.28$] or alumni [$\chi^2(1, N=79)=0.51, p=0.53$] (Tables 11a and 11b). The analysis of the CDO data (Table 11c) corroborates the above results.

Given that AL's impact on career transitions ranked very low compared with its impact on other professional benefits, and that the theme containing career transition benefits ranked behind both conceptualization and implementation themes, it is clear that AL's impact on career development is secondary – if present at all – to its impact on learning in the eyes of both students and alumni. Thus, the results of the survey did not support H5, that AL courses help (a) students and (b) alumni make career transitions.

Top Professional Benefit

For students, **implementation skills** – those associated with experienced practitioners – were remembered as a key takeaway.

For alumni, **conceptualization skills** – those traditionally associated with academic training – were among those remembered as a key takeaway.

Top Personal Benefit

Action Learning students and alumni agreed that their experience helped them with **teaming**, encompassing interpersonal skills and the ability to work across cultural and global boundaries.

Discussion

Though we had only formulated hypotheses at a high level vis-à-vis benefits of AL coursework, rather than any formal hypotheses about what students and alumni found most valuable about Action Learning courses, we were able to glean interesting insights from our methodological approach. These were often backed up by students' and alumni's remarks that emerged from the depth interviews we conducted prior to creating and distributing the survey – a selection of which we quote in this section.

AL's considerable influence on capability development benefits, as rated by students and alumni alike, is consistent with the pedagogical goals of AL, which emphasize learning in a complex, real-world environment; structuring and solving problems; developing project management skills; collaborating effectively in teams; reflecting for personal and professional growth; and learning to lead. The ratings data (Tables 7a and 7b) for specific professional benefits from our original framework revealed an interesting split between students and alumni. We see that, among students, implementation skills are more highly rated. In contrast, alumni rate the dimensions of conceptualization more highly (Figure 7). We wonder if students, early in their career lifecycles, are primarily focused on and appreciative of the practical capabilities that got them through the challenging AL project experience. Later in their careers, with time for deeper reflection on how they tackled problems and increased mastery of the practical aspects of problem solving, the alumni appreciate the more conceptual contributions AL has made to their strategic thinking.

Our interviews give support to this dichotomy. Whereas students talked about takeaways including “opportunities to try my project management skills;” of learning how to “get the buy-in of a certain key individual while not sacrificing the promises that we had made to other people, or impairing the value of the experiment that we were running;” and of “learning how to put together a PowerPoint and then communicate it to someone who doesn't know the specific analytics jargon you're using” (all implementation benefits, according to our framework), an alumnus/a described vividly an AL lab experience that taught him both how to develop a structured approach to problem solving and how to manage in complex, real-world environments –two key conceptualization benefits:

“We were pretty frustrated for the first couple of weeks because [our task] was like a mission impossible, and we couldn't possibly answer it. Then we looked at a lot of literature, and we started seeing what else could be done. Instead of answering the question directly, we figured out some more dynamic strategies which will be adaptive to the

shifting regime. We talked briefly about the question and various attempts to resolve it that had failed in the past. Then we presented the CEO with a strategy which would possibly answer half of the question. Even though we didn't give him a direct answer to this mission impossible, because we were pretty innovative in our ways of handling it, he was pretty happy in the end."

Another alumnus/a shared a similar story: "Over the course of three months, we must have gone to the firm at least four or five times and had very detailed discussions, from a few hours to half a day. Then [we tried] to understand what they [were] trying to go for. Then coming back to the drawing board, trying to figure out how best to tackle it. It was quite an interesting partnership, because they initially had 'A' goal in mind, while we discussed to see if we could go beyond 'A' and do maybe 'B' and 'C' also."

As for personal benefits, students and alumni both found AL to have the greatest impact on teaming skills—a finding consistent with the sort of interpersonal benefits that Leonard and Marquardt (2010) describe AL participants gaining in corporate and government settings. "It was a good opportunity to do conflict management and see how we can resolve conflict in a way that is beneficial for all our team members, but also for the host company," said one student. "Outside of learning the hard skills of designing experi-

ments and interpreting data and utilizing that data to make decisions about how the company should move forward, we also learned a lot about presentation skills and negotiating and navigating boundaries in and among departments within large organizations," said another.

The second highest-rated benefit, "Deal with ambiguity," aligns strongly with our pedagogical goals and is seen as a key quality of effective leaders (Cashman, 2013; Raudenbush, 2008). Students agreed. "The project being vague is much more like real life than anything else. That's a good thing. That's what life is like," said one. Another concurred: "What it reminded me of is that navigating ambiguity is one of the most important skills you can have, especially at an early stage. Your job will be very ill-defined, and you just need to hustle." And an alumnus/a described AL labs as helping participants learn "what you know and what you don't know."

Looking at the factor analysis of AL's 12 professional benefits listed in the survey, the fact that it seemed to have greater impact on capability benefits than career advancement benefits is consistent with our findings that AL is not, in general, used to help individuals switch careers or signal mastery to job recruiters via the resume. For the former – switching careers – a ceiling effect may blunt AL's impact: The survey revealed that the vast major-



IT WAS FOUR PEOPLE SPENDING 24 HOURS A DAY FOR THREE WEEKS TOGETHER, SO IT WAS A PRETTY INTENSE EXPERIENCE. BEING ABLE TO MANAGE THAT FROM A RELATIONSHIP PERSPECTIVE WAS HELPFUL TO PRACTICE.

STUDENT INTERVIEWEE
MBA 2017

ity of MIT Sloan students change either their industry, function, or both when they graduate; this means it would be difficult for AL – or anything, really – to push career-change figures much higher. As for resume signaling, while it appears the average student does not view AL as an important signal, there are two exceptions to this rule: (1) when a student has a deficit in other work experience³, and (2) when a student is not an international student and is working for a large U.S. company, in which case brand recognition may be used to start a conversation and increase a student’s desirability to recruiters. Underscoring the first case, one alumnus/a we interviewed talked about leveraging the G-Lab course into a job in a new industry despite having no prior experience in her target field. Another said, “S-Lab got me connected to the industry that I’m in right now and I’ve been in since.”

Nevertheless, given that MIT Sloan’s AL course design and value lies in long-term capability development (conceptualization and implementation), it makes sense that participants value its intellectual component above all, and that any impact on recruitment is secondary. As one student put it, the AL sphere was where he could try out new ways of thinking and working: “I think [the labs were] a great playground for me to try dif-

ferent things and start to get ready for what I need to do when I get back into real life, as I call it.”

AL appears to support MIT Sloan’s mission and pedagogical goals; does it also improve students’ and alumni’s overall attitudes to MIT Sloan? The survey results showed high satisfaction measures for the MIT Sloan school experience among both AL lab takers and non-lab takers. The American Consumer Satisfaction Index (ACSI), adapted for use in our context (Figures 8a and 8b), was marginally higher for student lab takers. It is likely that, given high satisfaction levels across the board, AL’s additional impact will inevitably be limited, due to a ceiling effect, in terms of how high the ratings could be.

The survey also asked respondents whether they would recommend MIT Sloan to friends and family (Figures 9a and 9b). The response was, again, similar for both lab takers and non-lab takers, and marginally higher for student lab takers. As with satisfaction ratings, students and alumni are in general very likely to recommend MIT Sloan, so the degree to which AL boosts this further may be limited.



EVEN THOUGH WE DIDN’T GIVE HIM A DIRECT ANSWER TO THIS MISSION IMPOSSIBLE, BECAUSE WE WERE PRETTY INNOVATIVE IN OUR WAYS OF HANDLING IT, HE WAS PRETTY HAPPY IN THE END.

ALUMNI INTERVIEWEE

MBA 2014

³Only one Action Learning Lab, Enterprise Management Lab (EM-Lab), is available to first-year, first-semester students enrolled in the Enterprise Management track, before they submit resumes for the summer internship recruitment cycle. Here, the survey data shows 57 percent of respondents feel their EM-Lab experience was instrumental during their internship interviews, with another 24 percent feeling it played some role.

Implications for Hosts

The ways students and alumni position AL on their resumes, and the personal and professional successes they attribute to AL, begin to underscore the value this format of learning delivers to real-world institutions – despite MIT Sloan AL being first and foremost a pedagogical framework. The benefits to sponsoring companies often fall outside the scope of our research questions but are still worth mentioning here. Undertaking business challenges that range from financing sustainable development to formulating global market strategies, the students produce clear, actionable recommendations for organizational advancement. Time and again, hosts report that Action Learning projects have transformed their businesses for the better (Appendix 4).

The mechanisms for these transformations are multiple:

Students gather data and provide in-depth research. They crunch the numbers and do the hard legwork of interviewing stakeholders – from company executives to vendors, customers, potential users, and sales personnel. They conduct site visits, research best practices, and apply the cutting-edge skills learned at MIT Sloan to provide hosts with rigorous, fact-based analyses of their business challenges. For one African company, a Global Entrepreneurship Lab (G-Lab) team conducted market research that supported the launch of a continent-wide network of secondary schools that now serves 1000+ students. The company even tapped a student from the Action Learning team,

Eric Pignot, to help launch that network. “I think G-Lab is an amazingly well-organized program,” Pignot said. “The quality of the projects is really impressive, and for all students who are interested in entrepreneurship in emerging markets, it’s just a no-brainer.”

Hosts gain actionable recommendations and tools that address their specific business challenges. These include product roadmaps, financial models, funding strategies, and recommendations for enhancing production, monetizing products, and forecasting performance. Students working for GE Transportation, for example, developed analytics to help the company optimize its locomotive maintenance schedule. A manager at the company commented, “The students became

subject matter experts for us on this niche project, and we were able to capitalize on their findings.” A startup that came to Israel Lab for help developing a pricing strategy for entering the U.S. market was similarly impressed. The host said, “The pricing model is excellent. Exactly what we wanted.”

Student teams help companies reduce costs, streamline operations, and improve performance. For example, India Lab teams have engaged with Paytm, India’s largest mobile commerce platform, for six consecutive years, providing crucial deliverables that have helped fuel the company’s explosive growth. An executive at the company described the impact this way: “Over the years, [students’] insights have helped our organization as we expand into new segments of financial services and expand our ecosystem. Their contribution is much appreciated.” Others have echoed this sentiment, including the CEO of Knoté, an Entrepreneurship Lab host, who said, “[The students] really helped us develop our market strategy and scale the business.”

Action Learning teams provide company executives with a fresh perspective. Unconstrained by “business as usual,” students assess problems objectively and work to provide novel but concrete solutions. The students in Leaders for Global Operations, for example, helped one family-owned business rethink its processes and re-evaluate its need for a new warehouse.



THE TEAM PROVIDED KEY INSIGHTS AND DIRECTION THAT CONFIRMED AND CHALLENGED OUR APPROACH TO SUPPORTING AND LEADING THE CHANGE EFFORT UNDER WAY IN PROVIDING THE ULTIMATE RETAIL EXPERIENCE FOR OUR CUSTOMERS.

SIMON HUANG

SALES STRATEGY MANAGER
BMW NORTH AMERICA

The host said, “The insights they shared and deliverables they provided were very helpful for us as a company. They did an excellent job of understanding our culture and made recommendations that fit with the priorities of our company.” In another case, Interlub, an industrial lubricant firm in Mexico, gained a business strategy from a Global Organization Lab team and returned a year later for help expanding into new markets. The company’s CEO commented, “This project was really a turning point for us in our mindset and in the history of the company.”

Projects have an impact on major global issues.

While students set out to solve the specific challenges companies face, the projects they complete often have broader benefits – from improving health care and education to reducing the environmental impact of business. For example, one Action Learning team helped Gorton’s of Gloucester, a major seafood producer, reduce the loss of some portion of edible fish that occurs during production. The project supported Gorton’s sustainability mission and also realized productivity savings. Another team helped Boston Medical Center increase its clinic utilization by 7 percent. In Brazil, students helped a company improve urban mobility—work that impressed one local mayor, who said: “Your work shows how we can develop, improve. I salute you for the excellent work.”

Conclusion and Next Steps

Since the concept of action learning was first introduced, it has become a staple not only of corporate executive training but also of higher education. MIT Sloan is not an exception to this rule. It leads its peers in the diversity of AL opportunities offered and the seriousness of its approach, using a range of resources to ensure that the application of classroom knowledge to real-world settings serves to deepen students' learning and promote skills acquisition. In this, AL at MIT Sloan aligns with the Institute's broader mission, to "advance knowledge and educate students in science, technology, and other areas of scholarship that will best serve the nation and the world in the 21st century."

But for all the care with which AL is being employed, there is a scarcity of methodological research looking at its impact on learning. Our project of the past year and a half attempted to address that and has yielded useful and sound insights. Our review of literature from the fields of neurology, psychology, and pedagogy reveals that AL as embodied at MIT Sloan falls very much in line with the latest thinking on how to optimize adult learning. Our data collection and analysis shows that students and alumni alike consider AL to have contributed significantly to both their learning at MIT Sloan and their capabilities, not just as professionals, but as thinkers and actors in the world.

Students tend to place more value on the benefits of AL related to implementing knowledge – from communication to taking initiative to project management. Alumni, who we hypothesize feel more secure in those

areas, having had more time to practice the associated skills, place greater emphasis on the ways in which AL has helped them develop and deepen their ability to conceptualize problems and possible solutions – by applying theoretical frameworks, for example, or developing structured approaches to problem solving.

One way to look at this split is as we have discussed it in this paper – analyzing the benefits of AL according to whether they aid participants' ability to conceptualize solutions to problems, or to implement those solutions. Another way might be to think about them in terms of quick-release versus long-term benefits; AL helps its participants prepare themselves first for immediate challenges ahead, like teamwork at their first post-graduation job, and also for a lifetime of tackling the sort of big, multifaceted, and complex problems that require the very analytical skills

an MIT education is meant to instill. One area for further research might be the degree to which different ways of framing AL changes what students get – or believe they get – out of it. Might more emphasis on conceptualization benefits help students appreciate, early on, the long-term benefits of these experiences? Would drawing a line between AL and career benefits result in students and alumni seeing a more straightforward relationship between the two than they currently seem to?

Another natural vein for methodological, and even quantitative, investigation is the impact of AL on host organizations. This might eventually merge with research into the way in which teaching people through AL impacts the companies and other organizations that may eventually employ them.

Keeping our focus on higher education might mean applying some of the analytic approaches and frameworks developed in this report to other pedagogical methods employed at MIT Sloan and among its peers – from case study analysis to class projects or traditional lectures. Since we did not ask students or alumni to link professional and personal benefits with these other approaches, it remains unclear to what degree respondents found AL particularly beneficial. Our analysis points to an encouraging idea: that students very much see their MIT Sloan experience in a holistic way, acknowledging that multiple factors, not just one or two, contribute to their learning; still, it is worthwhile and interesting to parse this general impression for lessons we can apply to our work as educators.

We are also curious whether certain groups of students or alumni – male vs female, younger vs older, American vs international –

extract different benefits from AL. The relationship between identity-based factors and how a person responds to a learning experience has, of course, been probed in educational research, but not applied to AL in particular.

Finally, it is important to note that, because we investigated the experiences of students and alumni from just one institution, the degree to which we can generalize our findings is limited. AL at MIT Sloan has been carefully designed to promote many of the learning factors discussed; this may not be true at other business schools. Students of similar programs elsewhere may well report reaping very different benefits from these experiences.

Like AL itself, meaningful research into its potential benefits is time- and resource-intensive. However, as shown here, the results can suggest actionable insights. The more these findings are shared and discussed, the greater the potential impact on AL and the individuals and institutions engaged with it. To that end, our results and recommendations will be reviewed by the MIT Sloan Dean's Office, by faculty and senior leadership, and by program offices, to identify areas where we might improve our practices. This report will also be presented at conferences, in meetings, and in relevant engagements with a variety of stakeholders, including potential hosts and donors, alumni and students, and colleagues in business school education and across academia more widely.

Research Contributions

The MIT Sloan Action Learning Impact Study was conceived by **Yasheng Huang**, Faculty Director of Action Learning, and was conducted over an 18-month period from September 2016 through February 2018.

Prof. Huang is the International Program Professor in Chinese Economy and Business, and Professor of Global Economics and Management at the MIT Sloan School of Management. He also served as the Associate Dean of International Programs and Action Learning at MIT Sloan during the time the research was conceptualized and initiated.

Our research was designed and led by **Sharmila C. Chatterjee**, Senior Lecturer in Marketing and the Academic Head for the MBA Track in Enterprise Management at MIT Sloan. Dr. Chatterjee supervised multiple workstreams, bringing her considerable expertise in action learning pedagogy and quantitative market research to the project.

Urmi Samadar, the Director of MIT Sloan Action Learning, and **Joseph Browne**, Assistant Director of MIT Sloan Action Learning, served on the core team with Dr. Chatterjee in conducting the research. While Ms. Samadar served as the project manager, engaging multiple stakeholders and research contributors while also providing content input, Mr. Browne was the technical lead for information collection, data processing, and analysis.

The alumni module was designed by Dr. Chatterjee in collaboration with the MIT Sloan Alumni Board's Action Learning project committee, comprised of **Sean Padgett** (MBA '98), **Sam Epee-Bounya** (MBA '13), **Min Lin** (MBA '04), and **Jorge Rodriguez** (MBA '96). They conducted in-depth interviews with alumni across the globe; the insights from those interviews as well as the perspectives of committee members, who are seasoned management professionals, were invaluable to the formulation of hypotheses as well as the framework and execution of the research.

Michellana Jester, Lecturer in MIT Sloan's Global Economics and Management group, and the course manager for Global Entrepreneurship Lab, provided historical and pedagogical context on the evolution of Action Learning as a teaching and training methodology.

Major sections of the report were written by **Rose Jacobs**. Other sections were written by some of the contributors named above, with additional writing by **Laura Koller**, Associate Director of MIT Sloan Action Learning, **Kathryn O'Neill**, and **Stephanie Schorow**. The entire report was edited by Ms. Jacobs.

We are grateful for the support of **Donna Russell**, Senior Director, Alumni Relations, Communication and Events, and **Emily Williams**, Associate Director, Alumni and Student Engagement, for extending the invitation to work with the Alumni Board.

Christine Bolzan, Career Advisor for MIT Sloan Graduate students, conducted depth interviews with current students to help develop the hypotheses. **Nimrod Magen** (MBA '18) and **Roshan Vora** (MBA '18) provided research assistance by analyzing survey data and coding depth interviews and resumes.

We would like to acknowledge the faculty and mentors who teach Action Learning labs at MIT Sloan, as well as our peers in the offices of External Relations, Alumni Relations, Admissions, Career Development, Educational Services, and Technology Services, for making crucial data and other information available for use in this study.

We are grateful to the many host organizations, both domestic and international, that made it possible for us to write short stories about their experiences with Action Learning student teams, and the lasting impact that these engagements have had on their businesses.

The research team would like to thank Dean **David C. Schmittlein**, John C Head III Dean of the Sloan School, **Jake Cohen**, Senior Associate Dean for Undergraduate and Master's Programs, **Tara Walor**, Executive Director of Student Services, **Jesse Souweine**, former Senior Associate Dean for Administration, and several members of the senior leadership of the School for their support towards this undertaking.

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Data Analysis Tables

(Please see Tables 1-5 within the main report.)

Table 6a: Ratings of MIT Sloan learning components comparing each to AL (data source: student survey)

Component	Average	Paired T-test with Action Learning
Sloan Culture	6.06	t(176)=6.39, p<0.01
Program Structure	5.52	t(176)=2.87, p<0.01
Student-led Experiences	5.49	t(177)=2.48, p=0.014
Classroom Experience	5.43	t(176)=1.70, p=0.09
MIT Ecosystem	5.31	t(174)=1.28, p=0.20
Safe Space	5.22	t(175)=1.06, p=0.29
Action Learning	5.14	—
Social Engagement	5.04	t(176)=0.81, p<0.42
MIT Mission	4.68	t(175)=2.61, p<0.01
Entrepreneurial Culture	3.97*	t(154)=6.75, p<0.01

*Difference from midpoint rating of 4 is not statistically significant.

Table 6b: Ratings of MIT Sloan learning components comparing each to AL (data source: alumni survey)

Component	Average	Paired T-test with Action Learning
Sloan Culture	6.32	t(74)=2.43, p=0.02
Classroom Experience	6.15	t(73)=0.98, p=0.33
Program Structure	5.99	t(72)=0.79, p=0.45
Action Learning	5.89	—
MIT Ecosystem	5.81	t(73)=0.55, p=0.56
Safe Space	5.68	t(72)=1.14, p=0.26
Student-led Experiences	5.66	t(72)=0.82, p=0.42
MIT Mission	5.47	t(74)=2.56, p=0.012
Social Engagement	5.27	t(73)=2.82, p<0.01
Entrepreneurial Culture	4.89	t(71)=4.28, p<0.01

Table 7a: Professional benefit ratings with factor analysis (data source: student survey)

Professional Benefit	Rating			Contribution to Theme	
	n	Mean	SD	Capability Development	Career Advancement
Collaborate effectively	105	5.65	1.51	0.79	0.13
Manage projects	105	5.22	1.71	0.84	0.27
Lead teams without formal authority	105	5.15	1.54	0.71	0.16
Communicate persuasively	105	5.10	1.54	0.83	0.17
Take initiative	105	5.04	1.62	0.75	0.38
Client interactions	105	5.01	1.77	0.63	0.42
Manage in real-world environments	106	5.01	1.78	0.65	0.49
Structured approach to problem solving	105	4.95	1.72	0.63	0.42
Apply theoretical frameworks	106	4.66	1.71	0.51	0.57
Make decisions and be held accountable	105	4.50	1.94	0.72	0.30
Develop professional connections	105	3.81	1.89	0.32	0.70
Support career transition	103	3.52	2.13	0.06	0.90

Table 7b: Professional benefit ratings with factor analysis (data source: alumni survey)

Professional Benefit	Rating			Contribution to Theme	
	n	Mean	SD	Capability Development	Career Advancement
Collaborate effectively	52	5.83	1.37	0.73	0.30
Structured approach to problem solving	52	5.69	1.41	0.72	0.54
Manage in real-world environments	52	5.63	1.60	0.82	0.34
Lead teams without formal authority	52	5.54	1.39	0.61	0.53
Apply theoretical frameworks	52	5.50	1.42	0.76	0.11
Communicate persuasively	52	5.50	1.29	0.87	0.25
Manage projects	52	5.46	1.39	0.59	0.46
Client interactions	52	5.44	1.46	0.62	0.57
Take initiative	52	5.21	1.70	0.76	0.32
Make decisions and be held accountable	51	5.13	1.74	0.83	0.17
Support career transition	49	4.43	1.91	0.18	0.87
Develop professional connections	52	4.42	1.72	0.18	0.76

Table 8a: Personal benefit ratings (data source: student survey)

Category	Benefit	Average	Std Dev
Teaming	Bond with classmates	5.62	1.53
Teaming	Expand worldview	5.23	1.78
Sense-making	Deal with ambiguity[*]	5.07	1.64
Teaming	Develop interpersonal skills	4.73	1.62
Sense-making	Adapt to unexpected changes	4.72	1.86
Self-awareness	Grow personally through reflection	4.50	1.80
Sense-making	Persevere in the face of obstacles	4.35	1.80
Self-awareness	Enhance self-reliance	4.34	1.81
Self-awareness	Strengthen value system	4.00	1.90

*No statistical difference from "expand worldview:" paired $t(107) = 0.96$, $p=0.34$

Table 8b: Personal benefit ratings (data source: alumni survey)

Category	Benefit	Average	Std Dev
Teaming	Bond with classmates	5.85	1.39
Sense-making	Deal with ambiguity	5.37	1.43
Teaming	Expand worldview	5.25	1.94
Self-awareness	Grow personally through reflection	5.19	1.65
Teaming	Develop interpersonal skills	5.10	1.48
Self-awareness	Enhance self-reliance	5.06	1.67
Sense-making	Adapt to unexpected changes	5.00	1.66
Sense-making	Persevere in the face of obstacles	4.69	1.83
Self-awareness	Strengthen value system	4.46	1.93

PROFILE OF STUDENTS MENTIONING AL ON RESUME

Table 9a: Project-based experience mentioned on resume (see sample in Appendix 3) vs. AL courses taken (Data source: Resume dataset, SES dataset)

		Number of Action Learning Courses Taken		
		0	1	2+
Mentioned Project-Based Experience on Resume	No	111	192	54
	Yes	37	83	17

Chi-Squared results: $X^2(2, N=494)=1.883$; $p=0.39$.

Table 9b: Project-based experience mentions vs type of career change (data source: resume dataset)

		Type of Career Change		
		Function and Industry	Function or Industry (not both)	None
Mentioned Project-Based Experience on Resume	No	54	20	10
	Yes	28	9	6

Chi-Squared results: $X^2(2, N=127)=0.20$, $p=0.90$.

Table 9c: Project-based experience mentions vs student type for domestic projects (data source: resume dataset)

		Type of Student	
		Domestic	International
Mentioned Project-Based Experience on Resume	No	190	35
	Yes	89	5

Chi-Squared results: $X^2(1, N=319)=2.2E-4$, $p=0.012$.

IMPACT OF PROJECT-BASED EXPERIENCE MENTIONS ON PRIORITIZATION OF RESUME CONTENT

Table 10a: Mean section line count by whether or not student mentioned project-based experience (PBE) (data source: resume dataset)

Resume Section	Mean Line Count		Two-Sample T-Test
	Did not mention PBE	Mentioned PBE	
Sloan Education	5.39	5.33	t(492)=0.31, p=0.76
Non-Sloan Education	5.75	5.42	t(492)=1.37, p=0.17
Work Experience + Skills and Activities	48.79	47.55	t(492)=3.01, p<0.01
Total	59.93	60.00	t(492)=-0.22, p=0.83

Table 10b: Rank of label by whether or not student mentioned project-based experience (PBE) (data source: resume dataset)

Label	Mean Rank of First Mention		Two-Sample T-Test
	Did not mention PBE	Mentioned PBE	
Academic Track/Certificate	2.10	2.22	t(171)=-0.71, p=0.48
Award/Honor	2.42	2.31	t(180)=0.63, p=0.53
Compensated Experience	3.23	3.29	t(40)=-0.12, p=0.90
Coursework (excl. AL)	3.23	4.07	t(114)=-3.23, p<0.01
Extracurricular Activity	3.14	3.98	t(329)=-5.30, p<0.01
GPA/Test Score	3.00	3.57	t(191)=-1.86, p=0.06
Leadership	2.69	3.04	t(350)=-2.98, p<0.01

TYPE OF CAREER CHANGES AMONG STUDENTS AND ALUMNI

Table 11a: Type of career change vs. AL participation (data source: student survey)

		Type of post-graduation career change			
		Function	Industry	Both	None
Took an Action Learning course	No	13	11	48	29
	Yes	15	12	62	19

Chi-Squared results: $X^2(3, N=209)=1.34, p=0.28$.

Table 11b: Changed industry or function vs. AL participation (data source: alumni survey)

		Changed Industry or Function post-graduation	
		No	Yes
Took an Action Learning course	No	8	19
	Yes	12	40

Chi-Squared results: $X^2(1, N=79)=0.51, p=0.53$.

Table 11c: Type of career change vs. AL participation (data source: Career Development Office)

		Type of post-graduation career change			
		Function	Industry	Both	None
Took an Action Learning course	No	25	10	77	7
	Yes	48	27	151	25

Chi-Squared results: $X^2(3, N=370)=2.32, p=0.49$.

Data Analysis Figures

(Please see Figures 1-2 within the main report.)

RESPONDENTS BY YEAR AND PROGRAM

Figure 3a: Student respondents by year and program

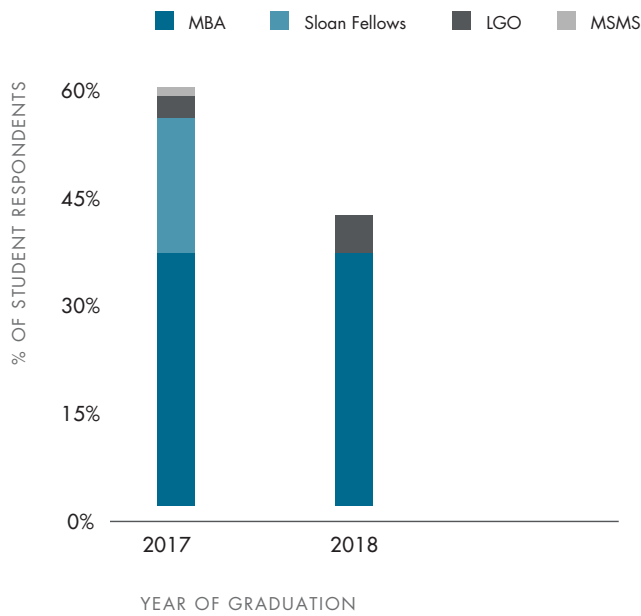
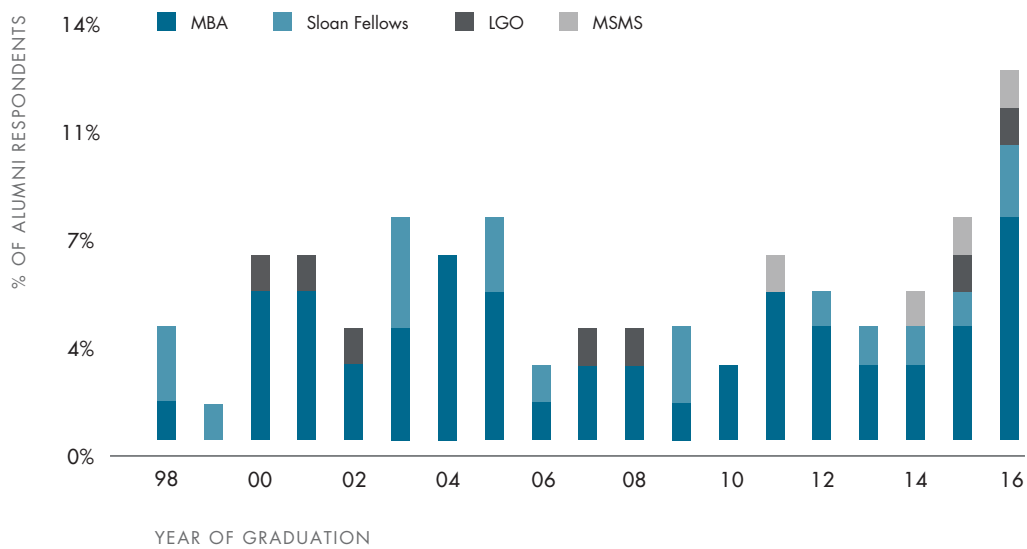


Figure 3b: Alumni respondents by year and program



ACTION LEARNING LAB EXPERIENCE AMONG RESPONDENTS

Figure 4a: Number of lab courses taken by student respondents

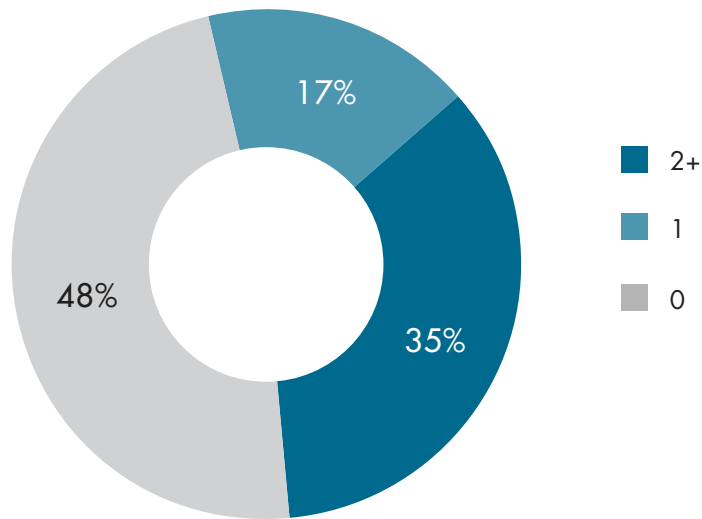
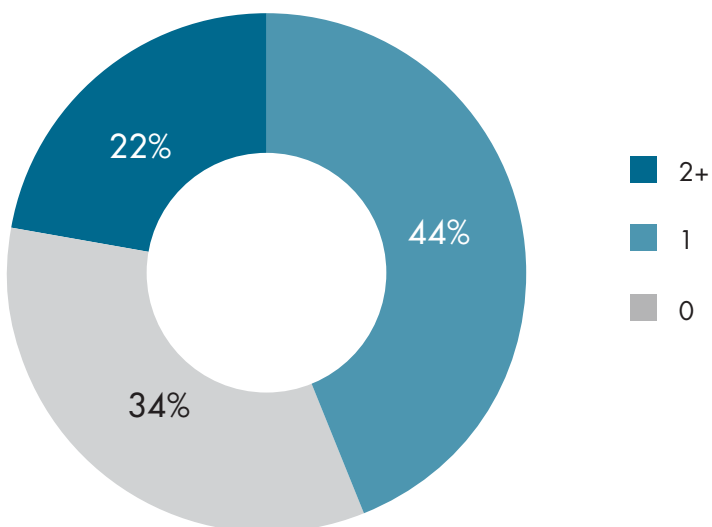


Figure 4b: Number of lab courses taken by alumni respondents



TOP 3 MOST VALUABLE LEARNING EXPERIENCE COMPONENTS AMONG RESPONDENTS (UNAIDED RECALL)

Figure 5a: Coding of responses to top 3 most valuable components of the MIT Sloan learning experience (data source: student survey [free response])

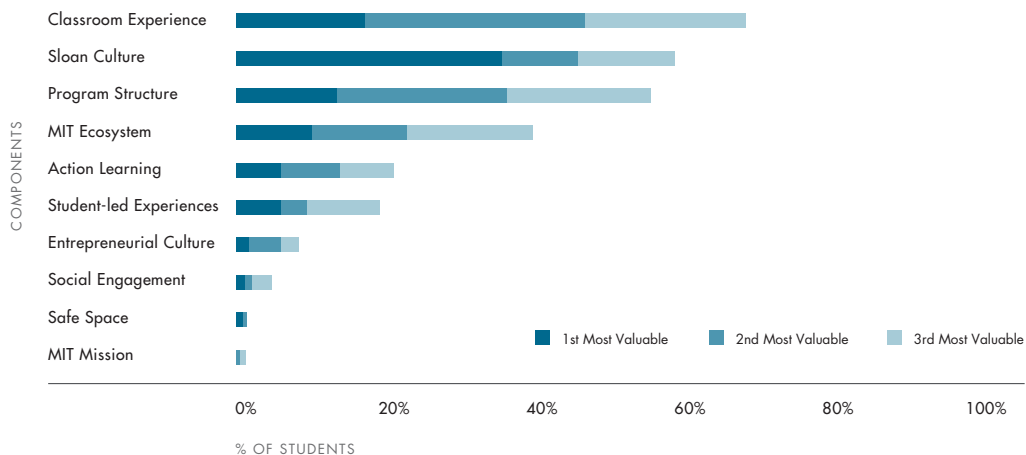
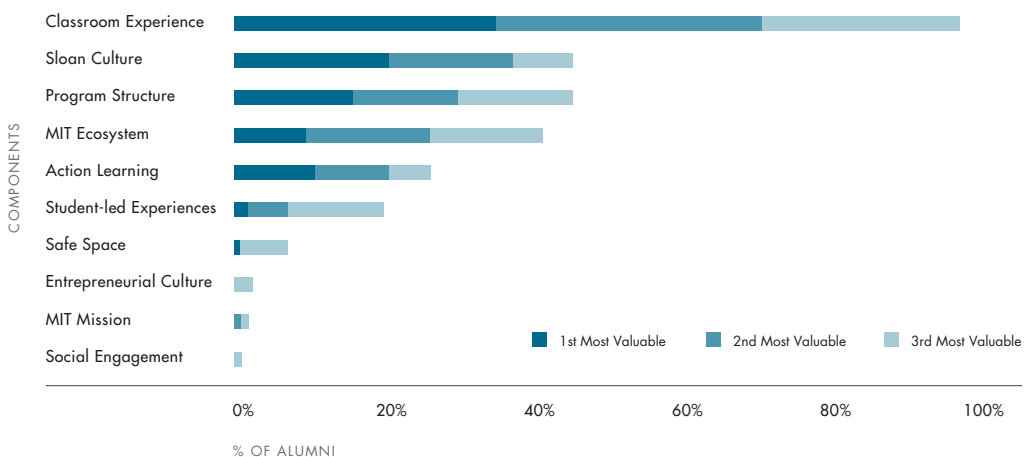


Figure 5b: Coding of responses to top 3 most valuable components of the MIT Sloan learning experience (data source: alumni survey [free response])



TOP 3 MOST VALUABLE LEARNING EXPERIENCE COMPONENTS AMONG RESPONDENTS (FORCED-RANK)

Figure 6a: Top 3 most valuable components of the MIT Sloan learning experience (data source: student survey [forced-rank])

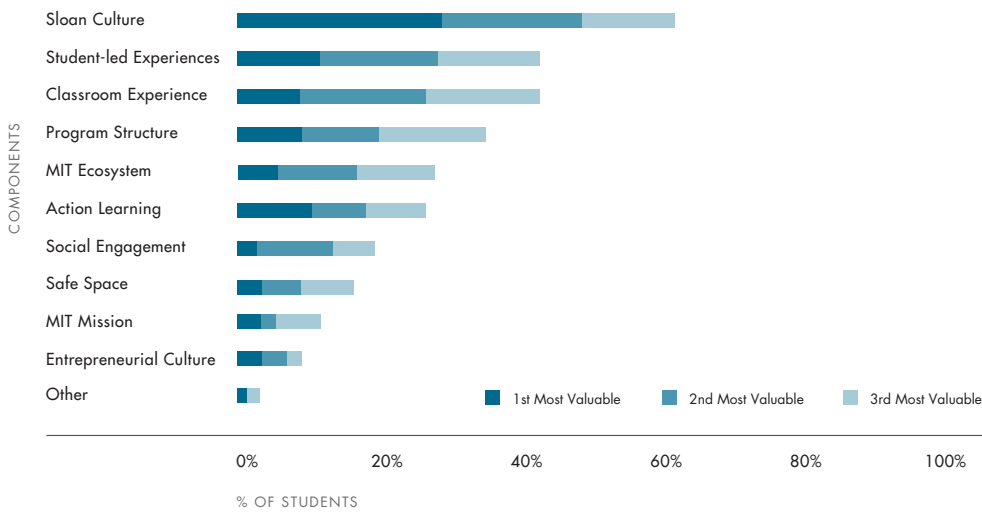
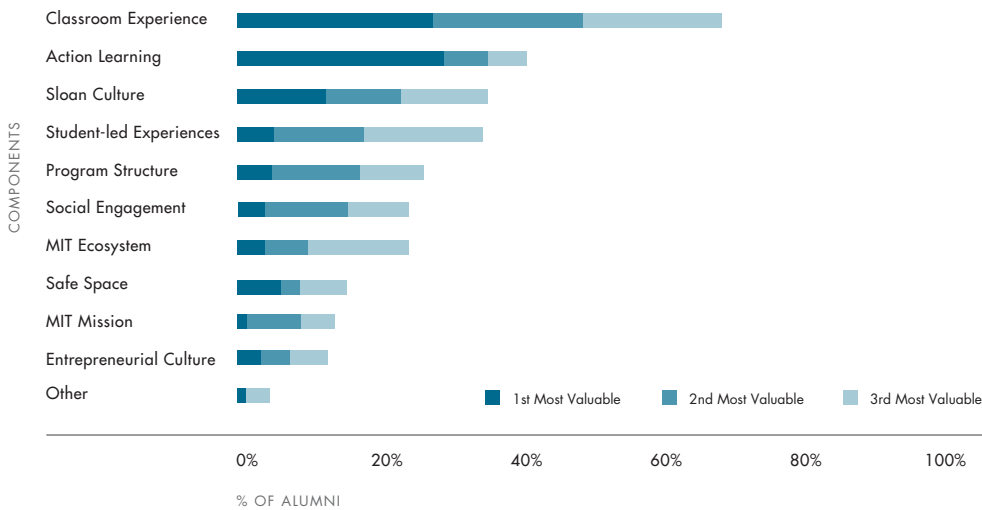
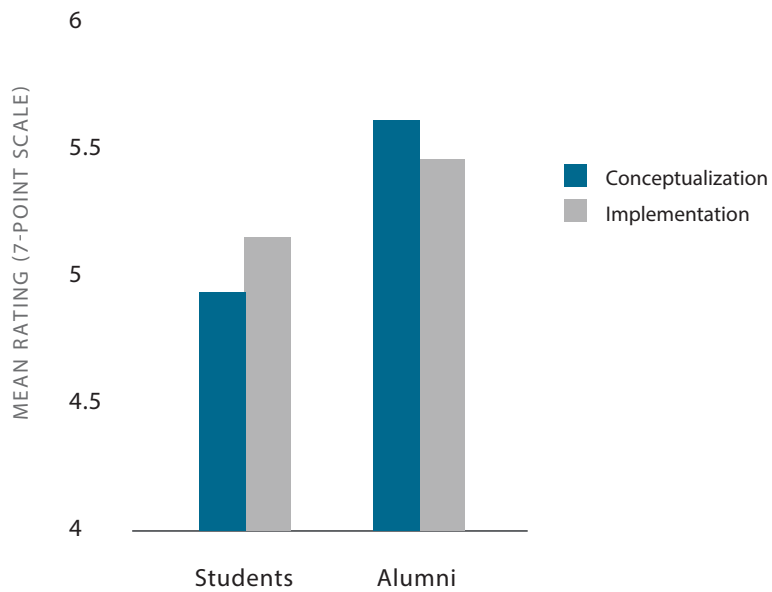


Figure 6b: Top 3 Most valuable components of the MIT Sloan learning experience (Data source: alumni survey [forced-rank])



A COMPARISON OF RATINGS OF PROFESSIONAL BENEFIT THEMES

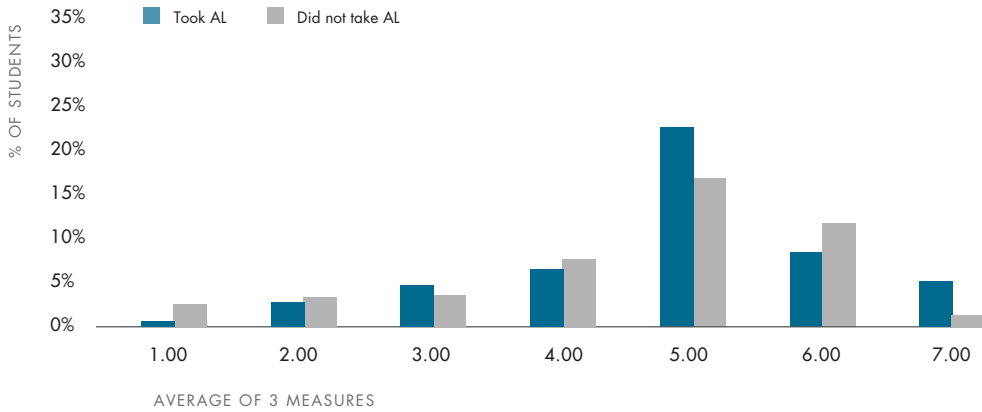
Figure 7: Ratings of professional benefit themes among students and alumni



Students rate conceptualization benefits (mean: 4.87) lower than implementation benefits (mean: 5.10) – paired $t(104)=-2.57$, $p=0.012$. For alumni, the relationship is reversed, with conceptualization benefits (mean: 5.61) marginally exceeding implementation benefits (mean: 5.45) – paired $t(51)=1.88$, $p=0.066$.

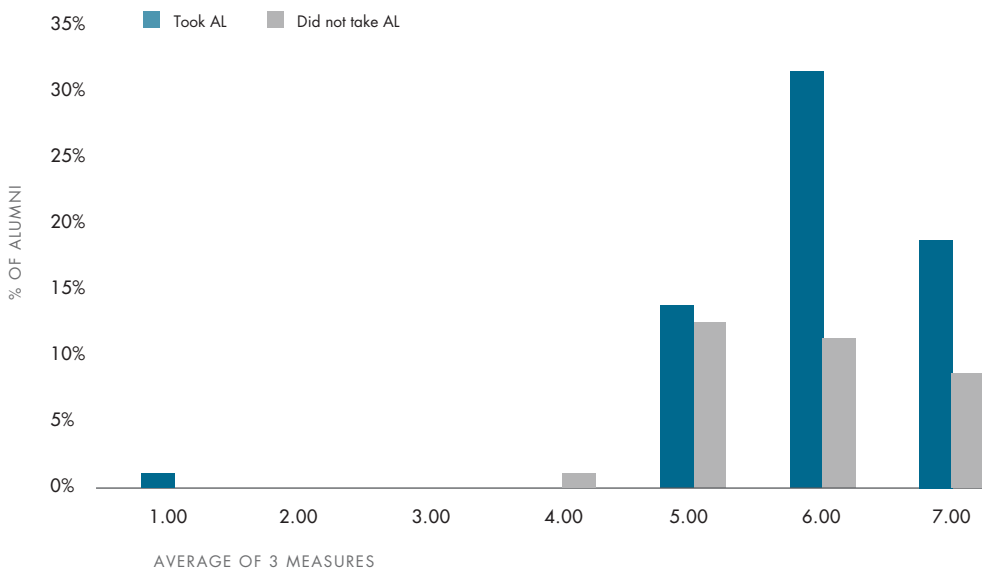
DISTRIBUTION OF ADAPTED AMERICAN CUSTOMER SATISFACTION INDEX (ACSI) SCORES AMONG RESPONDENTS

Figure 8a: Distribution of ACSI score by AL participation (data source: student survey)



ACSI for lab-takers (mean: 5.15) is marginally higher than non-lab takers (mean: 4.81) – $t(207)=1.78, p=0.07$.

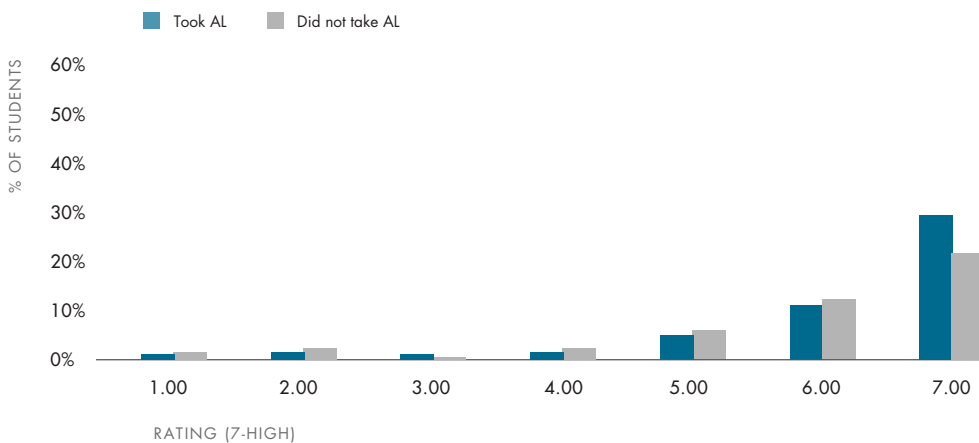
Figure 8b: Distribution of ACSI score by AL participation (data source: alumni survey)



No statistical difference between ACSI for lab-takers (mean: 6.14) and non-lab takers (mean: 6.10) – $t(77)=0.19, p=0.89$.

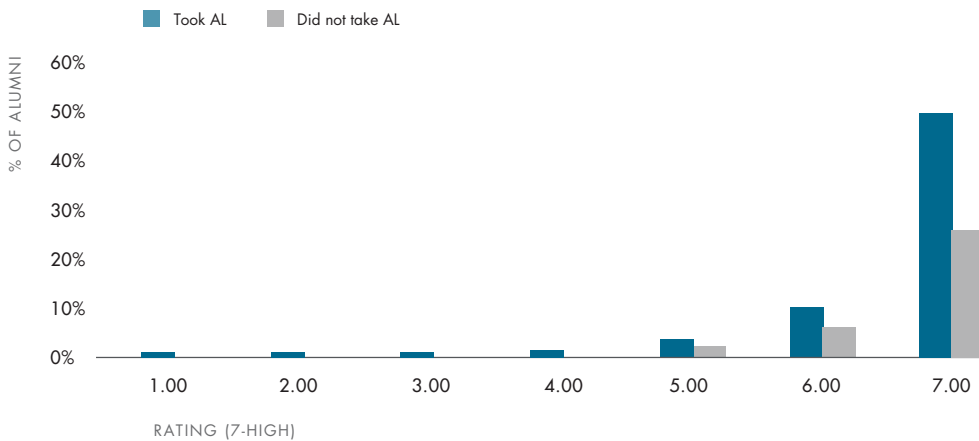
DISTRIBUTION OF RESPONDENTS' LIKELIHOOD TO RECOMMEND MIT SLOAN

Figure 9a: Distribution of likelihood of referral by AL participation (data source: student survey)



Referral likelihood is marginally higher for lab-takers (mean: 6.20) than non-lab takers (mean: 5.82) – $t(207)=1.92, p=0.06$.

Figure 9b: Distribution of likelihood of referral by AL participation (data source: alumni survey)



There is no statistical difference between lab takers (mean: 6.50) and non-lab takers (mean: 6.67) – $t(77)=0.75, p=0.45$.

Appendix 1: Depth Interview Guide

Goal: Identify benefits perceived by students or alumni from their participation in Action Learning courses.

Please note that, to prevent bias, interviewees will not be primed about this being an Action Learning study. However, though disguised, the interviewer will steer respondents to answer questions about perceived benefits, both professional and personal, of Action Learning coursework. We will try to adopt a funnel approach, starting with broad questions and getting more specific.

Opening: Thank you for agreeing to speak with me today. As mentioned in the email, we are working with the MIT Sloan faculty and administration to better understand the impact of the specific components of the Sloan learning experience. There are many ways that Sloan students learn over the course of their time at MIT, including:

- attending classroom lectures and case discussions
 - working together with core teams
 - participating in Action Learning or project-based courses where student teams work with real companies on projects as a major part of the course requirements
 - participating in extra-curricular activities, study tours and/or competitions
 - (organizing and/or partaking in C-functions)
1. What, if anything, do you believe differentiates the MIT Sloan experience from other business schools?
 2. Thinking back upon your days at Sloan, can you share two to three activities, classes or experiences that contributed most to your growth?
 - i.
 - ii.
 - iii.
 3. Probe lightly:
 - i. Why does (verbalize i) stand out as being particularly memorable in helping you grow?
 - ii. Why does (verbalize ii) stand out as being particularly memorable in helping you grow?
 - iii. Why does (verbalize iii) stand out as being particularly memorable in helping you grow?

- 4.** If Action Learning course(s) are mentioned in 2 above (say, ii is an AL course), ask
- i. How did (verbalize - ii) influence you
 - i. Professionally
 - 1. After they respond, if they have left out some aspects we want to probe, can ask aspects of interest to us such as, "What about other aspects such as career development, career change, recruiting, differentiating during job interviews, leadership skills...."
 - ii. Personally
 - 1. After they respond, if they have left out some aspects we want to probe, can ask aspects of interest to us such as, "friendships, working in teams, worldview, management style, decision making style, personal work style...."
 - iii. Did (verbalize - ii) influence you in any other way?
 - 1. Can probe for
 - a. Emotional growth
 - b. Impact on stakeholders (company, society...)
 - iv. What were the most important benefits of enrolling in (verbalize - ii)?
 - v. What more could this course have done for you?
 - vi. Given your experience, would you consider sponsoring a project for a project based class?
- 5.** If Action Learning course(s) are not mentioned in 2 above, ask, "Can you tell us about a couple of academic or curricular experiences/classes that contributed most to your growth?"
- i.
 - ii.
 - iii.
- 6.** Probe lightly:
- i. Why does (verbalize i) stand out as being particularly memorable in helping you grow?
 - ii. Why does (verbalize ii) stand out as being particularly memorable in helping you grow?
 - iii. Why does (verbalize iii) stand out as being particularly memorable in helping you grow?

7. If Action Learning course(s) are mentioned in response to 5 above (say, ii is an AL course), ask

- i. How did (verbalize - ii) influence you
 - i. Professionally
 - 1. After they respond, if they have left out some aspects we want to probe, can ask aspects of interest to us such as, "What about other aspects such as career development, career change, recruiting, differentiating during job interviews, leadership skills...."
 - ii. Personally
 - 1. After they respond, if they have left out some aspects we want to probe, can ask aspects of interest to us such as, "Friendships, working in teams, worldview, management style, decision making style, personal work style...."
- iii. Did (verbalize - ii) influence you in any other way?
 - 1. Can probe for
 - a. Emotional growth
 - b. Impact on stakeholders (company, society...)
- iv. What were the most important benefits of enrolling in (verbalize - ii)?
- v. What more could this course have done for you?
- vi. Given your experience, would you consider sponsoring a project for a project based class?

8. If Action Learning classes are not mentioned in 2 or 5 above, ask

- i. Did you take any classes where working with real companies on projects was a major part of the course requirements?

9. If they say yes, ask

- i. Can you name some?
- ii. How did (verbalize – AL coursename) influence you
 - i. Professionally
 - 1. After they respond, if they have left out some aspects we want to probe, can ask aspects of interest to us such as, "What about other aspects such as career development, career change, recruiting, differentiating during job interviews, leadership skills...."
 - ii. Personally
 - 1. After they respond, if they have left out some aspects we want to probe, can ask aspects

of interest to us such as, “Friendships, working in teams, worldview, management style, decision making style, personal work style....”

- iii. Did (verbalize - AL coursename) influence you in any other way?
 - 1. Can probe for
 - a. Emotional growth
 - b. Impact on stakeholders (company, society...)
- iv. What were the most important benefits of enrolling in (verbalize - AL coursename)?
- v. What more could (verbalize - AL coursename) have done for you?
- vi. Given your experience, would you consider sponsoring a project for a project based class?

Thank you so much for your time.

Can we reach out to you for any clarifying questions?

Appendix 2a: Student Survey

Dear {{Program}} {{Year}} Student,

We are working with the MIT Sloan faculty and administration to better understand the impact of the specific components of the Sloan learning experience. This is a strategic initiative for MIT Sloan where your input will be invaluable.

There are many ways that Sloan students learn over the course of their time at MIT including:

- attending classroom lectures and case discussions
- working together with core teams
- participating in Action Learning or project-based courses, such as E-Lab and G-Lab, where student teams work with real companies on projects as a major part of the course requirements
- participating in extra-curricular activities, study tours, treks and/or competitions
- organizing and/or partaking in C-functions, among others

Your response to the questions below will be critical feedback for the different components of the MIT Sloan learning experience. The survey should take up to 15 minutes of your time and will be completely confidential.

As appreciation for your time, we will randomly select 20 students who complete this survey to receive \$25 gift cards.

We thank you for your participation.

— MIT Sloan School of Management

Q1) Please list the three most important considerations in your decision to accept the admission offer from MIT Sloan.

Q2) Please list three components that stand out as being the most **valuable in your MIT Sloan learning experience**.

Q3) Please indicate the impact that each of the following components has had on your MIT Sloan learning experience, where "1" represents "Low Impact" and "7" represents "High Impact."

- **Action Learning:** Project-based courses, such as E-Lab and G-Lab, involving real-world companies and organizations
- **Classroom Experience:** Faculty quality; balance of lectures, cases, discussions, and panels
- **Entrepreneurial Culture:** 100K competition
- **Student-led Experiences:** Clubs, Treks, Study Tours
- **MIT Mission:** Focus on solving worldwide challenges
- **Safe Space:** Opportunity to get out of your comfort zone and try new things
- **Program Structure:** One semester of required classes; balance of hard and soft skills
- **Sloan Culture:** Non-competitive and collaborative; responsive alumni and cohort
- **Social Engagement:** Relationship building events such as C-functions and dinners
- **MIT Ecosystem:** Cambridge location; connection to the rest of MIT

Q4) Please select and rank order the top three significant experiences that you have had while at MIT Sloan, where "1" is most significant. (Rank experiences from **Q3**.)

Q5) Please indicate all of the MIT Sloan Action Learning/project-based courses in which you have participated or are currently participating (check all that apply). If you have taken none of these courses, please check "None".

If "None" is checked in response to Q5, then skip to Q12, else continue.

Q6) Please select the primary industry(ies) of your host organization(s) for your Action Learning project(s).

Q7) Please indicate the degree of influence your Action Learning course(s) have had in driving each of the following **professional benefits** for you, where “1” represents “Low Influence” and “7” represents “High Influence.”

- Develop a structured approach to problem solving
- Apply theoretical frameworks in real-world situations
- Develop professional connections
- Manage client interactions effectively
- Communicate persuasively
- Lead teams without having formal authority
- Collaborate effectively in teams
- Support career transition into a new role or industry
- Take initiative to drive outcomes
- Manage in a complex, real-world environment
- Manage projects
- Make decisions and be held accountable

Q8) Please select and rank order the top three **professional benefits** you have derived from participating in Action Learning course(s), where “1” is most important. (Rank professional benefits from **Q7**.)

Q9) Please indicate the degree of influence Action Learning course(s) have had in driving each of the following **personal benefits** for you, where “1” represents “Low Influence” and “7” represents “High Influence.”

- Grow personally through reflection and feedback
- Develop interpersonal skills
- Adapt to unexpected changes
- Bond with classmates through shared experiences
- Expand worldview and global awareness
- Deal with ambiguity
- Persevere in the face of obstacles
- Enhance self-reliance
- Strengthen my value system

Q10) Please select and rank order the top three **personal benefits** you have derived from participating in Action Learning course(s), where “1” is most important. (Rank personal benefits from **Q9**.)

Q11) Given your experience, do you see value in your sponsoring a project for an action learning course after graduation?

Q12) Please indicate your level of satisfaction with the MIT Sloan learning experience thus far.

Q13) Please indicate the extent to which the MIT Sloan learning experience is meeting your expectations.

Q14) Please indicate the extent to which the MIT Sloan learning experience is coming close to your ideal learning experience.

Q15) Please indicate your likelihood of recommending MIT Sloan to friends and family.

Display Q16 only if respondent has experience with action learning

Q16) Please select and rank the top three areas that should be addressed for Action Learning courses, where “1” is most important.

- Provide more financial assistance from MIT for travel
- Improve classroom experience
- Increase number of non-Sloan students in the courses
- Reengage the hosts in the future (maintain continuity)
- Improve the process of matching teams with projects
- Manage host expectations on project scope
- Improve training on global-cultural sensitivities
- Make available sample project deliverables by domain for reference
- Other (please specify)

Q17) Demographics

- Year of graduation
- Program
- Primary functional role at time of enrollment at MIT Sloan
- Primary functional role of your accepted job offer (for graduating students), or summer internship (for 1st year students)
- Primary industry expertise at time of enrollment at MIT Sloan
- Primary industry of your accepted job offer (for graduating students), or summer internship (for 1st year students)
- Employment after MIT Sloan (for graduating students), or over the summer (for 1st year students) (please check one)
 - o Start own company
 - o Work at a start-up
 - o Work in a mid-tier/growth-stage organization
 - o Work in an established company
- Approximate number of employees at the above company
- Are you designated as an international student here at MIT Sloan? (Yes or No)
- Name of company where you accepted your offer
- Job title of your accepted offer
- Country where you will be working (if you accepted an offer)

Q18) If you have any additional thoughts please share your comments below.

Q19) If you are interested in participating in the \$25 gift card drawing, please enter your email below. Please note that your responses will remain confidential.

Appendix 2b: Alumni Survey

Dear {{Salutation}},

We are working with the MIT Sloan faculty and administration to better understand the impact of the specific components of the Sloan learning experience. This is a strategic initiative for MIT Sloan where your input will be invaluable.

There are many ways that Sloan students learn over the course of their time at MIT including:

- attending classroom lectures and case discussions
- working together with core teams
- participating in Action Learning or project-based courses, such as E-Lab and G-Lab, where student teams work with real companies on projects as a major part of the course requirements
- participating in extra-curricular activities, study tours, treks and/or competitions
- organizing and/or partaking in C-functions, among others

Your response to the questions below will be critical feedback for the different components of the MIT Sloan learning experience. The survey should take up to 15 minutes of your time and will be completely confidential.

We thank you for your participation.

— The MIT Sloan Alumni Board

Q1) Please list three components that stand out as being the most valuable in your MIT Sloan learning experience.

Q2) Please indicate the impact that each of the following components had on your MIT Sloan learning experience, where “1” represents “Low Impact” and “7” represents “High Impact.”

- **Action Learning:** Project-based courses, such as E-Lab and G-Lab, involving real-world companies and organizations
- **Classroom Experience:** Faculty quality; balance of lectures, cases, discussions, and panels
- **Entrepreneurial Culture:** 100K competition
- **Student-led Experiences:** Clubs, Treks, Study Tours
- **MIT Mission:** Focus on solving worldwide challenges
- **Safe Space:** Opportunity to get out of your comfort zone and try new things
- **Program Structure:** One semester of required classes; balance of hard and soft skills
- **Sloan Culture:** Non-competitive and collaborative; responsive alumni and cohort
- **Social Engagement:** Relationship building events such as C-functions and dinners
- **MIT Ecosystem:** Cambridge location; connection to the rest of MIT

Q3) Please select and rank order the top three significant experiences that you had while at MIT Sloan, where “1” is most significant. (Rank experiences from **Q2**.)

Q4) Please indicate all of the Action Learning/project-based courses in which you participated during your time at MIT Sloan (check all that apply). If you took none of these courses, please check “None”.

If “None” is checked in response to Q4, then skip to Q11, else continue.

Q5) Please select the primary industry(ies) of your host organization(s) for your Action Learning project(s).

Q6) Please indicate the degree of influence your Action Learning course(s) had in driving each of the following **professional benefits** for you, where “1” represents “Low Influence” and “7” represents “High Influence.”

- Develop a structured approach to problem solving
- Apply theoretical frameworks in real-world situations
- Develop professional connections
- Manage client interactions effectively
- Communicate persuasively
- Lead teams without having formal authority
- Collaborate effectively in teams
- Support career transition into a new role or industry
- Take initiative to drive outcomes
- Manage in a complex, real-world environment
- Manage projects
- Make decisions and be held accountable

Q7) Please select and rank order from the top three **professional benefits** you derived from participating in Action Learning course(s), where “1” is most important. (Rank professional benefits from **Q6**.)

Q8) Please indicate the degree of influence Action Learning course(s) had in driving each of the following **personal benefits** for you, where “1” represents “Low Influence” and “7” represents “High Influence.”

- Grow personally through reflection and feedback
- Develop interpersonal skills
- Adapt to unexpected changes
- Bond with classmates through shared experiences
- Expand worldview and global awareness
- Deal with ambiguity
- Persevere in the face of obstacles
- Enhance self-reliance
- Strengthen value system

Q9) Please select and rank order the top three **personal benefits** you derived from participating in Action Learning course(s), where “1” is most important. (Rank personal benefits from **Q8**.)

Q10) Given your experience, do you see value in your sponsoring a project for an action learning course?

Q11) Please indicate your level of satisfaction with the MIT Sloan learning experience.

Q12) Please indicate the extent to which the MIT Sloan learning experience met your expectations.

Q13) Please indicate the extent to which the MIT Sloan learning experience came close to your ideal learning experience.

Q14) Please indicate your likelihood of recommending MIT Sloan to friends and family.

Display Q15 only if respondent has experience with action learning

Q15) Please select and rank the top three areas that should be addressed for Action Learning courses, where “1” is most important.

- Provide more financial assistance from MIT for travel
- Improve classroom experience
- Increase number of non-Sloan students in the courses
- Reengage the hosts in the future (maintain continuity)
- Improve the process of matching teams with projects
- Manage host expectations on project scope
- Improve training on global-cultural sensitivities
- Make available sample project deliverables by domain for reference
- Other (please specify)

Q16) Demographics

- Year of graduation
- Program
- Primary functional role at time of enrollment at MIT Sloan
- Primary functional role at first job upon graduation from MIT Sloan
- Primary industry expertise at time of enrollment at MIT Sloan
- Primary industry at first job upon graduation from MIT Sloan
- Employment upon graduation from MIT Sloan (please check one)
 - Started own company
 - Worked at a start-up
 - Worked in a mid-tier/growth-stage organization
 - Worked in an established company
- Approximate number of employees at the above company
- Were you designated as an international student while at MIT Sloan? (yes or no)
- Name of company where currently employed
- Current job title
- Industry where currently employed
- Country where currently employed

Q17) If you have any additional thoughts, please share your comments below.

Appendix 3: Anatomy of a Resume

This marked-up sample demonstrates how resumes were coded for analysis.

JEREMY SMITH
 123 Alphabet Drive #A | Cambridge, MA 02139
 555-123-4567 | jeremy.smith@sloan.mit.edu

Education

Institution

Degree

Degree Spec ●

Leadership ●

Project-based Experience ●

Coursework ●

Honor/Award ●

EDUCATION

MIT SLOAN SCHOOL OF MANAGEMENT Cambridge, MA
2012-Present

Candidate for MBA, June 2014

- Co-President, Sustainability Business Club; led major attracting over 500 guests and \$25,000 in donations.
- VP of Logistics, EMPower Conference 2013; organized weekend of events including conference day and VIP dinner
- Consulted Chilean health-tech startup on market expansion and integration of Brazilian acquisition
- Elective highlights: Strategic Decision Making in the Biomedical Business (complex valuations in life science ventures), Entrepreneurial Strategy (business strategies to achieve competitive advantage), Healthcare Operations (collaboration with MGH ICU), Global Branding (on-site study of marketing strategies at top European companies)
- Awarded the Dean’s Scholarship for Academic Excellence

BROWN UNIVERSITY Providence, RI
2002-2006

B.A., Economics

- On Dean’s Leadership Committee

WORK EXPERIENCE

BIODAT Cambridge, MA
Summer 2013

MBA Intern, Global Marketing and Strategy, Biosurgery

- Built financial model for market size assessments and revenue forecasts 10 years post-launch, created P&L and calculated NPV; applied model to assess a lifecycle management product improvement for LifeView®.
- Developed business case tool to prioritize new R&D opportunities; created template pitching value proposition, competitive strategy, development risks, opportunities, and financial plan.
- Verified marketing materials for MENA launch of BioPEN and internal Biodat review process; examined over 40 marketing claims made in core sales resource, product brochure, and clinical trial insert.

ROBINSON, PETERSON AND ASSOCIATES Cambridge, MA
2007-2012

Expert economic analysis and litigation support for law firms and government agencies.

Senior Analyst (2010-2012), Analyst (2007-2010), Healthcare Practice

Quantitative Modeling

- Calculated dollar impact of Fortune 500 companies’ business practices on plaintiffs, e.g. a top five pharmaceutical company was ordered to pay nearly \$300M in damages for loss of sensitive consumer data; performed similar economic analyses for over 60 cases
- Analyzed industry standard pricing and sales data using Excel modeling and R programming.

Strategic Market Analysis

- Examined marketing, sales, and launch strategies for blockbuster drugs using company planning documents; incorporated findings into over 150 expert witness reports filed in federal and state courts.
- Segmented markets for new biopharmaceutical therapeutic classes, resulting in targeted damages calculations for biologics.
- Researched FDA approvals and regulatory actions for drug products, providing qualitative evidence for expert’s arguments.

Persuasive Communication Skills

- Managed team of analysts and interns, setting goals for the unit, organizing training, and coaching for success.
- Persuaded president to institute new promotion policy and increase delegation of higher-level responsibilities.

ACTIVITIES AND INTERESTS

- Volunteer with Brother-to-Brother, Rhode Island (2003-2006): Mentored low-income high school seniors through college application process.
- Volunteer with Transliterate, New England (2013-present): Ran inclusivity workshops in public high schools.
- Interests: Running marathons, cooking, Brazilian literature, and the New England Patriots.

Appendix 4: Success Stories

While MIT Sloan Action Learning is first and foremost a pedagogical framework, students make invaluable contributions to their sponsoring companies. Whether their host is a small, family-owned business, a major multinational company, or something in between, either for-profit or non-profit, students address business challenges across the spectrum, as showcased in the stories that follow.

DATA HELPS KEEP TRAINS RUNNING

Creating value out of text logs

GE Transportation is a division of General Electric that supplies and maintains locomotives for transportation companies. In an effort to reduce costs, streamline operations, and increase performance, managers approached Analytics Lab to see if MIT students could derive useful data from the reams of messy text logs kept by the company's mechanics. The goal of the project was to use the data to help anticipate the need for locomotive maintenance, thus improving service to customers and saving GE and its customers money.

Applying analytics and modeling

GE Transportation gave the student team three years' worth of maintenance service sheets in electronic form. The students used multiple text-analytics methods to wrangle information from the entries, which were riddled with non-standard spellings and abbreviations. The students developed an-

alytics to cluster the text based on a variety of characteristics and created a model that linked certain features to higher likelihoods of mechanical failure in a key component of the locomotive. The additional data enabled students to better predict equipment failures within the first 78,000 miles of locomotive travel than using GE's quantitative data alone.

Predicting maintenance needs

"We're very happy with the results," said Justin Rivera, manager of data science and analytics at GE Transportation. "The students became subject matter experts for us on this niche project, and we were able to capitalize on their findings." Now, Rivera said, GE Transportation is able to optimize maintenance schedules in the many locomotives that GE supports.



THE STUDENTS BECAME SUBJECT MATTER EXPERTS FOR US ON THIS NICHE PROJECT, AND WE WERE ABLE TO CAPITALIZE ON THEIR FINDINGS.

JUSTIN RIVERA

MANAGER OF DATA SCIENCE AND ANALYTICS
GE TRANSPORTATION

TRANSFORMING AN INDUSTRIAL CENTER'S ECONOMIC DEVELOPMENT

A Municipality's Evolution

Anting, a township in the Jiading District of Shanghai, is one of China's automotive industry centers. Anting faces significant global competition and cost pressure due to rising labor costs in the region. As part of its economic development plan, the township seeks to diversify its industrial base by attracting high-tech industries, and it sees healthcare as a major opportunity for an industry cluster. With the relocation of a major acute care hospital facility to the area, local government officials wanted to identify and attract companies to a new tech-park development complex. Anting engaged a China Lab team to evaluate how to build out a healthcare-related innovation ecosystem around its new medical complex and attract global institutions and companies to locate and partner with it.

Bringing Medical Innovation

After evaluating innovation healthcare clusters in the US and Europe, and emerging trends in China's healthcare system, the team focused on precision medicine, an innovative segment of the healthcare space. They mapped out the full ecosystem of possible research,

pharmaceutical, diagnostic, and therapeutic technologies that could integrate with the medical center and other existing facilities in liver transplant and cell therapies. The team identified key thought leaders in this field and how to attract the conference gatherings, companies and talent necessary to build out a vibrant industry cluster. The China Lab team provided Anting with an implementation roadmap detailing priority segments, potential partners, and pitch proposals to move forward with its economic development plan.

E-LAB

ENTREPRENEURSHIP LAB

TAKING A START-UP TO THE NEXT LEVEL**Looking for new markets**

Knote is an information technology and services company that helps organizations automate document processing, handling, and analysis using natural language processing, a kind of artificial intelligence. Company leaders asked E-Lab to perform a primary market research study to help them identify new potential markets among such options as the legal, health, pharmaceutical, and insurance industries.

Identifying opportunities

The E-Lab team conducted online market research and interviewed more than 50 people at a variety of companies to zero in on the best market opportunities for Knote. The team assessed six verticals and compared the pros and cons of each using a variety of factors, including willingness to pay, average spending on technology, sales-cycle length, and

total available market. Ultimately, students delivered an insightful presentation in support of a specific recommendation for Knote.

Scaling up

E-Lab's recommendation enabled Knote to focus its limited resources on the most promising new market – a major bonus for a start-up, as Knote founder and CEO Ron Glozman remarked. "E-Lab really helped us develop our market strategy and scale the business," Glozman said. "The students are top-notch, and the work they deliver is of the highest caliber. It's an invaluable asset to any company and can help you take your start-up to that next phase."



THE STUDENTS ARE TOP-NOTCH, AND THE WORK THEY DELIVER IS OF THE HIGHEST CALIBER.

RON GLOZMAN
FOUNDER AND CEO
KNOTE

MAXIMIZING THE LUXURY BUYING EXPERIENCE

A drive for excellence

BMW, a world-leading manufacturer of luxury vehicles and related products, asked students in EM-Lab to answer two critical business questions for them: What makes a truly exceptional luxury car buying experience? And how can employee training help deliver on this goal?

Stealth data gathering and analysis

The EM-Lab team used secondary research to identify companies in the luxury market with both excellent customer service and well-respected training programs. Using a rubric and scorecard they created themselves, the students then conducted a series of “mystery shopper” expeditions. Posing as buyers at luxury car retailers, jewelry shops, and five-star hotels, they learned through experience what drives customer satisfaction. Students also met with several of BMW’s corporate managers, dealership managers, and regional sales directors to gauge their varying needs.

Ultimately, the EM-Lab team presented BMW with a series of recommendations for sales and training programs designed to ensure retailers provide the detail-oriented, seamless customer care that characterizes best-in-class service.

Key insights for executives

Simon Huang, sales strategy manager for BMW North America, praised the high quality of the EM-Lab team’s work: “The research done by the MIT Sloan team focusing on leading luxury and premium retailers was shared with our executives in the U.S. and colleagues in Munich. The team provided key insights and direction that confirmed and challenged our approach to supporting and leading the change effort under way in providing the ultimate retail experience for our customers.” BMW made plans to return as an EM-Lab host company the following year.



THE TEAM PROVIDED KEY INSIGHTS AND DIRECTION THAT CONFIRMED AND CHALLENGED OUR APPROACH TO SUPPORTING AND LEADING THE CHANGE EFFORT UNDER WAY IN PROVIDING THE ULTIMATE RETAIL EXPERIENCE FOR OUR CUSTOMERS.

SIMON HUANG

SALES STRATEGY MANAGER
BMW NORTH AMERICA

A ROADMAP FOR EMERGING TECHNOLOGY INTEGRATION

Adapting to technological change

Emerging technologies are profoundly changing the business models of the diverse clients of SAP, a leading multinational provider of enterprise software for business operations and customer relations. A team of four first-year MBA students in the Enterprise Management Lab was tasked by Colleen Walsh, SAP's director of strategic business for North America, with developing a framework to help clients consider adopting new technologies.

Gathering expert insight

SAP arranged for the students to talk with the chief information officers at several of their Fortune 100 clients to learn about their diverse technology challenges. The team also visited SAP's North American headquarters in Philadelphia to meet with key internal executives. The students consulted with their faculty mentor and other MIT Sloan experts in strategy, operations, and marketing, and ultimately

developed a dynamic framework companies can use to determine whether to adopt either mature or newer technologies to meet their immediate and longer-term business needs.

Employing thought leadership

The project was an unequivocal success, with concepts quickly employed by SAP in a pitch to Pepsi regarding a product launch. SAP also expressed interest in developing the thought leadership shown in the students' work into a white paper, and all four students were offered summer internships with SAP. Most importantly, the students were invited to present their work to executives at the highest level of SAP. As Walsh noted, "The students made quite an impression on the president of SAP North America, Jen Morgan! She would love to open a broader relationship of collaboration between the MIT MBA program and SAP. MIT's faculty and students add an informed and innovative energy to our innovation community."



MIT'S FACULTY AND STUDENTS ADD AN INFORMED AND INNOVATIVE ENERGY TO OUR INNOVATION COMMUNITY.

COLLEEN WALSH

DIRECTOR OF STRATEGIC BUSINESS FOR NORTH AMERICA
SAP

FINANCE

FINANCE PROSEMINAR IN CAPITAL MARKETS/INVESTMENT MANAGEMENT

FINANCE

INVESTMENT SOLUTION EARNS NOBEL-LEVEL ATTENTION

Financial giant seeks rebalancing policy

State Street Associates (SSA) is an affiliate of State Street Corporation, a major global financial services company. SSA develops risk, investor behavior, and economic indicators as well as indices for clients around the world. SSA proposed that students in MIT's Finance Proseminar in Capital Markets/Investment Management tackle a long-standing problem for investors: how best to determine a portfolio's optimal rebalancing policy. Previously, investors had relied on ad hoc rules that yielded suboptimal results.

Published results intrigue Nobelist

The Finance Proseminar team came up with a dynamic programming solution that compared the transaction costs of rebalancing a portfolio to the certainty equivalent of preserving a suboptimal asset mix. The team's faculty mentor was sufficiently impressed with their analysis that he encouraged them to write it up and submit it to a finance journal, which they did. After it was published, Harry Markowitz, a pioneer in the field of financial

economics and a Nobel laureate, called the faculty to say that he had read their paper, which he liked very much. He correctly pointed out that their solution was not scalable, due to the curse of dimensionality³. Markowitz asked the faculty member to test a quadratic heuristic that he believed would overcome this phenomenon. The test showed that the heuristic did so, and the results were published in a finance journal. Markowitz now lists among his achievements overcoming the curse of dimensionality, which he discusses in his most recent book.

Host gains profitable product

The host company developed a product based on the students' and Markowitz's insights, which they now distribute to institutional clients worldwide. In a nutshell, this project led to a student publication in a professional journal, which attracted the attention of a Nobel laureate, enabling him to claim credit for vanquishing a well-known phenomenon, and the sponsoring corporation developed an important and profitable product.

³The curse of dimensionality refers to various phenomena that arise when analyzing and organizing data in high-dimensional spaces (often with hundreds or thousands of dimensions) that do not occur in low-dimensional settings such as the three-dimensional physical space of everyday experience.

SUPPORTING INNOVATION IN THE PHILIPPINES

Fostering a start-up ecosystem

IdeaSpace is a nonprofit organization dedicated to building the start-up ecosystem in the Philippines – a key step to eradicating poverty in that country. Launched in 2012 with significant financial support from a short-term grant, IdeaSpace approached G-Lab for help developing a strategic plan for long-term success in supporting innovation, technology development, and entrepreneurship.

Forming a long-term strategy

G-Lab students conducted extensive research and interviewed a global range of incubators, government officials, and angel investors to explore how IdeaSpace could foster an entrepreneurial ecosystem in the Philippines. The team then led a series of interactive workshops and brainstorming sessions with the company's executive team to help them develop a strategy for long-term success. The

G-Lab team provided IdeaSpace with metrics, funding strategies, and a variety of business contacts as a future resource. In addition, the students created culturally relevant teaching materials for budding technology entrepreneurs and trained IdeaSpace employees to use them.

A satisfied customer

IdeaSpace was enthusiastic about the students' recommendations and quickly implemented several: they refined the metrics, they created clubs of angel investors to support start-up funding, and they reached out to government entities to find additional partners. IdeaSpace's associate director for strategy and business development told the G-Lab team, "Your work has really been instrumental in kicking all of these [ideas] off."



**YOUR WORK HAS REALLY BEEN INSTRUMENTAL IN
KICKING ALL OF THESE IDEAS OFF.**

ASSOCIATE DIRECTOR
STRATEGY AND BUSINESS DEVELOPMENT
IDEASPACE

EXPANDING ACCESS TO SCHOOLS IN AFRICA

Filling an education gap

LiquidAfrica Holdings Limited is a boutique investment bank focused on raising private equity capital for growing African companies. Recognizing a gap in the African education market between high-quality – but expensive – private schools and low-quality public schools, LiquidAfrica tapped G-Lab to define a business plan for acquiring existing schools and upgrading them to a target business model.

Laying the groundwork for new schools

The G-Lab team began by conducting a benchmarking analysis to better understand the existing education market in Francophone Central Africa. Students identified the most attractive markets and developed a list of schools that could be acquisition targets. The team also provided LiquidAfrica with a list of potential investors and a dynamic financial model to help the company make go/no-go decisions.

Ongoing partnership

This project was so successful that LiquidAfrica's chairman, Cyrille Nkontchou, and G-Lab team member Eric Pignot co-founded Enko Education, an Africa-wide network of international secondary schools. LiquidAfrica also funded the seed round for Enko Education, which now operates eight schools in five African countries, including Côte d'Ivoire, Cameroon, Senegal, Mozambique, and South Africa. Those schools offer high-quality international education to more than 800 students and employ 150 people across these locations.

Recently, Pignot asked another G-Lab team to analyze the pros and cons of expanding the business to include vocational training. "I think G-Lab is an amazingly well-organized program," Pignot said. "The quality of the projects is really impressive, and for all students who are interested in entrepreneurship in emerging markets, it's just a no-brainer."



THE QUALITY OF THE PROJECTS IS REALLY IMPRESSIVE, AND FOR ALL STUDENTS WHO ARE INTERESTED IN ENTREPRENEURSHIP IN EMERGING MARKETS, IT'S JUST A NO-BRAINER.

ERIC PIGNOT
CO-FOUNDER
ENKO EDUCATION

MANAGING TRAFFIC IN BRAZIL

Focusing on urban mobility

Splice Group, a strong player in the traffic management industry, operates 1,700 cameras focused on traffic control and law enforcement across more than 10 large cities in Brazil. The cameras detect vehicles and collect such information as date, time, speed, type of vehicle, and license plate. Splice approached G-Lab seeking ways to apply this data to improving urban mobility and monetizing related products for the private sector.

Developing an intelligent dashboard

G-Lab students visited operational control centers in São Paulo, Rio de Janeiro, Belo Horizonte, and Sorocaba to ask traffic managers about the most pressing problems they see every day. After discussing a variety of potential business opportunities with Splice, the team developed an intelligent dashboard that displays real-time traffic status to such customers as traffic managers, city planners,

police, and security companies. The team also came up with a second product idea: Splice could display variable messages in full-color LED signs integrated into stoplights to increase safety by relaying important messages to the public; these signs could also be used to show customized advertisements to individuals driving by.

Hitting the road

Splice was delighted with both the signage and the dashboard and decided to move forward with the two concepts. A trial of the dashboard was planned for two important avenues in Sorocaba. A representative from Splice remarked that the students from G-Lab met the company's expectations and even exceeded them. The mayor of Sorocaba was excited about the project, too, telling the students: "Your work shows how we can develop, improve. I salute you for the excellent work."



**YOUR WORK SHOWS HOW WE CAN DEVELOP, IMPROVE.
I SALUTE YOU FOR THE EXCELLENT WORK.**

MAYOR
SOROCABA, BRAZIL

TACKLING COMPETITIVE THREATS

Seeking an 'early warning system'

Akamai is among the largest content delivery networks in the world, providing customers such as Apple, Amazon, and Netflix with infrastructure services that accelerate and improve the online delivery of content and applications. The company approached GO-Lab for help strategizing how to compete with new local entrants to non-U.S. markets where Akamai was expanding. Specifically, the company looked to the student team to help develop an "early warning system" for competitive attacks.

Pairing local knowledge with global concerns

After extensive fact-finding research and analysis, including interviewing stakeholders at the company's U.S. and European offices, GO-Lab students recommended an early warning system, but with a twist. They suggested that Akamai establish product groups in major markets outside of the United States to consolidate the local knowledge

that already existed within the company.

The twist: develop a system to support these groups in adjusting to local competition, and use local perspectives to inform Akamai's global strategy.

Ongoing collaboration

According to Charley Dublin, vice-president of product operations at Akamai, the students' work on the early warning system provided a "thoughtful framework with immediate and long-term steps that was validated internally and largely accepted." Akamai followed up on many of the students' recommendations and went on to work with another GO-Lab team the next year.



THE STUDENTS ARE TOP-NOTCH, AND THE WORK THEY DELIVER IS OF THE HIGHEST CALIBER.

CHARLEY DUBLIN

VICE-PRESIDENT OF PRODUCT OPERATIONS
AKAMAI

GUIDING INTERNATIONAL EXPANSION

Seeking to scale up

Interlub is a specialty industrial lubricant firm based in Guadalajara, Mexico. In 2013, Interlub asked a GO-Lab team for help devising a strategy for expanding the company's highly intensive, customer-centric approach to product development into new international markets. The GO-Lab team researched the business and helped Interlub identify areas of competitive advantage. Then, in 2014, Interlub returned to GO-Lab for guidance as the company considered expanding into the mining sector, with a probable target of Peru.

Ethnographic research

The GO-Lab team surveyed management and sales personnel from both Interlub's headquarters in Mexico and its well-run operation in Brazil to analyze why the company was so successful. The students "shadowed" Interlub salesmen in both countries, which led them to identify benefits as well as notable differences in the two business cultures.

Relationship-building – a strong feature in Mexico – was important, but so was systematic management of the sales process – a key characteristic in Brazil. Ultimately, the students recommended that any new operation incorporate these best practices from both operations.

A turning point for the company

One year after the GO-Lab project, Interlub opened a new office focused on mining, but in Colombia rather than Peru – and immediately implemented the students' recommendations. "It is basically the way we are now operating our business in Colombia," said Interlub CEO Rene Freudenberg, noting that the Colombia expansion has been a great success. "This [GO-Lab] project was really a turning point for us in our mindset and in the history of the company."



THIS PROJECT WAS REALLY A TURNING POINT FOR US IN OUR MINDSET AND IN THE HISTORY OF THE COMPANY.

RENE FREUDENBERG

CEO

INTERLUB

H-LAB

HEALTHCARE LAB

HELPING DOCTORS SERVE MORE PATIENTS**Solving a no-show problem**

Boston Medical Center (BMC) is a private, not-for-profit, academic hospital whose bold mission is to provide “exceptional care, without exception.” BMC serves those most in need and was facing a challenge with not enough available Cardiology Center appointments at the time of scheduling. Patients were being scheduled several months out, while at the same time, due to a high no-show rate, only 60 percent of appointment slots were actually being used. The hospital challenged Healthcare Lab (H-Lab) to see if students could improve scheduling at the clinic so that more patients could be seen and expensive physician time better utilized.

Applying data analysis

The H-Lab student team was tasked with figuring out how the clinic could serve more patients by identifying those most likely to miss their appointments. The team analyzed years’ worth of scheduling data to determine which factors – including type of insurance, age, gender, marital status, type of appoint-

ment, etc. – were most predictive of patient no-shows. The students developed a simple decision tree that the Cardiology Center’s front desk staff could use to classify patients as more or less likely to show up. They provided practical guidelines to help staff schedule appointments to keep physicians busy without being overbooked and help get more patients into the practice.

A 7% uptick

The H-Lab team’s recommendations brought immediate results. “Our host organization implemented new strategies informed by our team’s recommendations and has been able to increase its clinic utilization by 7 percent since implementation,” said Michael Hu, an MIT Sloan PhD student who worked on the project. “[They] reached out to us after the project ended to continue the collaboration with the intention of expanding the project to other clinics.”



OUR HOST ORGANIZATION IMPLEMENTED NEW STRATEGIES INFORMED BY OUR TEAM’S RECOMMENDATIONS AND HAS BEEN ABLE TO INCREASE ITS CLINIC UTILIZATION BY 7 PERCENT SINCE IMPLEMENTATION.

MICHAEL HU

MIT SLOAN PHD STUDENT

GIVING MOBILE CREDIT A BOOST

Seeking a growth strategy

For six straight years, Paytm, India's largest mobile commerce platform, has turned to India Lab for help guiding the company's expansion. Launched in 2010 as a prepaid mobile recharge website for parent company One97 Communications, Paytm has worked with India Lab students year after year to refine its product offerings and grow its business. The company today serves more than 100 million registered users. In early projects, India Lab students designed a successful go-to-market plan for Paytm's mobile advertising and recommended a global expansion strategy. In 2015, Paytm returned to India Lab seeking a strategy for attracting small offline merchants to accept payment through Paytm's mobile application – a major challenge in India, which has traditionally been an overwhelmingly cash economy.

Conducting market research

To address this challenge, India Lab's student team went out on the streets of India to survey local merchants about how Paytm could best meet the needs of small mom-and-pop businesses, where most Indians do their retail shopping. The team then recommended an action plan and a product roadmap to target this market with Paytm's new mobile payment

application. The students also defined key components and features for the app that could help small retailers more effectively manage their stores.

A booming business

Within a year of this India Lab project, Paytm began implementing the team's recommendations – reaching out to local merchants to persuade them to accept mobile payments via Paytm. In November 2016, when the prime minister of India unexpectedly announced the demonetization of certain banknotes, spurring a boom in cashless transactions, Paytm was well-positioned to seize the opportunity: As of March 2017, Paytm was signing up new merchants at a rate of 100,000 per week. Krishna Hegde, senior vice-president of Paytm said, "Our partnership with MIT Sloan has enabled us to work with a bunch of bright young minds every spring as we build India's biggest and fastest-growing payments ecosystem. Over the years, their insights have helped our organization as we expand into new segments of financial services and expand our ecosystem. Their contribution is much appreciated as we forge our way toward bringing half a billion Indians to the mainstream economy."



OVER THE YEARS, THEIR INSIGHTS HAVE HELPED OUR ORGANIZATION AS WE EXPAND INTO NEW SEGMENTS OF FINANCIAL SERVICES AND EXPAND OUR ECOSYSTEM.

KRISHNA HEGDE
SENIOR VICE-PRESIDENT
PAYTM

AID FOR AN EMERGENCY RESPONSE SYSTEM

The challenge of market entry

Reporty is an early stage start-up seeking to use smartphones' advanced technology to revolutionize the way first responders and public safety agencies manage emergencies. Launched in Israel in 2016, Reporty enables civilians to transmit live video and audio reporting and tracks the locations of users to help authorities respond more quickly. The company approached Israel Lab to help develop a strategy for entering the U.S. market with a viable pricing framework.

Formulating an expansion plan

The Israel Lab team began by analyzing Reporty's competition in the United States and investigating market trends in the 911 space. The team then built a three-phased market penetration strategy: They identified the most attractive U.S. cities for a Reporty rollout; they recommended an expansion strategy for the

rest of the U.S. market; and they developed a globalization strategy pinpointing the most favorable countries and regions for additional growth. The team also recommended a dynamic pricing model that can help determine the optimal price point in a variety of U.S. cities and states.

Well-received recommendations

Reporty quickly implemented the Israel Lab team's recommendations, with good results. The company's CEO, Amir Elichai, said: "The pricing model is very excellent. Exactly what we wanted." He also praised the team's go-to-market recommendations and the overall experience of working with Israel Lab: "We are very grateful for having you here, and we have already recommended further collaborations with MIT to our investors and researchers."



WE ARE VERY GRATEFUL FOR HAVING YOU HERE, AND WE HAVE ALREADY RECOMMENDED FURTHER COLLABORATIONS WITH MIT TO OUR INVESTORS AND RESEARCHERS.

AMIR ELICHAHAI
CEO
REPORTY

A LESSON IN INVENTORY MANAGEMENT

Warehouse space crunch

Intralox is a family-owned provider of conveyor belting, conveyor equipment, and plant-optimization services. From its base in New Orleans, the company serves a wide range of customers from car washes to airports, up to and including such Fortune 500 companies as Amazon and FedEx. Committed to meeting all its customer needs immediately, Intralox intentionally carries a large inventory. However, as the company faced the prospect of running out of warehouse space, executives approached Leaders for Global Operations (LGO) for help with inventory management.

Setting inventory levels

Students interviewed multiple stakeholders within the company to gain a better understanding of the business and refine the project scope. They gathered data on demand/usage, production, inventory levels, and reorder points. Using this data, they developed an inventory level-setting methodology and a framework for implementation.

Saving money

The model the students created enabled Intralox to conduct scenario planning and compare the costs of holding inventory to the costs of changing manufacturing setups to produce new inventory more frequently. This data analysis transformed entrenched thinking at the company, with the CEO becoming receptive to new ways of running his business. Ultimately, the work also helped Intralox re-evaluate its warehouse needs. Intralox is now seeking to put another LGO team to work on a new project, which will be based on the first team's recommendations. In reflecting on the students' work afterward, one company leader noted, "We were very impressed. The insights they shared and deliverables they provided were very helpful for us as a company. They did an excellent job of understanding our culture and made recommendations that fit with the priorities of our company."



THEY DID AN EXCELLENT JOB OF UNDERSTANDING OUR CULTURE AND MADE RECOMMENDATIONS THAT FIT WITH THE PRIORITIES OF OUR COMPANY.

CEO

INTRALOX

STREAMLINING PRODUCTION AT SPACEX

A supply chain challenge

SpaceX, a private company founded in 2002 by Elon Musk, designs, manufactures, and launches advanced rockets and spacecraft. In 2015, the company brought onboard an MIT Leaders for Global Operations (LGO) alumnus, Kurt Campbell, to tackle its burgeoning supply chain issues. He in turn hired Elizabeth Sondecker, MBA'16, who decided to engage an LGO team to help solve production delays believed to be caused by poor forecasting of when needed parts would be available.

Providing systems perspective

The LGO program assembled a team of students with deep technical expertise in aeronautics and astronautics, including a doctoral student from MIT's AeroAstro department. The team interviewed key members of the company's receiving operations group and walked through the entire receiving flow to gain a systems perspective of SpaceX's operations. They also gathered and analyzed data to develop a deeper understanding of

supplier variability. The team discovered that while the company did have supply issues, it also had inefficiencies in its own operations that were delaying production. By applying lean principles and 5S methods that they had learned in their MIT coursework, they produced a forecasting model that tracked supplier performance, and a list of recommended improvements to SpaceX's shipping and receiving operations.

Continuing connection

The team's point person at the company called the students' analysis "extremely valuable" and noted that the project "provided quantifiable insight into supplier behavior." SpaceX was quick to implement both the model and the improved management system and has since continued to engage with LGO by participating in its seminar series, recruiting on campus, and seeking to participate in another Sloan Action Learning project.



THE PROJECT PROVIDED QUANTIFIABLE INSIGHT INTO SUPPLIER BEHAVIOR.

COMPANY CONTACT

SPACE X

OPS-LAB

OPERATIONS LAB

REDUCING WASTE IN THE SEAFOOD INDUSTRY**Seeking efficiency**

Gorton's of Gloucester, a major U.S. producer of fish and seafood, was established in 1849, and since that time the company has been trusted to provide products that surpass expectations and help consumers lead healthier lives by eating more seafood. Gorton's has been a partner with Operations Lab since 2011, and for several years before that sponsored similar projects with the MIT Sloan Leaders for Global Operations and MBA programs. In 2016, Gorton's approached Ops Lab to tackle an all too common problem in the seafood industry – trim loss,“ or the loss of some portion of edible fish that occurs during the production process. Gorton's is dedicated to preserving the health of the worldwide seafood supply through sustainable practices. This project supported Gorton's sustainability mission and also realized productivity savings.

Applying rigorous analysis

The Ops-Lab team examined Gorton's trim loss data over time and used data mining and statistical analysis to identify several

key factors that affect how much fish is lost during production. The team then zeroed in on the variable deemed most likely to make Gorton's process more efficient and designed experiments to determine the best method for reducing trim loss.

Ensuring high fish quality

After conducting a sequence of experiments on site at Gorton's, the Ops Lab students developed a robust strategy for enhancing the company's seafood production process. The team's recommendations had an immediate and lasting impact by helping the company reduce trim loss. As one company leader said, “[The team's] dedication to the project and leadership helped Gorton's have new insights into the trim loss issues. We so much appreciate their collaborative efforts, enthusiasm, and professional approach to the problem and their recommended solutions.”



THE TEAM'S DEDICATION TO THE PROJECT AND LEADERSHIP HELPED GORTON'S HAVE NEW INSIGHTS INTO THE TRIM LOSS ISSUES.

COMPANY LEADER

GORTON'S OF GLOUCESTER

AIDING GAP'S MOVE TO RECYCLED COTTON

Eying environmental impact

Gap Inc. is a Fortune 500 retail clothing company with approximately \$15.8 billion in annual sales. In 2016, Sloan alumna and sustainability certificate recipient Alice Hartley (MBA '12), manager of Gap's Sustainable Innovation team, engaged a Sustainable Business Lab (S-Lab) student team to evaluate the potential for incorporating recycled cotton into the company's clothing as one method for achieving the company's sustainability goals. Cotton is Gap's most important fabric by volume, and the company wanted to explore using recycled cotton as an option that might reduce the company's overall environmental impact. (Cotton production is very water-intensive, for example, with as much as 20,000 liters of water needed to produce 1 kilogram of cotton.)

Assessing fabric options

The S-Lab team used a framework presented in their class at MIT to analyze the business impact of using recycled cotton through three sustainability value drivers: risk, revenue, and cost. The team also researched the recycled cotton industry and met with Gap Inc.

employees and external stakeholders, including factory managers, to gain insight into the company's supply chain and manufacturing processes. Finally, the students delivered a wealth of information to the company about cotton recycling methods, a decision tree for assessing fabric options, and recommendations for implementing a recycled cotton strategy.

Moving to 100% sustainable cotton

Gap Inc. gained a tremendous amount of useful information from this project, Hartley said, particularly pertaining to the different methods for recycling cotton. "We didn't know that much about recycled cotton. This project helped us learn more about its benefits and flesh out recycled cotton as an option for our sustainable cotton portfolio," she said. Gap, one of Gap Inc's five brands, has since made a commitment to move to 100 percent sustainable cotton by 2021 — and the path to that goal will include the use of recycled cotton. "It's fair to say that having done due diligence with S-Lab's help made it possible to include recycled cotton as one of the options," Hartley said.



WE DIDN'T KNOW THAT MUCH ABOUT RECYCLED COTTON. THIS PROJECT HELPED US LEARN MORE ABOUT ITS BENEFITS AND FLESH OUT RECYCLED COTTON AS AN OPTION FOR OUR SUSTAINABLE COTTON PORTFOLIO.

ALICE HARTLEY (MBA '12)

MANAGER OF GAP'S SUSTAINABLE INNOVATION TEAM

