The Future of Executive Development: The CLO's Compass and The Executive Programs Designer's Guide

Mihnea Moldoveanu
Professor of Economic Analysis,
Desautels Professor of Integrative Thinking, and
Vice-Dean, Learning, Innovation, and Executive Programs,
Rotman School of Management, University of Toronto

Das Narayandas
Senior Associate Dean, External Relations and
Harvard Business Publishing
Edsel Bryant Ford Professor of Business Administration
Harvard Business School, Boston

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Mihnea Moldoveanu
University of Toronto

Das Narayandas
Harvard Business School

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Abstract: Executive education worldwide has entered a period of disruption catalyzed by the digitalization of content, connectivity, and communication - while the demand for managerial skills is growing. The forces of disintermediation, disaggregation, and decoupling are creating an unprecedented increase in the nature and number of education options available to companies seeking to increase their skill and capability base. Based on an extensive survey of the industry informed partly by a large set of in-depth interviews with chief talent and learning officers, participants, and providers, we introduce a compass that will help CEO's and CLOs navigate the emerging landscape of executive education and a parallele compass for designer of executive programs faced with a new industry dynamic and technology curves that open up numerous design and re-design options.

Acknowledgments

Introduction

The digitalization of content, connectivity, and communications has disrupted the executive education and development industry. The three forces unleashed by digitalization -- the disintermediation of academics' services, the disaggregation of the bundles of experiences that constitute an education program, and the decoupling of the sources of value that participants derive from an educational experience – are reshaping the demand for executive education. The growing dissatisfaction in companies with the mismatch between the skills that executive education programs inculcate and those that executives need has also reached a critical point. Unless education-providers address two major gaps which we have identified – the skills gap, which is the gap between the skills required by companies and those provided by education-providers, and

the skills application gap, between the acquisition of skills and their usage in the workplace – they're unlikely to succeed or survive in the new landscape [*Moldoveanu and Narayandas, 2017;*].

In this paper, we will articulate a compass designed for Chief Learning Officers and Chief Talent Officers who want to chart effective routes through the emerging landscape of executive development. We've also developed a guide for executive education-providers, which have to adapt quickly to the new demand patterns and cost structures if they wish to survive. We will also show how feedback loops have to be reengineered if education-providers want to stay connected to their clients and learn how to adapt their offerings to the changing marketplace.

Mapping the Skills Gaps

Skill development – comprising both skill acquisition and skill transfer – is the fundamental source of value in executive education for both companies and executives. No executive would attend an education program if the only benefits it offered were social signaling, networking opportunities, or interesting conversations, in spite of the benefits these experiences provide [Moldoveanu and Narayandas, 2017]. There are many other cheaper, and more effective, substitutes available for those purposes in the times of podcasts, digital rendez-vous sessions and impromptu thematic conferences.

Because of the paramount importance of skill development in executive education, we have previously identified the key skills (Figure 4.1) that executives and organizations seek [Moldoveanu and Narayandas, 2017]. Our map covers the technical and cognitive skills associated with functional expertise as well as the relational, affective, perceptual, and X-factor skills affiliated with leadership. The map reinforces the two gaps we had earlier identified: The skills gap, which is the difference between the skills that organizations need from their executives and the skills that education-providers develop, and the skills transfer gap, which relates to the low probability that a skill acquired in the classroom will be used in the workplace. Interestingly, while companies monitor skill transfer, most education-providers do not. The latter only track participants' satisfaction with their programs, a process that sometimes includes self-reported measures of skill acquisition. That disconnect has led to a divergence between the programs that

companies need and those that education-providers develop. Moreover, education-providers tend to believe they have succeeded if participants have acquired any skills from programs while companies believe that programs have failed if executives don't use all the new skills they're supposed to have acquired in their work.
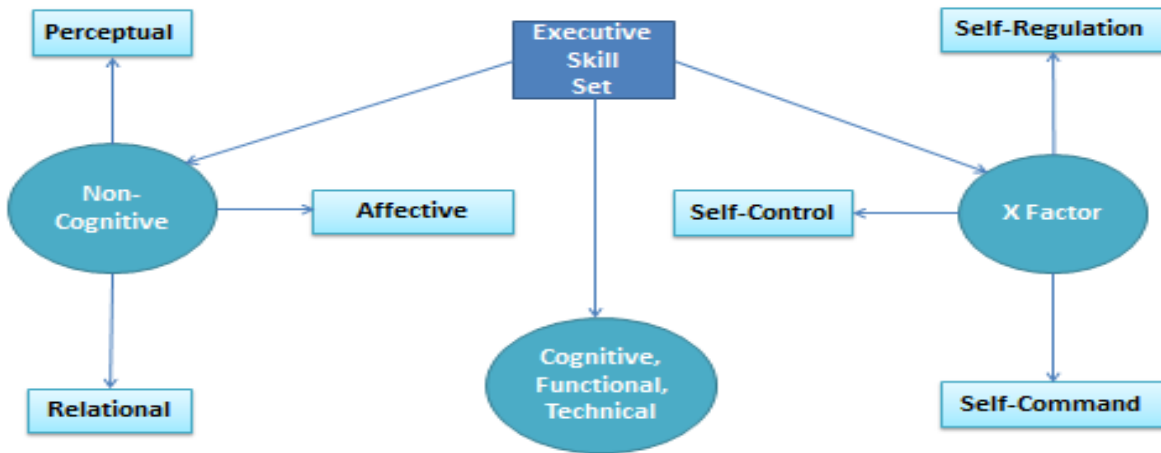

Figure 4.1. The Executive's Skill Sets: Skill Families that Organizations Seek

Two Ways of Bridging the Skills Gaps

To bridge the skills gap and the skills transfer gap, most executive education providers need to change their strategies. One approach that education-providers can take is to develop programs that build skills in the same context in which they will be applied; that is, to develop skills within the organization, inside each function, in each team. For this to happen, teaching must be based on the projects, problems, and predicaments an organization currently faces. The practice of new skills must also take place in the same context – the organization, the function, and the teamin which they will be used. This way, participants will face the same constraints that everyone in their organization faces when trying to develop new skills. Moreover, the evaluation of programs and participants' skill sets must incorporate the values and learning objectives of the client company rather than those of the education provider. The growing popularity of this approach is evident from the rise in the number of corporate universities; the increase in the number of

programs that deliver online content to on-the-job learners; and the large number of custom programs that management consultancies and business schools now offer.

The other approach is for education-providers to develop programs that use teaching pedagogies that have been designed to transfer skills to any context - across companies, industries, and countries. Those pedagogies must take into consideration the need for contextualized and socialized learning; allow customized feedback to each participant; and alternate the learning of abstract principles with their concrete application. That will maximize the chances that participants learns how to apply a skill even as he or she learns about it. An on-campus program will then become a learning laboratory in which traditional teachers and instructors may have to give way to learning facilitators. The latter will help participants learn how to learn, so to say, so that executives understand both how to acquire new skills and how to apply them to specific contexts.

Whichever be the path that an education-provider takes, one implication is clear. As more programs are developed, better information about education-providers becomes available at a lower cost, and customers can attain their learning objectives more precisely, the middle of the market will hollow out. The demand for education programs that neither teach skills acquisition in context nor facilitate the transfer of skills across contexts – for instance, the B-schools' open enrolment programs and business-related massive open online courses (MOOCs) – will fall. As companies become adept at figuring out how to learn new skills, they will also devise ways of calculating the Learning ROIs (LROIs) of educational experiences. That will result in the demise of programs with low returns unless education-providers figure out how to develop new offerings or adapt existing ones.

Mapping the Sources of Value in Education Programs

In our earlier papers, we traced the specific sources of value in executive education to the participants (executives) and the payers (organizations), respectively, and highlighted the tensions and synergies between what participants seek and what payers require [*Moldoveanu and*

Narayandas, 2017 1,2,].   Then, we showed how the digitally induced disaggregation, disintermediation, and decoupling of the sources of value allow organizations and individuals to pay only for what they most value. In addition, digitalization is enabling organizations and executives to choose among modules, workshops, and classes at higher levels of granularity than before to create *a la carte* learning experiences. The ability to see - online - what is likely to happen inside classrooms; to experience the delivery of teachers, especially 'star instructors', before paying to enroll executives in their classes; and to collect detailed information about modules' learning outcomes - is allowing CLOs as well as executives to choose and pay for, only the learning experiences they deem useful. Digitalization, compounded by today's virtual, uncertain, complex, and ambiguous environment, is increasing the pressure on companies to optimize the allocation of resources to leadership development. 'Web 2.0' has thus become the dis-aggregator of executive education programs. It enables the greater optimization of educational programs than was possible even 10 years ago, when executive education programs were clothed in opacity. Due to the Web 2.0 ecosystem of ubiquitous communication and distributed inexpensive computation that enables interactive and socialized forms of learning, the opacity has been eliminated and the mystique of the 'exec ed classroom' is gone. That leaves learning, or skills development, as the determinant of the value of an education program.

Mapping Education Programs Suppliers and Their Offerings

We mapped the major suppliers of executive development – from business schools and universities, through general and specialized consultancies, corporate universities, and other learning organizations, to the emerging personal learning cloud – with respect to their core offerings in our initial papers. That enabled us to show how education programs differ in terms of their advantages and downsides, and, given participants' and organizations' objectives, helped identify the challenges and opportunities that education-providers face today (Figure 4.2).
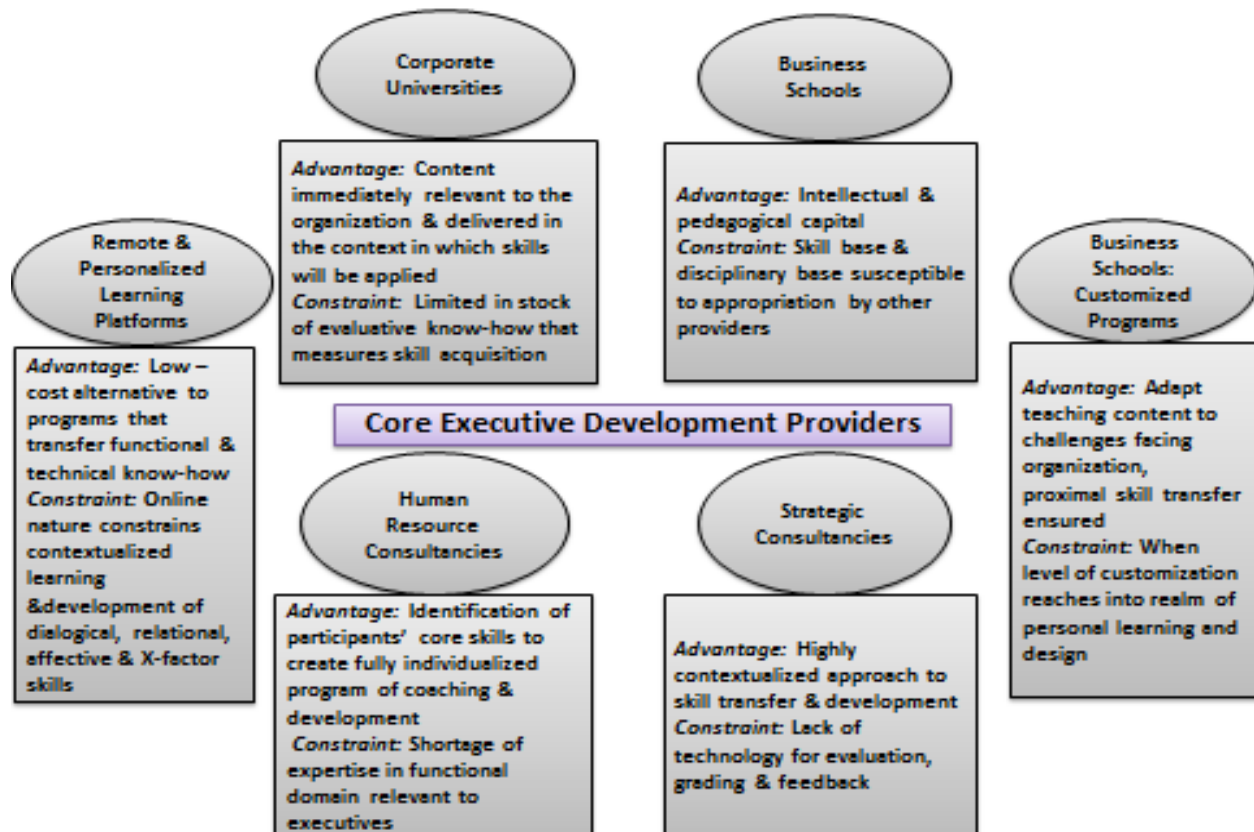
Figure 4.2. Comparative Advantages and Constraints of Executive Development Providers

Universities are being displaced as monopolists over the canons of teaching, learning, and evaluation as well as intermediators and aggregators of the skills of their faculty members. They are being challenged by consultancies, online education companies, and corporate universities, all of which are adapting teaching to the environment. Human Resource (HR) development firms, for instance, are using their human capital evaluation and development knowhow to tailor more effective programs on-site, on-project, and within teams, utilizing the large base of online courses and modules as a starting point. In addition, Web-based learning platforms that aggregate the content of universities' best faculty members pose a rising threat to traditional education-providers.

As the focus of executive education is moving from mere skill acquisition to skill transfer - as reflected by the growing number of corporate universities - skills development is brought in-house, inside organizational projects, to the teams that need them most, at the time at which they need

them. In fact, the steady decline in the B-schools' open enrolment programs signals they are being supplanted by the 'personal learning cloud' - the fabric of on-demand, cohort- and certificate-based learning courses that have become available for cultivating skills in executives [*Moldoveanu and Narayandas, 2017; Narayandas and Moldoveanu, 2017*].

The CLO's Compass

The greater visibility offered by online platforms and courses, the rising competition among course-providers, and the comprehensive feedback from participants all point to the need for more transparent treatment of educational offerings. That's why we unpacked the basic elements of executive education programs such as the core learning vehicles and experiences including lecture-based classes, case discussions, simulations, live projects, team and individual coaching sessions, and master classes (Figure 4.3). We analyzed each component with respect to its skill-acquisition and skill-transfer properties.
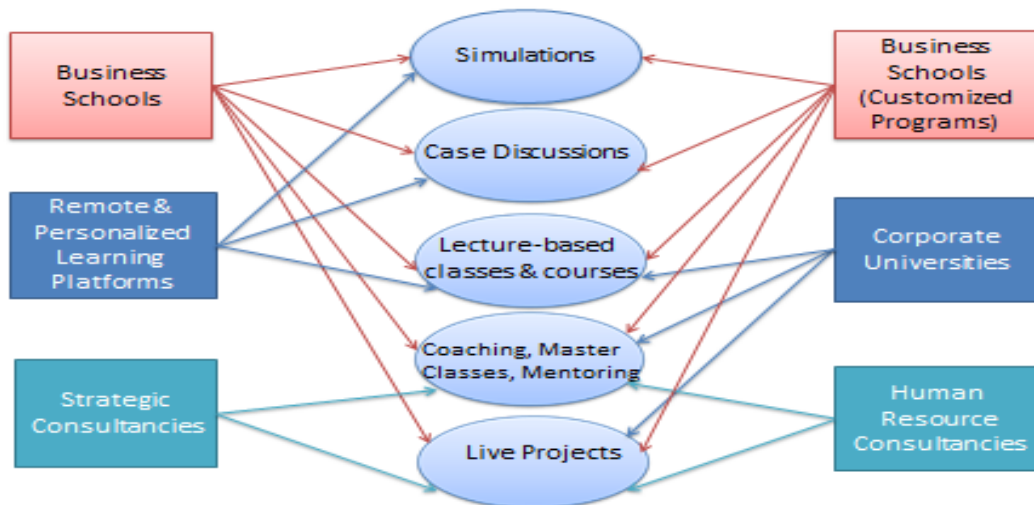
Figure 4.3. Executive Development Unpacked: Core Experiences and Vehicles by which Executive Learning Happens

The increase in the transparency of executive education programs enables both CLOs and participants to optimize priorities and budgets. They can do so across all the providers and programs in the market as well as the different ways in which skill sets can be developed. Because data on the available options are more granular today than they were even 10 years ago, it's possible for CLOs to take a mix-and-match approach to designing executive education programs. They can bring together the best of both academic-created and practitioner-developed content, and yoke them together to develop the skill sets and capabilities that their organizations need. Companies' talent-development functions can focus on the key differences between programs to make their choices. They can ask: How much better at skill development and skill transfer than the personal learning cloud is an in-person-delivered learning experience? How should the personalized learning fabric of the learning cloud be augmented to maximize the organization's development needs? The CLO's Compass (Figure 4.4) is an organized battery of critical questions they need to answer before investing in the creation of executive development programs.

THE CLO'S COMPASS

1. WHAT ARE THE SPECIFIC SKILLS YOU NEED DEVELOPED?
HOW ARE THEY RELATED TO THE OVERALL OBJECTIVE AND PERFORMANCE OF YOUR ORGANIZATION?
WHICH PROVIDERS ARE OFERING TO DEVELOP THEM ?

3. ARE THESE SKILLS LEARNABLE? ARE THEY TEACHABLE?
CAN THEY BE LEARNED:
DURING THE LENGTH OF TIME OF ANY OF THE PROGRAMS OFFERED BY THE PROVIDER?
USING THE METHODS OF TEACHING AND LEARNING OFFERED BY THE PROVIDER?

SPECIFICATION

ACQUISITION

2. HOW DO YOU MEASURE THE PRESENCE OF THESE SKILLS IN A MANAGER OR EXECUTIVE?
DO THE LEARNING OUTCOME MEASURES OFFERED BY THE SUPPLIER MATCH YOUR OWN MEASUREMENT METHODS?

SKILLS

4. HOW DO YOU MEASURE THE DEGREE TO WHICH A LEARNER HAS ACQUIRED THESE SKILLS?
HOW DO *THIS* PROVIDERS'S OWN MEASURES OF LEARNING OBJECTIVES COMPARE WITH YOUR MEASURES OF SKILLS ACQUIRED?

TRANSFER

5. HOW DO YOU MEASURE THE TRANSFER OF THESE SKILLS TO YOUR WORKPLACE?
WHAT EVIDENCE DOES THE PROVIDER GIVE OF TRANSFER AND APPLICATION OF PROMISED SKILLS INTO THE SETTING OF THE ORGANIZATION?

Figure 4.4. The Chief Learning Officer's Compass

To develop skills that will be useful, corporations have to specify them clearly. If a Chief Learning Officer cannot define the skills his or her executives need, it will not matter which provider or program he or she turns to. All of them supply pleasant experiences that provide participants with conversational capital which makes them appear knowledgeable in professional and social settings. However, just as understanding machine learning is more than learning how to rattle off a few terms and names, learning and using a skill is much more than knowing a topic. In order to specify the skills their companies need, CLOs must look under the hood of offerings for the skills they teach -- be the topics classic ones, such as leadership, financial analysis, and project management, or new, such as Blockchain technology, machine learning, and scrum development practices.

It is not enough for CLOs to ask: What new terms will our executives learn by participating in the program? And who will they get to know? The question CLOs must rather ask is: What will our executives be able to do better, or differently, as a result of participating in this program? But neither CLOs nor education-providers are currently used to asking or answering pointed questions about skills acquisition and application.

The implications of doing so are profound. By way of illustration, if the skill that an organization desires in its executives is the ability to allocate responsibility in product management teams to maximize their effectiveness, it could arguably find courses in several different subject and disciplines -- from organizational economics, marketing, and R&D management to production optimization, strategic planning, and problem solving – that can deliver results. However, if the objective is to create in managers the ability to engage in an educated dialogue about the applications of deep learning to create collaborative projects, the company could either mix segments of programs offered by business schools and computer science departments, or identify education-providers that have created programs specifically designed to develop that skill set. Searching by skill, not by topic, is an imperative that CLOs can no longer afford to ignore.

Articulating the benefits of a skill goes hand-in-hand with specifying it. Thinking of an executive as a bundle of skills, rather than as a repository of domain-specific knowledge with certain traits, proclivities, and habits, will allow CLOs to map the use of skills in the organization's problem-solving processes. It presses the CLO to specify the marginal value that the organization places in dialogical and collaboration skills, for instance, as opposed to technical and design skills, and to identify the organization's willingness to pay for developing certain skill sets. Metrics must anchor an effective skill-specification exercise. The CLO must ask: How do we know if we possess, or don't possess, those skills and capabilities? Most educational measurement systems are designed to ascertain the know-what; that is, executives' ability to recall cognitive structures, which can be measured via tests and exams. But the measurement of skills, especially those with a non-cognitive component and X-factor skills, requires new methods of measurement that CLOs will have to specify [*Moldoveanu and Narayandas, 2017*].

The other end of the compass' needle helps CLOs become more precise about the ways in which a program will help participants acquire the skills that the organization deems are important. The key issues are: Are those skills teachable? Are they teachable by standard methods such as lectures, discussions, quizzes, and exams? Are they learnable though guided practice and feedback even if they are not teachable by standard methods? Importantly, skill acquisition measures must help CLOs distinguish between programs that have, and haven't, enabled skill acquisition. Pre- and post-program skill-measurements must be conducted. That is, CLOs should measure skill development in participants not only before every program, but also, after they return after completing them. They must figure out: What has changed? How has it changed? Is there evidence of the application of the skill after attending the program? Is there data suggesting that individual skills have turned into group- and organizational capabilities?

Compasses are meant to orient actions and guide choices and the CLO's Compass is no exception. It isn't meant to lead to companies to choose one program over another or one executive over another for leadership development, but to guide attention to the questions most worth asking -- and the measures most worth heeding -- when making choices. It will help CLOs make informed

decisions in a crowded marketplace in which education-providers often obscure the value of the complex experiences they provide.

The Executive Education Program Developer's Guide

Education-providers that want to cope with the disruption in the executive education industry must re-think what it means to skill up executives, and organizations, from first principles. That means understanding what an executive development program is all about at its core. To help do so, we decomposed an executive education program into two different components, the *context* of learning - and its content.

Context – the cultural, geographic, and organizational factors that shape learning outcomes – is critical to address the skills transfer gap [*Moldoveanu and Narayandas, 2018a*]. At the same time, because knowledge engines, learning management engines, and personalized learning platforms have made information, data, and facts free to users, the content of learning – the combination of know-how and know-what that together comprise the substance of any program – must also be re-considered today. Education-providers that hope to persuade companies and executives to leave their work and families for long periods to attend on-campus programs must design learning experiences that justify the large investments in terms of time and money. The programs must be fundamentally different, and more valuable than experiences that can be remotely replicated such as lectures and exams.

A compass for executive education-providers consists of a set of questions whose answers provide the foundations of a strategy for developing a program:

Context-related questions relate to the times and places of interactions among learners; their interactions with facilitators; the relationship between the program content and the participants' skills and predispositions; and their work experience. Among the key questions: How is the program's context designed to maximize skill acquisition? How is the content designed to maximize the transfer of skills to work contexts? To what other contexts can these skills be transferred?

Content-related questions relate to the thematic and topical subject matter presented and discussed in a program including case studies, notes, visual materials, and online materials. Among the issues: What are the skills the content is designed to cultivate? How does the content help cultivate those skills? How is the content designed to maximize skill acquisition by participants? How does it maximize skill transfer to work contexts?
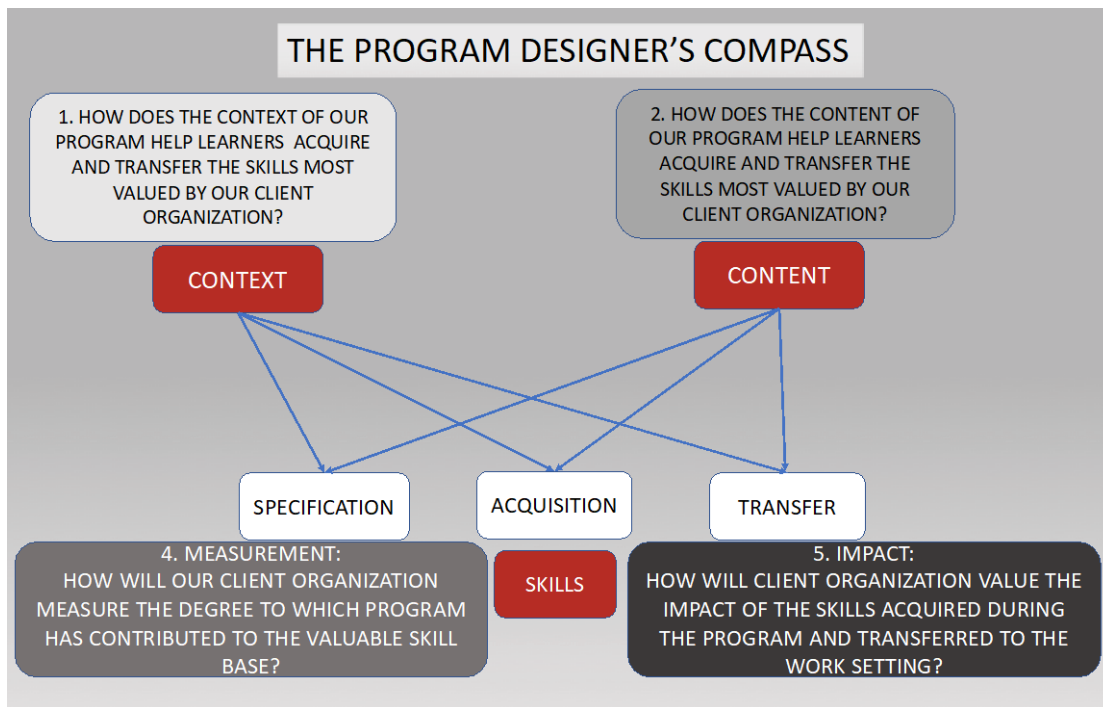

Figure 4.5. The Executive Development Program Designer's Guide.

No program designer can afford to ignore the critical questions in the minds of his or her clients such as: What are the specific skills that the program seeks to develop in participants? How do participants acquire those skills during the program? How are those skills measured by organizations? How is their acquisition measured by the program? Accordingly, the Program Designer's Compass makes explicit the ways by which participants acquire skills, and the mechanisms by which their transfer to the workplace is maximized. The compass reorients program-designers by pointing them to the most fruitful directions for program re-design.

Few education-providers fully understand the kinds of skills that companies need or the best ways of developing them, we find. It's time therefore to redesign the feedback loops that inform

executive program design. Feedback is essential to learning and adaptation, as demonstrated by research in organizational design [*Sterman, 2002*] as well as learning and teaching science [*Moldoveanu and Djikic, 2017*]. However, feedback in executive development is currently limited to evaluations of instructors by participants, which often degenerate into popularity contests, and the development of indices that relate to feeling good and being treated well. That needs to change urgently.

The time has come to re-design the feedback that must inform executive program design. Feedback is essential to learning and adaptation, as repeatedly demonstrated by research in organizational design and dynamics [Sterman, 2002], learning and teaching science [Moldoveanu and Djikic, 2017]. That has also been confirmed by the rapid advances in machine learning and deep learning algorithms that make proficient and efficient use of feedback, from training data sets, to create intelligent agents from large sets of sparsely connected and individually 'dumb' entities [McKay, 1993; Haykin, 2014].

Yet, feedback practices in executive leadership programs are limited to instructor evaluations by participants. Those often degenerate into popularity contests and indices of "feeling good" and "being treated well." Repeat visits to a business school by companies' HR executives, who have little insight into the extent to which the skills programs claim to develop are being applied, are likely to signal the "convenience of doing business" with education—providers. The metrics used will likely include calls returned, emails answered, the quality of the food, and the quality of billing and logistical services.

However, that is not the kind of feedback that will produce meaningful change. What will result in transformation is precise, personalized, textured, timely, and actionable feedback that takes place along six loops (Figure 4.8). They are:

1. Feedback from the participant to the instructor regarding the effectiveness of the methods, experiences, tools, and techniques s/he uses to facilitate the achievement of the executive's learning goals (F1).

2. Feedback from the instructor to the participant about the latter's progress along the trajectory that brings the participant closer to his/her skill development objectives (F2)

3. Feedback from the participant to the program as a whole regarding the degree to which the design of the program – including instructor selection, sequencing of learning activities, learning practices, content, context, and experience -- brings the participant closer to his/her skill development objectives [F3].

4. Feedback from the client organization to the education provider regarding the degree to which the program has brought about the development of executive skills and organizational capabilities that are relevant and valuable to the organization [F4].

5. Feedback from the education-provider to the client organization regarding the most reliable ways in which the organization's skill and capability development needs can be met and its stock of skills and capabilities can be measured [F5].

6. Feedback from the education-provider to the instructor – based partly on feedback from the client organization and the executive learner – on the degree to which the instructor's pedagogical design and presence furthers the learner's skill development goals and the organization's capability development needs.
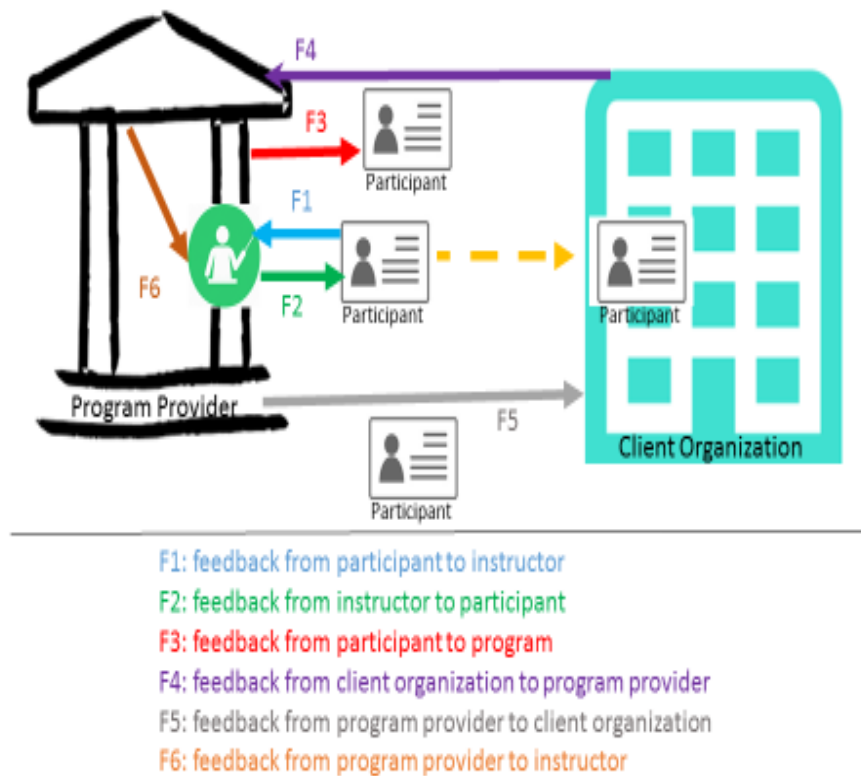
F1: feedback from participant to instructor
F2: feedback from instructor to participant
F3: feedback from participant to program
F4: feedback from client organization to program provider
F5: feedback from program provider to client organization
F6: feedback from program provider to instructor

Figure 4.8. The Feedback Loops that Should Guide Executive Education Program Design

Web 2.0's informational ecosystem makes the acquisition and tracking of feedback along these loops so simple that the obstacles to doing so can only be organizational or institutional. Given the degree to which continuous, distributed, parallel, multi-user feedback systems have disrupted most industries outside education and health care, the latter would do well to create new feedback loops before it is too late.

A Roadmap for the Future

Using the compasses and redesigning the feedback loops is essential to create education programs that will fill the skills-related gaps. However, even those tools won't help education-providers figure out how to redesign their offerings so that they become more useful to corporations. Both of us, the authors, have led the creation of executive development programs at large B-schools

over the past decade, and personally grappled with the problems of re-engineering offerings so they become skills-centered. What happened when our compasses guided program-designers to direct their attention to the contexts and content that leadership development programs offer?

Solving the Skills Transfer Problem

Solving the skills transfer problem drives many education-providers -- new entrants ensconced in the worlds of client organizations, such as the strategy consultancies, as well as incumbents such as the business schools, which are equipped with a large body of teaching, facilitation, and measurement materials -- to bring learning inside organizations, where skill acquisition and skill application can be co-located. All the literature on skill acquisition and skill transfer [*Moldoveanu and Narayandas, 2017a*] shows that learning takes place most effectively when there is a tight acquisition-application loop. That is, when the executive applies what s/he has learned immediately in the context in which the skill is meant to be used.

Executives have more of an incentive to learn a new skill when they need to solve a concrete problem than when tackling a problem designed solely to test their theoretical mastery of the skill. They are also more likely to apply a skill when the language system and the social environment in which they have learnt it are the same as that in which they must apply it. The organizational uses of language, the specific ways in which words glom onto events and objectives, and how words parse out domains of relevance in the context of meetings are all different in companies from the ways in which the same phenomena play out in classrooms among learners unfamiliar with each other's ways of communicating.

A skills-in-context approach to re-designing executive education programs will have several components:

  Contextualizing Content. Content is becoming ubiquitously accessible through the personal learning cloud comprising courses, modules, and interaction platforms that can be turned into programs, courses, or mini courses that may be offered in open, semi-open, and closed environments. As a result, the ability of education-providers to tailor content to the specific and

timely needs of every organization will increase to the point where the latter can address companies' skill-related needs on the job in real time.

The standard fare of MBA, Executive MBA, and open enrolment executive education programs will be broken up into short and targeted education programs that promise rapid skilling for tasks that are relevant at that point in time to the executive in his or her work. That's the approach several online learning platforms -- such as LinkedIn Learning, Coursera for Enterprise, and Skillsoft -- have taken. The skill transfer gap between content and context will narrow; participants will only engage with the content designed to meet task specific and organizationally relevant needs. Both virtual and local experts will be available to help participants contextualize their learning to the organization's task base and culture. Interestingly, the certification power of the business schools' programs will be supplanted by "digital badges" that can be stored on online ledgers or blockchains. They will amplify the power of virtual badges to certify skills in professional circles.

Imagine you're an executive education program developer who wants to offer a short skilling program on viral marketing. Earlier, you would have been forced to design, staff, and market an on-campus program consisting of modules of various durations and intensity. The course may not have been up to date because it could only be staffed by your institution's faculty members and instructors. Now, the personal learning cloud will allow you to curate the best online content – be it lectures, demonstrations, or exercises -- in ways that are tailored to the specific needs of the client in terms of its industry, products, technologies, and size.

Whereas your earlier offerings would have been constrained by the blocks of time and space that an on-campus offering demands, the new cloud-based offering will not be fettered by those parameters. Most of the learning can be self-paced, and most interactions will be asynchronous except for those that will undoubtedly benefit from the presence of both facilitators and participants. Testing participants before and after the program will help the company ascertain the extent to which the program has met its learning objectives. And tests of the group's capabilities

will evaluate the extent to which individual skills have turned into team- or group-level capabilities.

Context on Demand. The ability to electronically segment learners into working groups and cohorts allows the adaptive tailoring of the context of learning to organizational needs. A learning group can be so created that its members come from the same team, department, function, discipline, division, organization, and industry, or from many different ones. Adaptive cohorting -- a standard feature of today's learning management systems -- allows for the segmentation of participants into the optimal learning groups for a particular skill set. Coupling that with project-oriented interventions, which help participants apply in real time the skills they're acquiring, will allow the organization to accurately tailor the context of skill-development to its capability-development needs.

By way of illustration, assume you're developing a program that will increase collaboration and teamwork among several teams in an organization. Until recently, you would have had to develop an on-campus program to which the client may not have been able to send all the teams and groups that can benefit from it. Since interactions with the participants and the organization would have been constrained by technology, the upshot would, most likely, have been a quick-and-dirty residential program that would not have produced lasting results. Of course, neither you nor the client would realize that because the program's customer satisfaction ratings, based on feedback from the participants who enjoyed the experience and the time away from work, would have been high. By contrast, the next program you design will be able to combine technology and pedagogy to get every participant to change the behavior patterns that impede the teams' workflows. Because of adaptive cohorting and online teaching, you will be able to get executives from every team to participate in the discussions and interactions, which will help uncover the key issues that impede cross-team collaboration.

It is, thus, possible for education-providers to tailor the context of interactions so that they speak to the challenge at hand. With the latest polling technologies allowing companies to capture

feedback from each executive, they will be able to objectively evaluate education-providers' claims about their programs' ability to increase collaboration within the organization.

From Know-What to Know-How as Content

It's important to understand that data and information can no longer be the rationale for executives attending leadership development programs or for their organizations to support them in doing so. Facts change as a function of time, geography, and social context. Even academics can no longer claim epistemic privileges or a special status in presenting the most up-to-date, relevant, or accurate information. Moreover, all the information that is currently used in education is expected to remain free to users. Executive development programs cannot base their value propositions on providing participants with topical or disciplinary knowledge, or specialized information about their areas of interest. The renewed focus on developing skills, rather than topical information, suggests that most education-providers have to make a steep climb from the know-what to the know-how.

From Information & Facts to Models & Theories

Due to the Web, the user is always just one click away from the facts. In fact, the marginal value of pure information to any executive is zero. Unlike skills, facts and data are not transferrable; they relate to what has been. Their widespread availability ensures that education-providers can no longer persuade anyone that the information they provide is valuable. In fact, the benefits of imparting facts are doubtful when smart devices serve as ersatz memories. Even the argument that learning lots of Latin words helps develop the declarative memory, which is required to retain other useful information, is steadily losing ground.

However, the models and theories used to make sense of data to generate explanations, justifications, extrapolations, and predictions are portable from learning vehicles. According to experts, the world currently produces around five exabytes of data every two days - the equivalent of all the information produced by humankind until 2003. All that data needs to be compressed so that as to be potentially useful, and that is what models and theories do. They are the equivalent

of the MPEG-4 coders in a set top box, compressing facts into patterns rather than pixel arrays into bits.

Many executive education programs operate under the assumption that all models and theories are learnable, useful, and transferrable. That may be a stretch. To be useful, models and theories need to be grounded in executives' ways of thinking and speaking, in the purposes and predicaments of the participant and the organization, and in the code bases and data bases on which they work… In other words, the skill that corresponds to the predictive or explanatory use of models and theories needs to be contextualized for it to be transferable.

Students must study models or theories applied to several predicaments to develop the confidence and skill to use them in their own situations. Moreover, the rapid development of data-based modeling tools -- from computational knowledge engines such as Wolfram Alpha to deep learning platforms such as H2O and CaffeAI – that allow the user to build and test models suggests that it's time to reconsider the real sources of learning in executive programs. That's why, as we pointed out earlier, education-providers must learn to develop programs that build skills in the context in which they will be applied.

From Models & Metaphors to Special Languages & Mental Habits

Academics, teachers, and instructors help executives tackle managerial challenges not only by teaching them models and theories, but also the special languages, questioning techniques, and reasoning patterns they have developed. Valid theories and models come and go; in business, their lives are no more than twice the one-year half-life of data. However, the half-life of the special languages and logic systems that allow academics to pose meaningful questions, formulate hypotheses, specify experiments, and fashion equipment to carry them out often extends for decades.

The language systems of neoclassical economics, network science, and system dynamics, for instance, are long-lived, learnable, and teachable as languages. They are universal enough to be

applicable to a wide range of phenomena and predicaments -- the hallmarks of transferability. Pursuing them requires a shift from content to context and process as the drivers of skill acquisition. Strategies for inquiry, argumentation, explanation, justification, and synthesis – the cognitive analytical skills that are likely to move the needle in the development of a complexity-coping capability – must be developed across a variety of examples, situations, contexts, and managerial predicaments, and not in one functionally-oriented class, module, or course.

Content is a pretext for helping a learner develop a skill; it's part of the context, not the entire context, though. The reliable acquisition of transferrable skills depends on the degree to which the skill is practiced on different pieces of content in many contexts rather than the extent to which it is drilled into the participant in the context anchored in a piece of content.

From Models & Methods to Patterns & Functions of Thinking

The development of functional skills, traditionally associated with executive education programs, has given way to the development of cognitive skills that are abstract and also applicable in contexts that transcend a business function or academic discipline, such as critical thinking, systems thinking, design thinking, integrative thinking, complexity thinking et al. Program-developers, who have traditionally been guided by functional skills, will find it tough to articulate outcomes at a higher level of abstraction than that of the disciplinary models and methods we have discussed earlier.

The challenge arises partly because of the heterogeneous and amorphous nature of cognitive expertise in business. Note, for example, the complexity competence that many CEOs in Fortune 1000 companies wish they could tap [IBM, 2013]. It's also related to the greater transferability of cognitive skills that operate at a more abstract level. Learning a computer language with a high level of abstraction such as LISP or Python will ensure that the software you develop will be applicable to more contexts, problems, and environments than one based on Java or HTML. Similarly, learning the basic modes of thinking – such as deductive, abductive, and inductive – and modeling - relational, structural, causal, and functional - will help develop cognitive skills

with broader applicability than learning the models used to capture specific phenomena that occur in institutional, economic, and cultural settings (Figure 4.6). Executive program designers would be well advised to map the skills-acquisition and skills-transfer promises of their offerings at a higher level of abstraction, and with greater precision, than they do at present.

In order to catalyze the process, we've developed a list of the patterns of thinking that will be useful for designers of executive development programs who want to design skills-based curricula from scratch. It starts from the recognition that we are makers of representations, such as models and pictures, as well as inferences, analyzing perceptions by making distinctions and synthesizing representations by making connections. A program-designer can break up any piece of content into components that will inculcate certain kinds of mental behavior in participants, and s/he can optimize the curriculum design to help participants acquire specific cognitive skills (**see Appendix 1**). Describing patterns of thinking may not be enough if we are to develop a picture of the modes of thinking that will be useful across purposes and contexts. Because thinking has multiple uses and contexts, understanding all the purposes to which it can be deployed – in the form of distinctions and the resulting categories – will add precision to the toolkit we are building (**see Appendix 2**).
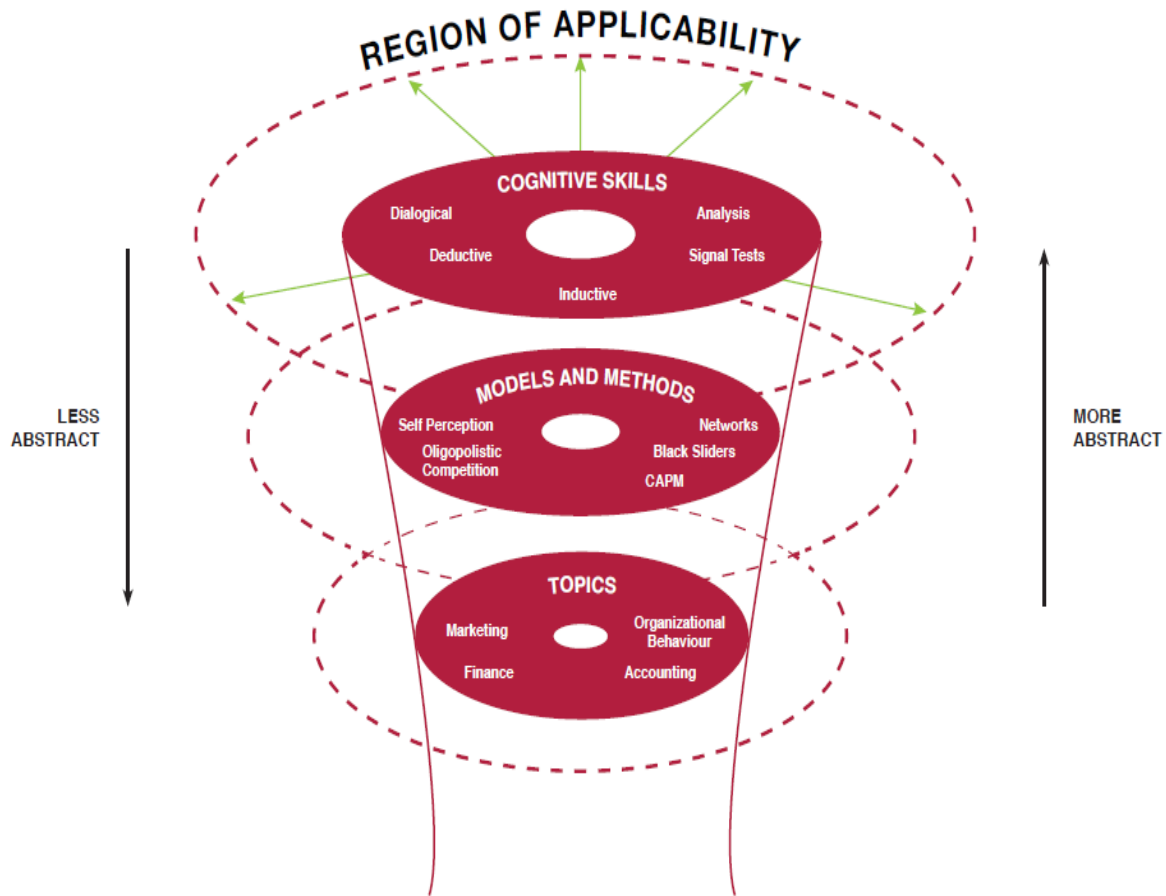
Figure 4.6. As leadership development conceptualizes cognitive skills at greater levels of abstraction, the applicability of the skills that program developers seek to cultivate in participants widens.

From Models & Theories to Ontologies & Ways of Being

The models academics develop are useful to executives only as stylized facts and things to know rather than as skills they can apply. The models are subject to the merciless devaluation that the learning cloud brings to all information. As Karl Marx pointed out, the philosophers have so far just interpreted the world; the point, though, is to change it. Unlike most philosophers, executives are makers of organizations, markets, products, relationships, and transactions. They are not

explainers, describers, or justifiers; the critical skill they seek is not representational or explanatory, but one that is dialogical and performative in nature.

Executive development programs that aim for the far transfer of skills must invest in developing participants' skills in acting on the language systems developed in classrooms or coaching settings, across a variety of contexts. That's how they can maximize the extent to which participants can enact the new language they've learnt in their own contexts. For instance, executives need not only to be able to talk about the agency costs of alternative contractual employment arrangements or the firm's capital structure, but also to act as principals in a principal-agent nexus of relationships. They need to apportion decision rights by hiring and firing people or changing their organizational roles; decide the compensation packages and performance metrics that will determine variable compensation levels and likelihood of promotion; and design the financial structure of a business in order to mitigate the adverse incentives created by debt and equity issues.

Future offerings must chart the specific paths by which education-providers will develop transferable skills in participants. With that in mind, let us study the re-design of learning vehicles that cultivate skills that can transferred to work settings, utilizing what we know from the science of learning. The question of skill transfer is relevant for those designing both on the job and off-site executive development programs because, in both cases, the objective is to turn the acquired skills into useful skills.

Re-designing Executive Development by Turning Learning Science into Pedagogical Practice

Even as lectures and lecture-based presentations are replaced by high-production-value online content and a host of learning-as-an-app offerings, traditional methods of teaching-for-learning, such as case discussions and business simulations, must be re-designed with a view to maximizing the distance of skill transfer they produce. Re-thinking' executive programs cannot stop at just asking questions. The process of designing new offerings aims to build specific paths by which useful and transferable executive-level skills can be developed in participants.

Keeping that in mind, we will consider next the re-design of learning vehicles cultivating skills for maximal transferability to the work setting, embodying what we know to date in the science of optimal learning. The question of skill transfer is as relevant for on-the-job programs as they are for offsite executive development programs; in both cases, the objective is to turn acquired skills into useable and useful skills. The question is pressing for traditional developers of executive programs on campuses and in other environments that are far away from the geographic, functional, social, and technical contexts in which executives must use these skills.

The Science of Skill Transfer

The extent to which executives apply the skills they learn, in the settings for which they are intended to be used, is not as much as is commonly assumed. In fact, skill transfer is rare and improbable [*Moldoveanu and Narayandas, 2017*]. We have used several measures of distance -- time, space, social, and functional context, for instance -- to show that the farther away the place where an executive applies the skill is from the place where s/he learnt it, the lower the probability that the skill will transfer.

These findings explain the shifts to on-the-job learning by corporate universities; to online classes run specially for cohorts within an organization; and to development programs run by management consultancies in conjunction with their solutions and services practices. It also sheds light on the growth of online warehouses of skill-development, such as Skillsoft, and the steady decline in attendance in the open enrolment executive education courses offered by universities and business schools.

Evidence from learning science speaks, importantly, to the teaching practices that are likely to lead to skill transfer. High-level skills, such as critical reasoning and problem framing, are the most likely candidates for programs that seek to achieve skill transfer. That's because they can apply to many different situations and predicaments; by definition, they are the skills with the longest half-life and the farthest reach. A review of the literature on the transfer of high-level skills

[Billing, 2007] reveals that even though skill transfer is rare and challenging, programs that are most successful at doing so have a number of common features:

#Such programs teach general principles and concepts alongside applications. The successful transfer of skills is aided by methods that specify general principles, methods, and concepts – abstract entities that can be exported to other settings.

They use a large number of examples for each abstract entity. Skill transfer is facilitated by methods that use large sets of examples that come from different scenarios and case studies. That highlights their exportability and applicability.

They vary the context of application of abstract terms. A variety of content and a variety of functional, social, and technical contexts of application help to increase the transferability of skills.

They employ highly socialized forms of learning by which we mean discussions, interactive presentations, and simulations. That helps to increase the transferability of the acquired skill by making concepts, constructs, models, and methods become part of the communicative fabric of the learning environment.

They provide intensive and immediate feedback. Intensive, frequent, and personalized feedback helps to facilitate the process by which the skill is acquired as well as the degree to which it will be transferred to other settings. It does that by creating a normative corpus, or an easily accessible memory of successful and unsuccessful uses of the skill.

They embody the process of skill transfer in the process of teaching the skill. Generally, skill transfer is facilitated by learning processes that emulate the process by which a skill is transferred to other cases, situations, and predicaments. Conceptual schemata, models, and methods are more easily transferred, for instance, when they are applied to examples that are generated by learners and independent sources -- as in project based learning -- than when they are learnt based on a canonical set of textbook examples of a schema or method.

Developing Transferrable Skills Through Case Discussions

Case discussions have been a staple of in-person executive education. Most readers are familiar with the format: Participants come to class having read a detailed account of a business predicament or situation that features one or more protagonists who are faced with making choices and decisions that will have an immediate impact on their businesses. The facilitator – guided by teaching notes and past practices – creates a communicative space in which the participants, working together, can reconstruct the relevant fact bases, take on the roles of the protagonists in proposing frames for the situations, options for action, and recommendations for the actions most worth pursuing. They debate different courses of action and arrive, through guided discussion and moderation of different or conflicting perspectives, at a reflective equilibrium regarding the executive predicament documented by the case.

At their best, case discussions are realistic and compelling simulations of executive dialogues, debates, and problem-solving sessions. Participants can rehearse the important processes of taking on roles that are relevant, but different from their usual ones -- higher-up or lower down on the hierarchical scale, functionally different, culturally different etc. – and advocate for a point of view in the face of conflict, ambiguity, and uncertainty. They can engage with sharp dissent from their classmates in real time, and develop an executive persona by trying out behaviors, such as different ways of expressing, arguing, and listening, outside their everyday repertoire.

At their worst, case discussions become competitions for airtime among participants vying for attention, validation, or extrinsic rewards such as grades in ways that undermine the communicative environment of the classroom. They also sometimes become opportunities for instructors to score conceptual points by using the facts of the case selectively to establish the validity of their favorite theories and models.

Besides, the classroom environment can be dulled by an inexperienced instructor following teaching notes and teaching plans mechanically, which could curtail or altogether eliminate

discussions that seem tangential to his or her conception of the case. The large variance in the quality of case discussions in business schools, in spite of all the work done to elucidate the pedagogic mission and agenda of case-based learning by academics such as HBS's David Garvin and Ronald Christensen, suggests that there is an facilitator-dependent factor that decides how well a case discussion goes.

Of course, how well a case discussion goes is currently measured by participants' evaluations of the experience. However, that is not a learning outcome measure, a skill acquisition measure, or a measure of the value of the experience to an executive's organization. That's surprising; after all, companies subsidize executive education by as much as 75% to 80%.

A facilitator could produce an environment in which participants feel they have had a good time, or personally and collectively validated by a socially unthreatening and emotionally smooth classroom discussion. They could even think they have mastered a skill set by virtue of having learned some new words and phrases, which may add to their conversational capital, but no new skill would have been developed in the participants or transferred to their organizations.

By contrast, the learning fabric enabled by Web 2.0 makes it possible for CLOs and their organizations to track education providers' claims of adding value to their organizations. They can track not only participants' attendance, satisfaction, and graduation, but also the degree to which they become more skilled as well as the extent to which the skills are transferred to the organization and congeal into capabilities. For CLOs, and organizations, to take advantage of the new capabilities that technology enables, they need a map of the transferrable skills that case study discussions aim to develop. If there is no map, there can be no measures, and when there are no measures, no measurements are possible.

Where do we start? The key to identifying transferrable skills is a mapping of case discussions at a high enough level of abstraction so we can talk, with precision, about what the case discussion

involved participants in doing without talking about what the discussion was specifically about. Learning key terms, buzzwords, acronyms, and synonyms cannot be the skill-building value added of case discussions, but what is?

If we think of case discussions that build transferrable skills as simulations of the environment of meetings -- that have different purposes such as due diligence, deliberation, final approval, or planning -- and constituencies -- product teams, service teams, sales teams, executive meetings, board meetings, annual general meetings -- that employ an identifiable set of genres for their organization (Figure 4.7), it is possible to see that case discussions can build the transferrable skill set of public reasoning in the forms and genres that are relevant to most business settings. They can do so even if the case discussions are about Reebok in 1984 or General Electric in 1950; that is, cases that don't feature contemporary predicaments or the latest buzzwords.
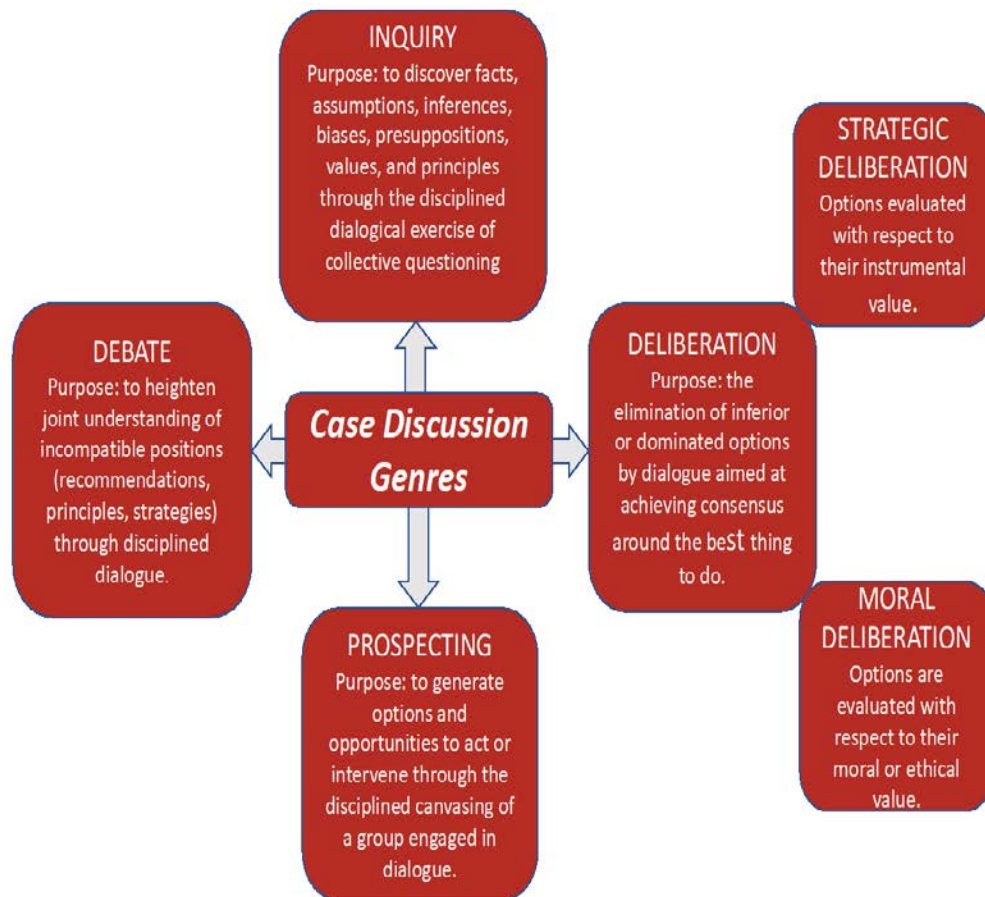
Figure 4.7. Case Discussions that Track the Genres of Business Communication

If case discussions are to become vehicles of skill development, whose skill acquisition and transfer capacity can be evaluated, it is important to map the genres of case discussions to the genres of business communications. As in the case of functionally relevant and generic cognitive skills, it is possible to identify the communicative and dialogical skills that case discussions can cultivate. They include:

Inquiry. Those modes involve the iterative probing of the facts of the case and the inferences that participants – and the case writer – make from experience using a series of direct, indirect, and follow-on questions. Facilitators may aim to develop both the skill of iterative and attuned questioning, and the skill of answering questions in informative ways. Questions and answers are not created equal; just as there are cognitive virtues that the development of cognitive skills aims to nurture, there are inquiry skills that case discussions can develop. The way in which questions seeking epistemic warrant (how do you know?) and relevance (so what?) are asked and answered as part of the discussion, so they admit follow-on questions, amounts to a dialogical skill (dialogical inquiry) that is transferrable to settings that have nothing to do with the subject of the case. The facilitator's skill in creating an environment that mimics the emotional landscape of a real discussion will shape the degree to which the skill is transferred to the social and functional settings of the participant's organization.

Prospecting, a special case of inquiry, is a genre of case discussion that aims to reconstruct an option or opportunity set for a protagonist or her organization. In addition to questions that seek to uncover facts, inferences, and the reasons for holding them to be valid, prospecting involves a series of counterfactual (what would X have to have done in order to be in a position to…?) and subjunctive (what would Y do were X to…?) questions that aim to uncover the conditional dynamics of executive action. Prospecting can be thought of as a set of dialogical skills -- asking relevant questions and answering them in ways that are responsive to the question, informative to

the questioner, and relevant to the group as a whole -- that can be transferred to discussions about other topics across a range of situations.

Deliberative genres of case discussions, be they strategic or moral, seek the iterative elimination of inferior options for possible actions. Questions are aimed at enumerating, evaluating, and comparing different options for executive or organizational action; at eliciting participants' beliefs about the likely costs and benefits of each option; and at reducing the number of options by eliminating the ones that are dominated by the others. Moral deliberation differs from strategic deliberation in that moral principles, rules, and virtues may be invoked to justify the costs and benefits of alternative courses of action, but it often retains the logic of enumeration, evaluation, and sequential .

Debating is a genre of case discussion that can be deployed in any of the others we have described. Given the tension among discussants, which a facilitator can establish through polling or the elicitation of dissenting views to a dominant view, the genre proceeds in bootstrapping fashion. It features iterative challenges and questions that each side -- or the facilitator speaking on behalf of each side -- raises regarding the opposing position as well as the answers and responses that aim to defend, refine, or renounce the position advocated for.

...

We have laid bare the building blocks and design heuristics for an executive education program that heeds the importance of jointly re-engineering context and content to maximize skill acquisition and transfer. It will deliver value in an economy in which skills – rather than subject matter knowledge and certification – will be the dominant source of value. It is appropriate then that we end with a challenge for our fellow program designers and educators: They should incorporate an awareness of their pedagogic purpose as learning facilitators and designers of learning vehicles into the new technological and social landscape of learning -- not avert their gaze from it.

References

(2016). The Human Capital Report. World Economic Forum.

Barnett, S. M., & Ceci, S. J. (2002). When and where do we apply what we learn?: A taxonomy for far transfer. Psychological bulletin, 128(4), 612-637.

Billing, D. (2007). Teaching for transfer of core/key skills in higher education: Cognitive skills. Higher education, 53(4), 483-516.

Bechara, A., & Damasio, A. R. (2005). The somatic marker hypothesis: A neural theory of economic decision. Games and economic behavior, 52(2), 336-372.

Craik, F. I., & Lockhart, R. S. (1972). Levels of processing: A framework for memory research. Journal of verbal learning and verbal behavior, 11(6), 671-684.

Fama, E. F., & Jensen, M. C. (1983). Separation of ownership and control. The journal of law and Economics, 26(2), 301-325.

Gentner, D., Loewenstein, J., & Thompson, L. (2003). Learning and transfer: A general role for analogical encoding. Journal of Educational Psychology, 95(2), 393-408.

Goodfellow, I., Bengio, Y., & Courville, A. (2016). Deep learning. MIT press.

Jensen, M.C. and W.H. Meckling (1992), Specific and General Knowledge and Organizational Structure, in Werin, L. and H. Wijkander, Contract Economics. Cambridge: Blackwell.

Matthews, D. (2017) The shape of things to come in higher education. Times Higher Education.

McKay, D.J. (1993), Information Theory, Inference and Learning Algorithms. Cambridge University Press.

Moldoveanu, M., & Leclerc, O. (2015). The Design of Insight: How to Solve Any Business Problem. Stanford: Stanford University Press.

Moldoveanu, M. & Narayandas, D. (2016a) The Skills Gap and the Near-Far

Problem in Executive Education and Leadership Development. Harvard Business School Working Paper 17-019.

Narayandas, N. and M.C. Moldoveanu (2016) Executive Education Enters the Digital Vortex. I. Disrupting the Demand Landscape. Harvard Business School Working Paper 17-020.

Moldoveanu, M.C. and N. Narayandas (2016b), Executive Education Enters the Digital Vortex. II. Disrupting the Supply Landscape. Harvard Business School Working Paper, forthcoming.

Moldoveanu, M., & Nohria, N. (2002). Master passions: Emotion, narrative, and the development of culture. Cambridge: MIT Press.

Moldoveanu, M. C., & Martin, R. L. (2010). Diaminds: Decoding the mental habits of successful thinkers. University of Toronto Press.

Moldoveanu, M. C., & Martin, R. L. (2008). The Future of the MBA: Designing the Thinker of the Future. Oxford University Press.

Nohria, N., & Eccles, R. G. (1992). Networks and organizations: Structure, form, and action. Boston: Harvard Business School Press.

Simon, H. A. (1973). The structure of ill structured problems. Artificial intelligence 4 (3-4) 181-201.

Sterman, J. (2000). Business Dynamics: systems thinking and modeling for a complex world. Boston: Irwin/McGraw Hill.

Wittgenstein, L. (1953). Philosophical investigations. Macmillan Publishing.

Appendix 1: Patterns of Thinking Executive Education Should Seek to Inculcate

Decomposing the patterns of thinking that should be inculcated by an executive education program will help program-designers create more effective education experiences. We've developed a list of the thinking patterns that designers of executive development programs can draw on to design a skill-based curriculum from scratch. It starts from the recognition (Figure 4.9) that humans are makers of representations (models and pictures) and inferences, analyzing their sense perceptions by making distinctions, and synthesizing new representations by making connections. The designer can break down any piece of content or experience into components that will develop specific kinds of mental behavior in participants, and s//he can optimize the curriculum design to help participants acquire specific cognitive skills. For executives, there are close to a dozen different types of thinking modes that matter:
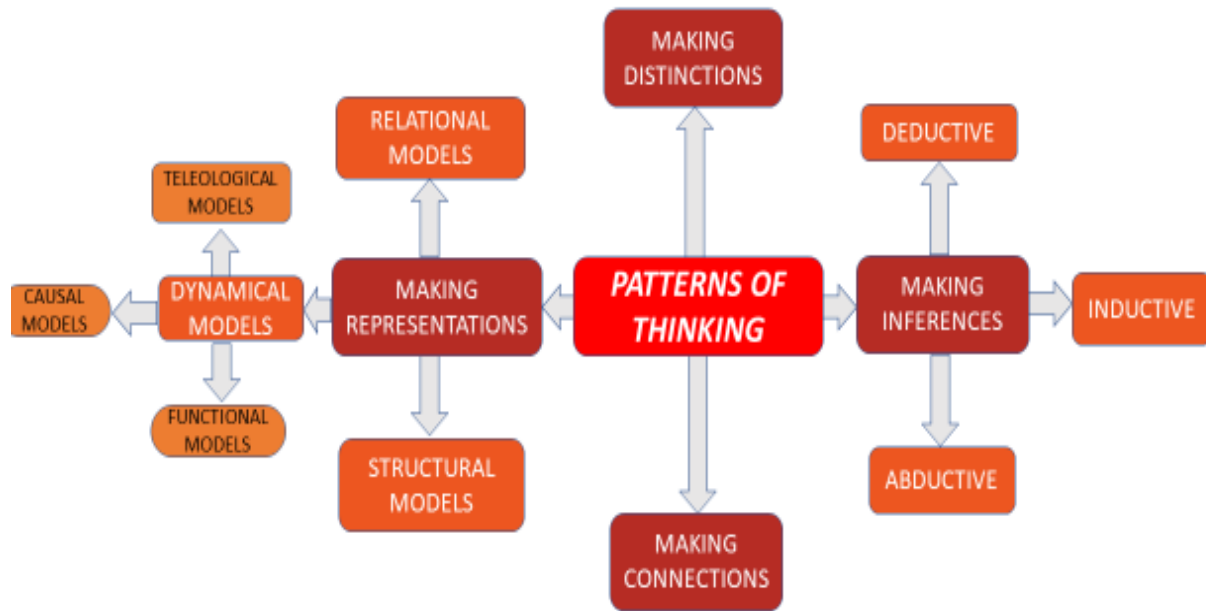
Figure 4.9: A Hierarchical Decomposition of Patterns of Thinking

1. Analytical Thinking. Analytical thinking, true to its etymological roots, refers to thinking that divides (lysis, in Latin) wholes into parts that behave in identical fashion (ana, in Latin). For instance, economic theory breaks up the market (the whole) into buyers and sellers (the parts) who behave in similar fashion (rational). Similarly, mechanics carves up wholes (a car's suspension system) into parts (linked masses, dashpots, and springs).

2. Synthetic Thinking (aka design thinking) refers to the combination of two or more parts to form a whole (syn is Latin for with; thesis for placing). If the whole to be synthesized is new, then synthetic thinking becomes a model of design thinking. Executives can synthesize an investment memorandum from the data that analysts and managers provide, for instance, or synthesize the market's response to a new product from the reactions of would-be users.

3. Convergent thinking aims at producing a result that is optimal, maximal, or, in some way, is better than the alternatives. Thinking through a set of linear equations to arrive at a solution is convergent thinking as is attempting to prove a theorem in finance. Structuring the first paragraph

of an article to support the title is also convergent thinking; the paragraph is supposed to provide a justification for the title.

4. Divergent thinking leads away from an end point. Randomly listing all the strategy options for launching a new product, the possible motivations of a key character in a case study, the likely experiences of a user of a product, or the many emotions evident at a meeting of executives are all forms of divergent thinking.

5. Constructive thinking proceeds from an established foundation towards a goal, with the process building something out of something else. Proving that a market with buyers and sellers with demands of a specific kind has an equilibrium is constructive thinking. So is the thinking involved in designing an algorithm for computing the payoff structures of collateralized debt. The difference between constructive thinking and synthetic thinking is that the paths along which constructive thinking proceeds are fixed.

6. Deconstructive thinking challenges the foundations on which a phenomenon - an argument, a dialogue, a description -- rests. An analyst can deconstruct a leader's rhetoric by examining the propositions that would have to be true for his or her arguments to have the force suggested by the vehemence with which they were articulated. An economist could deconstruct the US Federal Reserve Bank's policies by examining the propositions about human rationality and behavior that would have to be true for its policies to produce Pareto optimal economic results. Similarly, a US Supreme Court opinion on civil liberties could be deconstructed by showing how it depends on the validity of assumptions about the definition of rights and liberties, and the forms in which the latter may be alienated from citizens.

7. Inductive thinking aims to establish the validity of a universal statement, such as "All swans are white," from the validity of a particular statement like "All the swans we have seen until now were white." The objective is to seek the universal statements that are compatible with a set of statements ("What is the most empirically-supported explanation for the US securities crisis of 2008?"), or to produce statements that are most likely to follow from another set of statements

("Given the co-dependence of inflation with these 21 variables over the past 76 years, what is most likely to happen to the rate of inflation in 2018?")

8. Deductive thinking tries to derive specific statements (for instance, "This person behaves as if he is rational") from universal statements (like "Human beings behave in ways best explained by rational choice theory" and "This person is human"). It proceeds by applying a set of operators -- modus ponens (if a conditional statement is accepted and the antecedent holds, then the consequent may be inferred); modus tollens (if a conditional statement is accepted and the consequent does not hold, then the negation of the antecedent can be inferred); the law of the excluded middle (for any proposition, either that proposition is true or its negation is true); and the identity principle (each thing is identical with itself) -- to statements to produce new statements that are self-evidently consistent with accepted statements. Proving a theorem in plane geometry, the optimality of an algorithm in computational complexity, or the existence of a unique equilibrium in a market of rational traders whose preferences obey certain conditions are all examples of deductive thinking.

Interestingly, deductive thinking is a constrained form of synthetic and constructive thinking. However, the validity of the laws of logic used to construct a deductive proof is not deductively provable. Many scenarios associated with inductive thinking -- such as figuring out the mechanisms most supported by the evidence that were responsible for a market collapse or bubble, for instance -- require the deployment of additional deductive apparatus for reaching useful conclusions.

9. Abductive thinking seeks to derive the best explanation for one, or more, statements of fact that describe a state or an event. By way of illustration, "There are bear tracks in the snow outside" is a statement that is best explained by the fact that there is a bear in the neighborhood than by the possibility that someone with a bear-claw-shaped shoe made tracks to fool the observer. Unless, of course, it is unlikely that there would be a bear in the neighborhood at that time of year, and there is someone who would like to fool people into believing that a bear is around.

Abductive thinking cuts through the requirements of both deductive thinking -- the existence of a set of universal statements that are beyond doubt -- and inductive thinking -- the existence of a large data set on which probabilities can be computed about the conjunction of various statements -- and aims to provide the best approximation to a law from which some conclusions can be inferred. Explaining the Enron crisis or the WorldCom meltdown by reference to mismatches between the incentives of executives and shareholders is abductive thinking. It isn't the best inductive explanation; an exhaustive search for all possible laws and mechanisms that could explain those phenomena may not have been conducted. And it isn't deductive either because there isn't a set of self-evident and logically compatible set of axioms from which we can derive facts in the way that theorems can be derived from the axioms of the real number system.

10. Representational Thinking. To communicate with others, people create representations. Those can be as simple as pictures, maps, and sketches, or in plasma physics, as complex as Fokker-Planck and Vlasov-Maxwell equations. As disciplines have developed ways of talking about their subjects, they have proliferated representations of domains of experience; that is, models of the way things are, from the standpoint of that discipline's practitioners. Not all models are the same, and we can distinguish among them as follows:

Relational Models represent relations between objects or other entities. A relational model is an imaging tool that is used to represent in a manageable scale and format the disposition, usually in space, but sometimes in space-time, of the 'mapped' or modeled entities. Typical examples are a map, which represents locations in a two-dimensional plane, a topographical map (three-dimensional plane), or an anatomical chart (which can be two- or three-dimensional).

Structural Models are relational models that contain additional information about the properties of the objects being modeled such as their size, strength, texture, weight, and kinematic degrees of freedom. Architectural scale drawings, engineering mock-ups, and blown-up models of atomic and molecular orbitals are examples of structural models.

Dynamical Models represent the space-time evolution of entities such as electrons, atoms, molecules, mitochondria, cells, brains, humans, organizations, markets, and societies, for example. They can be broken up into causal models, which use laws or cause-and-effect relationships governing the interaction between its parts -- such as those relating to the conservation of mass

and momentum, the non-decrease of entropy and the minimization of free energy -- to derive the dynamical evolution of an entity. Using causal models, we can derive the laws of motion for muscles and joints from the basic causal mechanisms relating chemical to electrical to mechanical potentials; the dynamics of human brains from the law-like principles of statistical mechanics; and the behavior of markets from the statistical mechanics of brains linked by means of information transmission and reception media.

Then, there are teleological models, which represent the dynamical evolution of entities by reference to the goals, purposes, and objectives ("telos") of their constituent parts. Models of real markets as ersatz markets, wherein self-interested and rational buyers and sellers come together to trade, or of human creatures as vehicles for genes that seek to increase their own evolutionary fitness, or of ideas, identities and narratives that seek to increase their own cultural footprint by ensnaring minds are ready examples.

Finally, functional models represent the dynamics of entities in terms of the functions that these entities as a whole serve. Views of markets as functioning to maximize the joint welfare of producers and consumers; of the price system as existing in order to maximize the speed and accuracy with which information propagates in a society; of a cell as fulfilling a function within a tissue that lies within an organ system; or of ideas and theories as advancing the interests of certain classes of humans at the expense of others are examples of functional models.

Appendix 3: Functions of Executive Thinking
Executives use different kinds of thinking for different purposes and in different contexts. The main ones are:

1. Advocacy & Discovery. Executives can think advocatively for the purpose of justifying or persuading. Think of a legal brief arguing a court case or a pitch to a potential investor. In this case, thinking is directional and convergent; it is aimed at achieving a specific state of mind (persuasion). People can also think inquisitively for the purpose of discovering information. Imagine a cross examination or the due diligence conducted by an investor. The thinking here is

non-directional, often divergent, and may be random. it is aimed at opening one, or many, avenues for further thinking.

2. Understanding & Explanation. People can understand without being able to explain, and vice-versa. For instance, we can sometimes understand another person's feelings or solve a mathematical problem without being able to explain how we did so. Similarly, we can explain why someone could be feeling the way they are without being able to feel the same emotions ourselves or explain how to solve a mathematical problem without being able to do so at the right time in the right place. That's why understanding and explaining differ.

Successful performance has been used to distinguish between understanding and explanation; "if you think you understand a phenomenon, produce it, don't just explain it" runs the common refrain. However, that distinction belittles the importance of explanation in the transfer of skills. Describing how the Black Scholes formula for pricing a call option maps on to real data is an important part of getting someone to use the formula and describing how to make a surgical incision into an infant's armpit is a critical part of teaching how to make effective incisions. But the ability to use the formula in the right way at the right time for the right reason and the ability to operate on an infant's armpit indicate competence in derivatives pricing and pediatric surgery, respectively, which cannot be substituted by the ability to explain.

3. Reliability & Validity. Thinking can be deployed to produce more reliable or more valid judgments, beliefs, propositions, and actions, but the two purposes should also be regarded as distinct. An expert can build a model that best fits the data at his or her disposal, thus maximizing the goodness of fit; s/he can also build a model that is exportable to other situations, which will maximize its reliability. The concern in the first case must be about the particular, with all the differences that make a difference to that case. In the latter, the concern will be only with the differences that make the most difference in the largest number of cases. These concerns color differently the thinking of an academic who is concerned about the universal applicability of a model or a formula, as compared to its empirical reliability, and a financier who has a large stake in a business deal, where every little detail matters. Or the difference between the industrial

psychologist who may care about the relationship between moral intuition and the sense of disgust in humans at large, and the executive who must figure out in real time the moral norms and disgust reflexes of a single candidate.

4. Performance & Description. Thinking can be used to describe a state of affairs -- writing an account of an experiment in a scientific journal, for instance -- or it can be aimed at producing a state, such as ensuring inner calm by repeating a prayer. It can also have a performative function that is distinct from its descriptive function but embedded in it. For instance, writing an account functions descriptively as an articulation of a scientific result and performatively to signal the writer's credibility, responsibility, and intellectual honesty.

5. Emulation & Simulation. We regard thinking as a cognitive enterprise, but that is a false reduction. Thinking like someone is different -- call it emulative – from thinking about how someone thinks; call that simulative. In emulative thinking, you seek to immerse yourself in another's life; to walk in his or her shoes, so to say, and understand the inner life without having an explicit cognitive model or representation of that life. In a simulation, you try to build models (logically deep, deductive, analytical, etc.), and to test them against observations of the output of another person's thinking, such as her words or actions. The distinction is relevant. It's the difference between the kind of understanding developed and used in literature and the arts (emulative) and the social sciences (simulative), or the difference between producing a screenplay for a social cataclysm (emulative) and producing a model of a social cataclysm (simulative).

6. Symbolic Creation & Manipulation. Thinking may be deployed poetically for the creation of new categories, concepts, metaphors, and associations ('the audacity of hope', 'the world is too much with us', 'I am not what I am', 'the totalitarian ego'). It may also be deployed for the rule-based manipulation of existing categories of thought (words, concepts, models, pictures, sentences), as in the case of the derivation of a new call option pricing formula from modified forms of probability density functions of returns on assets.

It becomes possible for program designers to develop these distinctions into a pedagogical map of use cases for thinking. That will guide the ways in which they design the context and experiences that comprise programs aimed at helping learners acquire specific skills (thinking patterns) in different contexts.
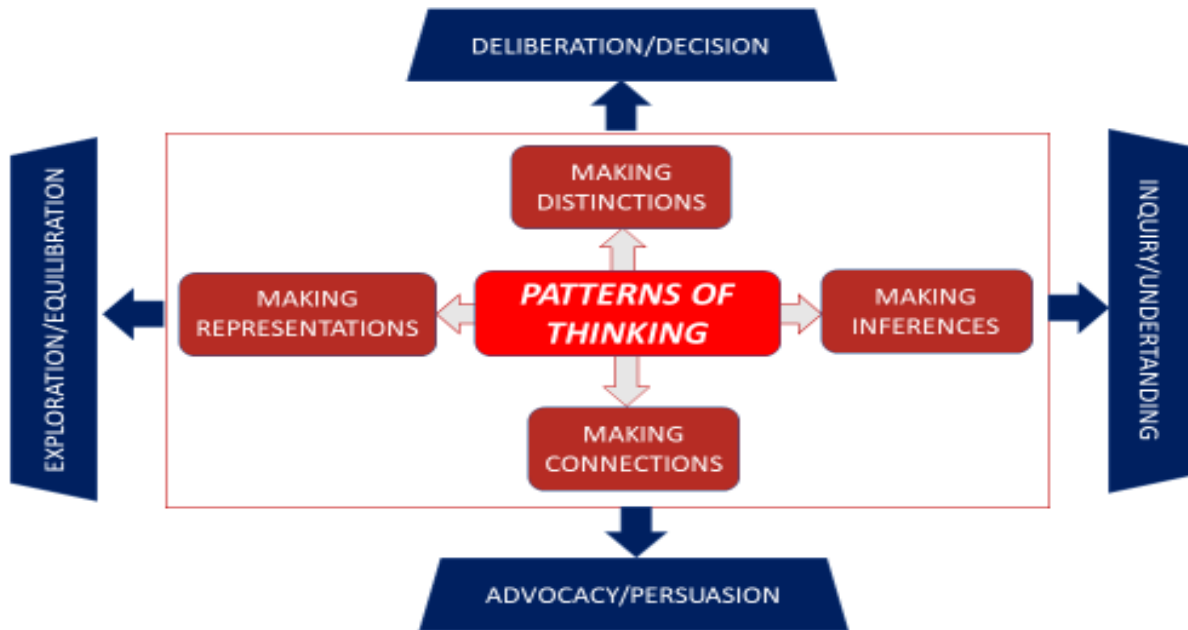
Figure 4.10. Mapping the Functions of Patterns of Thinking

Appendix Three: Turning Business School Canon into Skill Development Vehicles

To design executive education programs that transfer skills, program designers must be clear about the nature of the skills they wish to develop. That's why specifying a skill in its most abstract form is important; doing so allows providers to be precise about learning outcome measures. In addition, the more abstract a skill, the more it is likely to transfer over distances in terms of space, time, social, functional, and technical contexts. Such skills are more generally applicable; that is, they can be used in more contexts.

Business school faculties have come to be populated by experts in the applied social sciences, such as economists, psychologists, sociologists, and anthropologists, as well as operations research specialists. Consequently, the evolution of the core canon of business school pedagogy has been shaped by the social science disciplines of the faculty members teaching them, viz. economics in strategy, finance, and accounting; psychology and economics in marketing; psychology in organizational behavior; psychology and sociology in organizational behavior, and so on. The practical, first-person, know-how, know-who-based teaching used before 1960 has been replaced by a combination of the know-what (models) and know-how (methods) of social scientists, most of whom have little experience in setting up, managing, or working in an organization (Figure 4.10).

On the face of it, this trend should have helped executives acquire transferrable skills. The models and methods favored by research-focused academics are abstract, and, thus, more exportable than the intuition and acumen of the practitioner-pedagogues that pre-dated them. However, business education curricula, like higher education curricula, have been opaque with respect to the specific skills that they aim to develop and the learning outcomes they hope to achieve.

That's partly because of academics' reluctance to allow monitoring, which allows them to preserve their autonomy and authority. The veil they have drawn has created a mystique that clouds business education. It makes it difficult for learning ROI-conscious CLOs, executives, and participants to audit the claims of education-providers that they develop valuable skills in executives. Skills-oriented curricular maps are hard to come by.

The emergence of the personal learning cloud encourages business schools to place their entire curricula online, either in a revenue-generating form, as IE Madrid has done, or , like Wharton School, as freeware. Moreover, curriculum-mapping and aggregation tools, facilitated by fourth- and fifth- generation learning management engines, are mushrooming. Due to those factors, it has become possible to create a map of the core pedagogies of the business schools, grouped by the cognitive skills they teach. Previously, program developers would rely on inarticulate conceptions

of business skill and executive skill as the skills that participants acquired by attending their courses and classes. It is now possible to map out the specific skills that each functionally oriented class or participant interaction tries to impart.

To demonstrate that, we have constructed a map of the core pedagogy of several MBA programs (Figure 4.11) based on an analysis of the functional courses they teach. We broke down the content of each course into a set of representations, or models, and a set of procedures, or methods, that, together, represent the cognitive skill base of the discipline to which they belong. For example, being skilled in the capital asset pricing model involves knowing models (risk-reward frontiers, portfolio variance) and methods for performing calculations (maxima/minima/mean variance frontier, etc.) using the model's conceptual building blocks. Our decomposition of the skills base of business school curricula focuses attention on the value added by teaching, and demystifies the non-specific functional skill base of business expertise. It allows CLOs and executives, as well as program-designers and providers, to design measures of skill acquisition and skill transfer.

COURSE:
Managerial Making Decision

HIGH LEVEL PROBLEMS
How to evaluate alternative courses of action under uncertainty in single agent and multi agent scenarios

MODELS
- Rational Agents
- Utilities
- Probabilities
- Decision Trees
- Interdependent Decision Trees (Games)
- Irrational agents (cognitive biases)
- Risk and Uncertainty
- Risk aversion

METHODS
- Collapsing Decision Trees
- Bayesian Updating
- Nash Equilibrium Calculations
- Expected Value/ Utility Analysis

Applied Problems
- Use decision trees to understand options and incentives of relevant agents
- Represent agent incentives in terms of expected value (utility) and uncertainty in terms of proababilities
- Consider impact of risk aversion on decisions under uncertainty

COURSE:
Managerial Economics

HIGH LEVEL PROBLEMS
How to evaluate alternatives regarding pricing, production, and investment given different market structures

MODELS
- Rational Agent
- Supply and Demand
- Games
- Models of market structure/competition
- Production models
- Pricing Models
- Value of Information models

METHODS
- Linear Optimization
- Equilibrium Calculation
- Analysis at the Margin
- Nash Equilibrium

Applied Problems
- Use demand modeling and consider elasticities to aid in decisions regarding pricing and production levels
- Understand implications of market structure on pricing, profitability, entry, production and exit decisions

COURSE:
Statistics for Management

HIGH LEVEL PROBLEMS
How to make probabilistic inferences from data by evaluating relationships among variables

MODELS
- Stochastic Systems: random variables
- Models of inductive inference
- Probability distribution models

METHODS
- Regression
- Sampling
- Statistical Inference methods
- Hypothesis & Significance Testing (ANOVA, correlation, t-test)
- Dummy variables

Applied Problems
- Differentiate between descriptive vs. predictive statistics
- Use hypothesis/significance testing, prediction intervals to infer from sample to population
- Use of dummy variables to test impact of events or isolate impact of variable

COURSE:
Finance

HIGH LEVEL PROBLEMS
- How to allocate resources over time under conditions of certainty or uncertainty
- How to maximize firm value based on capital structure decisions and resource allocation decisions

MODELS
- Time Value of Money (TVM)
- Black Scholes Option Pricing Model
- Capital Asset Pricing Model (CAPM)
- Fama French Three Factor Model (FFM)
- Dividend Discount Model (DDM)
- Modern Portfolio Theory
- Probability
- Principal agent model
- Miller Modigliani
- Time Value of Money
- Prospect Theory
- Irrational Agent (Behavioural Economics)

METHODS
- Discounted Cash Flow Method (DCF)
- Net Present Value (NPV)
- Free Cash Flow Discount Model (FCFDM)
- Regression
- Discounted Cash Flow (DCF)
- Net Present Value (NPV)
- Internal Rate of Return (IRR)
- Adjusted Present Value (APV)

Applied Problems
- Value different assets (bonds, stocks, futures, options) based on time value of money principle (cash flows, risk, time)
- Understand debate around shareholder value as the sole corporate objective

COURSE: Strategic Management

HIGH LEVEL PROBLEMS

How to sustainably capture economic value for the firm

MODELS
- Porter's Five Forces
- Activity Based Competitive Advantage
- Valuable Rare Inimitable Organized (VRIO) Analysis
- Society Technology Environment Economy Political (STEEP)
- Decision Trees
- Game Theory
- Competition model (diversification vs. low cost)
- SWOT (Strengths)

METHODS
- Better Off Test & Ownership Test for Diversification
- Expected Value Analysis
- Unit Economics Analysis
- Methods for using SWOT, STEEP, VRIO, Porter's Five Forces to make business unit/firm strategic decisions

Applied Problems
- Represent strategy as a function of value adding and inimitable set of activities based on clear tradeoffs
- Understand distinction between two fundamental strategies - diversification (increasing willingness to pay) vs. cost leadership (reducing supplier opportunity cost)

COURSE: Financial Accounting

HIGH LEVEL PROBLEMS

How to prepare and interpret financial statements to measure company performance

MODELS
- Purpose of Financial Statements (Representative of Reality/Predictability)
- Debit/Credit Model
- Financial Statements (Income Statement, Balance Sheet, Cash Flow Statement)

METHODS
- Financial Ratio Analysis
- Discounted Cash Flow Method
- Methods for preparing financial statements

Applied Problems
- Differentiate between profits and cash flow
- Differentiate between accounting profit and economic profit
- Perform a 5C credit analysis to evaluate credit worthiness of company

COURSE: Marketing

HIGH LEVEL PROBLEMS

How to create, communicate and deliver economic value by satisfying consumer needs

MODELS
- Value Need Model of Value Creation
- 4P (Price, Place, Product, Promotion) Marketing Mix Model
- Product Lifecycle
- Experience curve
- Purchase funnel
- Marketing process model (environmental analysis, marketing strategy, 4Ps)
- Growth Share Grid (BCG Matrix)

METHODS
- Marketing strategy methods (Segmentation, targeting, positioning)
- Expected commercial value (ECV) calculation
- Market research methods (Semantic Scales, Multidimensional Scaling, Conjoint Analysis)
- Customer purchase behavior modeling
- Pricing process
- Resource allocation methods (Economic, rules of thumb, decision calculus)
- Strategic Analysis based on BCG matrix

Applied Problems
- Differentiate between profits and cash flow
- Differentiate between accounting profit and economic profit
- Perform a 5C credit analysis to evaluate credit worthiness of company

COURSE: Organizational Behaviour

HIGH LEVEL PROBLEMS

How to organize and motivate people to effectively accomplish organizational objectives

MODELS
- Work Group Model (WGM)
- Models of Motivation
- Model of Leadership
- Models of Interpersonal Interaction
- Model of Power
- Models of Org Design
- Models of Team Process

METHODS
- Social Styles Analysis
- Organizational effectiveness analysis based on WGM

Applied Problems
- Become a more effective leader by understand components of (e.g. interdependence vs. authority) + role expectations
- Avoid pitfalls of group decision making (decision process, groupthink, cognitive biases, shared/unshared information, specialization vs. integration, asking for additional data, etc.)
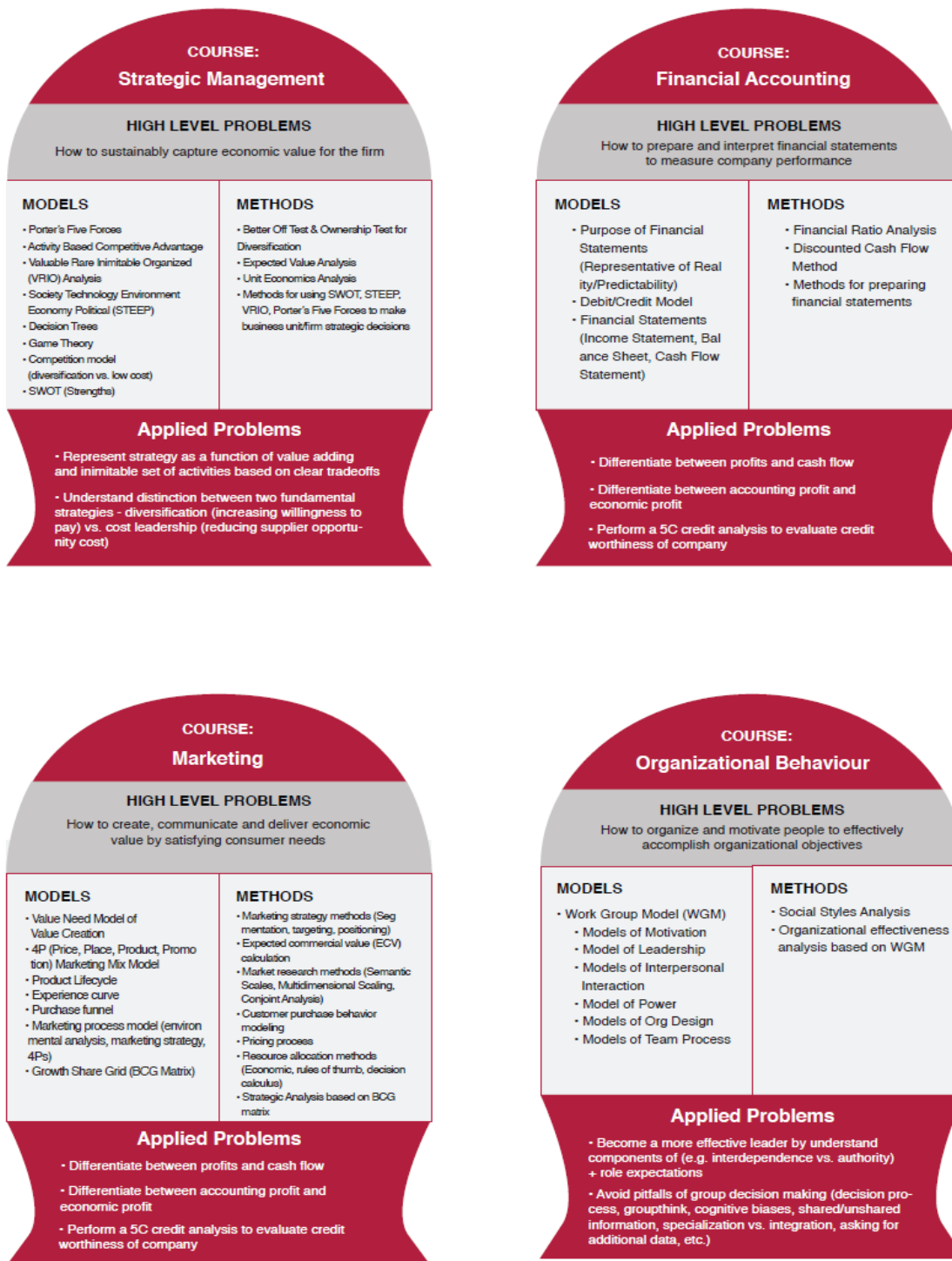
Figure 4.11. A decomposition of the pedagogical IP base of B-school curricula in terms of the cognitive skills associated with executive education

Equipped with this map, a CLO or education program-designer can identify the specific cognitive skills -- models, methods, or combinations of them-- that need to be developed in the participants in a program. It will also help, importantly, to identify the sorts of problems that participants will get better at resolving by acquiring those skills. That, in turn, will enable CLOs and program-designers to develop accurate measures of skill-acquisition and skill-transfer (aka learning outcomes). Such measures will allow program designers to evaluate two things. One, the extent to which the models and methods used by business schools are optimal, as compared to frameworks from disciplines outside the social sciences, for solving the canonical problems of the field. Two, if the problems that the pedagogical core helps participants solve is close to the critical issues that organizations face today.

Designing the Transferable Learning of Conceptualization and Modeling Skills: Understanding the skills base that a routinized curriculum can be used to develop is only the first step for an education program-designer who is bent on re-engineering his/her offerings. In this appendix, we will also examine how the teaching of one subject can be reconceptualized and re-engineered, so it becomes a development vehicle for a conceptualization skill.

The skill of thinking about a situation or predicament through the lens of a set of concepts and constructs brings about greater levels of precision, clarity, and reliability to reasoning and deliberation. That's commonly thought of as a high-level skill and irreplaceably human [Moldoveanu and Martin, 2008]. Such skills are usually not algorithmic in nature, and cannot be sub-contracted to machines.

A conceptual skill is discursive and dialogical in nature; it is used in the production of dialogue and text, and in the interpersonal process of giving and taking reasons and entertaining and answering questions and challenges. Its acquisition depends on numerous interactions between the participant and the facilitator, wherein feedback is provided, both implicitly and explicitly, on the way participants use language to confer ontological ("real") status on experiences and predicaments that were previously categorized differently. For instance, the categorization may

have used different metaphors and mental models; answered to different discursive practices; or may not have been cognitively penetrable.

Teaching Organization Design for Optimal Skill Transfer: The goal of the experimental prototype we describe below is to provide a learning platform to teach participants to define, structure, analyze, and think through organizational issues, predicaments, and challenges -- that is, ill-defined and ill-structured problems [Simon, 1973] -- using a dedicated language system. The latter maps everyday language (power, authority, responsibility, take home pay, bosses, employees, promotions, perks, year-end evaluations) that forms the core of a lay person's understanding of his or her job to a technical language (decisions, choices, outcomes incentives, decision rights, principals, agents, contracts, specific and general knowledge, capital structures and performance measures). The technical language allows the participant to make more relevant distinctions among causal variables, and to carry out the partial or global optimizations of a situation (organizational design) using the variables that are under the participant's control (the decision or policy variables).

The skill that the organization wants participants to master and transfer could have many aspects:
1. A representational skill. The ability to map everyday variables onto the expanded variable set of a problem solving language (PSL), and to inversely map solutions derived using the variables of the language, such as decision rights and pecuniary incentives, onto everyday language systems and executable actions (hiring, firing, promoting).
2. A symbol manipulation skill. The ability to piece together a description of an ill-defined or ill-structured predicament using formulas that use the variables of the formal language and the regulative principles of the formal language to arrive at a well-defined and well-structured problem.
3. An optimization skill. The purposive manipulation of the variables of the problem-solving language to synthesize solutions. That is, design optimal or better solutions to the problems that result when everyday predicaments are conceptualized through the terms and variables of the problem-solving language.

The goal is to help participants develop skills for interacting with their organizational predicaments and situations through the disciplined use of a conceptual lens embodied in an organizational problem-solving language. It aims to transfer conceptual skills to domains that are linguistically (in what field of organizing?), functionally (for what purpose?), socially (in what context: at home? At work? In voluntary activities?) and modally (in what way is the problem presented and solved?) far from the context in which they are learned -- one of the central challenges of education [Barnett and Ceci, 2002].

Teaching the conceptual structure of organizational strategy in the classroom can be done in three ways:

a) A Model as Linguistic Practice and Praxis. Using a theory to represent a situation and to execute change is like speaking a language fluently without having access to a dictionary or a thesaurus [Wittgenstein, 1953; Eccles and Nohria, 1992; Moldoveanu and Nohria, 2002]. Analogously, teaching and learning a theory is akin to teaching and learning a language.

Theories comprise three sets of components. The first relates to terms that denote concepts, such as decisions, payoffs, incentives, contracts, agency costs, coordination costs, and communication costs in the case at hand. The second relates to axiomatic propositions that make use of those terms, and can be thought of as formulae that relate terms to each other (S-1: efficient organizational forms minimize the sum of coordination, communication, and agency costs; S 2: aligning individual and organizational incentives minimizes agency costs, and so on.). Finally, they comprise hypotheses that result from the conjunction of axiomatic propositions and the conditions to which they are applied. For instance, one hypothesis could be: "Giving oversight rights to Person X over decisions of type D will reduce communication costs in Team A in this situation."

Theories thus have a semantic component that relates to the mapping of their terms (decision rights) on to plain English (authority or power) - and a syntactic component relating to the combination of the terms into formulas, or propositions, using a grammar specific to the theory in

question (i.e., minimizing agency costs by generating alternatives and choosing the one with the lowest cost). Framed in that fashion, the process of learning a theory is analogous to learning a language, involving both semantic (vocabulary, word usage) and syntactic (grammatical) competencies. It suggests that conceptual skill usage can be perceived to be a form of linguistic competence. Iterative versions increase skill transfer because they teach agency theory or network theory as languages meant to represent messy business problems as opposed to being facts or findings that describe organizational life and work.

b) Dialogue as an Instrument for Feedback and Adaptation. The development of conceptual skills as linguistic skills depends on using structured dialogue to iteratively fine-tune, correct, refine, and adapt the use of the new language of a theory. Errors -- both semantic (the wrong use of words) and syntactic (the erroneous application of rules) -- and their corrections are critical to linguistic development.

Saying "The Snow is White" in German (Die Schnee ist Weiss) can be corrected in real time by a classroom instructor (Der Schnee ist Weiss). He/she can also supply the regulative principle that makes the correction necessary, viz. "Schnee" is a masculine, not feminine, noun in German. The error correction, or feedback signal, functions as an important somatic marker [Bechara and Damasio, 2005] of the word or phrase. It helps participants remember both the correct form of the sentence and the regulative principle that justifies its usage just as the body remembers the negatively-charged emotional experience of receiving the feedback.

Analogously, the use of theoretical terms -- such as agency costs due to the misallocation of decision rights of type R to agent A -- to refer to, in plain English, the costs of delaying a decision can be regulated through feedback that helps sharpen the use of the language (What kind of delay? Who will bear the costs of the delay?). That helps executives distinguish between failures of self-control and self-command (delaying relative to the participant's own goals and interests) from the failures of adequately assigning incentives in teams (delaying effort that contributes to group objectives). Classroom discussions conducted in the new language system of problem-solving are

perceived to be more successful at transferring conceptual skill to participants than presentations that try to convince participants about the empirical validity or internal coherence of theories.

c) Analysis-Synthesis-Praxis as a Unified Skill. Just as language usage is purposive (we speak and write to achieve a goal) so too is theory and concept use. Context and purpose supply the regulative schemata for language use. For instance, learning salutations and greetings to visit a foreign country for a vacation is a little different from learning them for setting up business meetings. Analogously, learning a problem-solving language -- such as agency theory or network theory -- is shaped by the purpose for which the theory is used (e.g., for designing a more efficient pay-for-performance system; building a network that increases the speed of information dissemination among researchers; or for minimizing work-piece transfer delays on an assembly line).

In general, analysis, synthesis, and praxis form a triad in conceptual skill-transfer processes. Executives don't learn agency theory to picture their organizations in a different way, but to design better performance-management and reward systems, solve accountability problems, or mitigate information distortion in top management meetings, to name but three possible goals. The transfer of the conceptual skill from the participants' worlds (home and work) depends on the practice of the language of the new theory to structure and solve problems in contexts that are far from those in which the language was taught.

Accordingly, exams and exercises aimed at applying the language to problems supplied by participants may be perceived to be more successful at transferring the conceptual skill than assignments, exercises, and exams describing problems that are readymade for the language being taught. Representing, relating, and doing are all critical components of the uses of theory, and they contribute in equal measure to evidence of the skill associated with learning a new model, framework, or theory.