Supporting Operational Agility
Through
A New Generation of Learning Technologies

Alex Kass
Accenture Technology Labs
Palo Alto

Katharina A. Probst
Accenture Technology Labs
Chicago

Ryan M. LaSalle
Accenture Technology Labs
Chicago

Executive summary

As the pace of change increases, many organizations in both the public and private sectors have recognized an urgent need to achieve greater *operational agility*. Operational agility depends on a number of factors, including efficient organizational structure and elimination of unnecessary bureaucracy, but perhaps the most important factor in operational agility is *workforce agility* – where an agile workforce is one that can be reconfigured quickly in response to changing conditions, with workforce members quickly adopting new roles and responsibilities at high levels of performance. As this drive toward workforce agility accelerates, it will require that organizations adopt a dramatically expanded view of workforce learning and the technologies that they need to embrace to support that learning.

At Accenture, we believe that advances in mobile communications, media, knowledge-management, software architectures, and simulation technologies are key technology enablers that will lead to the required step change in organizations' abilities to realize workforce agility through new modes of training and performance support. Together with improvements in standards for integration of learning and knowledge-management systems, the technological advances will provide the means to deliver more effective models of instruction, at the place and time of need. Improvements will include: embedding instruction directly into workflow, interleaving learning with execution; and conveniently connecting learners to the best human-delivered instruction, without regard to geography, through increasingly effective virtual classroom and remote mentoring technologies. Emerging learning technologies will provide organizations that understand how to leverage them effectively with key competitive advantages by enabling dramatically increased flexibility regarding the location, timing, and form of learning activities.

In this white paper we examine why learning technologies will become a crucial competitive weapon, and we point toward the new forms of learning technologies that will be needed to enable the agile workforce of tomorrow's high-performance organizations.

Operational Agility is Increasingly Crucial to Success

There was a time when it was easy to believe that the path to success, especially for large organizations, basically involved forming a brilliant master plan and then executing it flawlessly: *Plan, prepare, execute, win*. But in a fast-changing, dynamic world, where even the most carefully constructed plans can quickly become obsolete, the advantage more often goes to organizations that are agile – organizations that are not tethered to their existing plan, and can *re-deploy assets freely* and *change tactics quickly* as conditions change and new threats and opportunities present themselves. O*perational agility* is the common thread that connects so many of the transformation initiatives across the commercial and public sectors. The organization whose operations are more agile than its competitors' can take advantage of change at the expense of the rest of the field.

Operational Agility Requires an Agile Workforce

Achieving operational agility is not simple, especially for large organizations; it requires a number of different types of infrastructure improvements including more flexible information technology, management, and financial infrastructures. But perhaps the hardest-to-achieve prerequisite of operational agility is an *agile workforce*. For example, the troops in an agile fighting force have to perform in increasingly numerous environments and engagements (e.g. fighting insurgency to peace-keeping to gathering intelligence to responding to natural disasters) which means that their skills need to be flexible enough to allow them to be redeployed in new, ever-changing ways, with very short lead times. In commercial industry, workforces are continually pressured to do more with less. This in turn implies that they need to be able to come up to speed on tasks quickly; they need to be able to learn new roles, new tactics, new skills on a just-in-time basis, with little or no time to prepare when a new kind of mission thrusts a new set of roles upon them. In other words, a more agile workforce requires a superior *learning* infrastructure.

This whitepaper examines just what a learning infrastructure needs to provide in order to support that agile workforce and the technologies that can be used to realize such an infrastructure.

An Agile Workforce Places New Demands on an Organization's Learning Infrastructure

Traditionally, workforce learning has been dominated by two modes of learning:

1) **Occasional formal training courses:** These are often delivered in a dedicated location, during a fairly large block of time that is set aside for training rather than executing, in the company of an instructor or at least an authored set of instructional materials (perhaps including online materials).
2) **Continuous, informal, on-the-job training:** This is typically achieved with little or no direct support from the learning infrastructure.

Many learning organizations have moved away from the more common form of traditional "stand-up" training class, with the "sage on the stage" who transmits his or her wisdom to a group of relatively passive learners as they find that for many learning situations, the experience is of very limited effectiveness. As anyone who has watched a child learn to walk knows, people are really built to learn by doing. For this reason, on-the-job training is, in many contexts, the better of these two choices for teaching many kinds of job skills.

In determining the right format and balance of learning delivery, it is important to raise two related questions about a learning infrastructure: what level of competence do workforce members need to achieve for the organization to succeed; and how quickly after assuming a new role do they need to achieve it?

Under the older *plan, prepare, execute, win* paradigm, each team of workers prepares for their assigned role, which is assumed to be relatively well understood and slow to change. If a worker will be in a fixed role for a long time, the organization can afford for a workforce member to take a significant amount of time to become an expert in it, but when roles need to be fluid, organizations need to be able to get workforce members on the job quickly, interleaving advanced learning with performance. An organization that focuses on an agile workforce is assuming that roles change frequently, with little time to practice on the job before high levels of performance will be required.

For example, as job rotations became more dynamic, defense organizations are moving away from investing heavily in up-front training and are instead shifting dramatically to on-the-job training. In this case, the workforce needs to be able to develop competence even while fighting a war. And now the landscape is changing even more dramatically; even within a given job rotation, the roles, tasks, and decisions are becoming more varied and complex, setting *workforce agility* as the primary focus of force development: *the success of a mission will frequently depend on troops who are doing something that is relatively new to them*.

Looking back at the traditional, slow-moving job infrastructure, the demands it placed on training now appear relatively modest. Learning could take its time, and could take place at locations dedicated to training. The role of technology in supporting that infrastructure was mostly about enhancing the effectiveness of classroom training around the edges, and even more so, about reducing the cost of delivering training. In contrast, a focus on operational agility generates a whole new set of requirements for the technologies that support the learning infrastructure; in the context of this brief white paper, we will only have time for fairly short discussions of five:

1. **Increasing accessibility of training:** An agile workforce requires training that is much easier to access on short notice, without the scheduling and travel overhead that is often associated with traditional, instructor-led classroom training. This need is particularly intense in the context of large, distributed organizations whose workgroups can be based across the country or around the world. Wireless networks and mobile computing (especially handheld, and eventually other wearable technologies) are at the core of technological capabilities that will drive increased accessibility.
2. **Increasing the effectiveness of training:** An agile workforce requires training that is more effective at quickly building operational skills**.** In organizations whose operations are slow to change, the goals of the training operation are often rather unambitious. Often the goal is less really to build skills to a level of true competence, and more to lay the basic groundwork for informal on-the-job training. Learning objectives often revolve around relatively modest goals of familiarizing learners with relevant vocabulary. But in an agile-workforce context, the organization often cannot afford to live with training that does anything less than allow trainees to hit the ground running when they begin executing a new job role. Technology can be used to deliver more effective content; and it also aids in measuring worker competence. For example, remote desktop management can enable companies to track employees' software usage, which can provide insight into performance and skill level, signaling when additional training may be needed.

3. **Reducing the cost of training delivery:** Because the workers in an agile workforce may change roles often, they may require correspondingly more frequent training. For this reason, managing or reducing the cost of delivering that training takes a heightened importance. The ability to reuse, repurpose, and effectively manage learning content is the key benefit of many of the emerging standards (e.g. SCORM) in learning technology. And it should be pointed out again here that the increased connectivity of computers via (wired or wireless) internet, including video conferencing capabilities, drives down the cost of training delivery, as electronic training content can now be delivered nearly free of cost to any location.
4. **Allowing learning to be interwoven with execution:** An agile workforce requires learning to be supported on a just-in-time basis throughout execution, not just during preparation. With the much shorter lead times to change of roles that is a defining characteristic of the agile operation, it is no longer realistic to expect that even the most effective training program will build all the skills needed before a worker begins to execute a new role. In fact, that understates the paradigm shift that is needed. A truly agile operation demands a workforce that is *always* learning. This requires a change of mindset, and it also requires a technology infrastructure that supports learning at the point of need. In a sense, learning infrastructure that supports operational agility erases the boundary between training and execution – weaving support for learning directly into the executions environment so that workforce members can execute competently even tasks for which they have not fully prepared. Adoption of Service Oriented Architectures, and the explicit business-process modeling that it encourages, will make it much easier for organizations to embed instruction within enterprise systems. Instruction can be directly attached to workflow steps, and eventually even automatically generated and triggered based on analysis of workflow execution. And again, the connectivity of desktops, laptops, cell phones, and hand-held devices can greatly aid in making both computer-delivered, and computer-mediated learning more accessible throughout the job execution process.
5. **Proactively finding relevant expertise, wherever it resides:** Remember that operational agility involves more than just the flexibility to move workforce members around between well-understood roles; a truly agile operation is often required to define an entirely new role on very short notice. The workforce members who fill these new roles may be performing new kinds of tasks that have never been consolidated in a single role, or even tasks which nobody in the organization has done before. Therefore, the traditional model of training is inadequate, and the expertise needed to master the role may not be localized within any one individual in the organization. Technologies that help identify experts, capture their expertise, and create advanced expert-finder applications will play a key role in facilitating access to appropriate sources of expertise as the need is recognized. Pinpointing the locus of expertise and fostering asynchronous and synchronous collaboration create opportunities for accelerated competency development and are untapped sources of enterprise knowledge. Ubiquitous, easy-to-use electronic communication will also allow experts to lend small amounts of their time, which will be increasingly key as expertise becomes more distributed. While it was once the case that a training session required a big investment of time from a single expert trainer, experts can now more easily share the burden and train employees at the point of need, in some cases requiring no more than a short reply to an email question.

Components of a Modern Learning Technology Infrastructure

Because the five goals outlined above cannot be satisfied by any one technology across all relevant contexts, the learning technology infrastructure for an agile organization should include a fairly diverse arsenal of tools. The broad range of available options can make it difficult to organize one's thinking. We have found that it helps to organize these technologies along two important dimensions, as outlined below:

- The first dimension relates to ***how*** learning is delivered; in particular, a key distinction is between
    - **Technology-mediated approaches** to delivering instruction, which require human instructors at delivery time, as opposed to
    - **Technology-delivered approaches**, in which learning is entirely delivered through technologies; in this second category, human instructors may pre-author content, and configure technologies that deliver instruction, but they are not required at the time that the learner is accessing the instruction.
- The second dimension relates to ***when*** learning is delivered relative to execution. Again, there are two key categories along this dimension:
    - **Training delivered in preparation for execution:** Formal support for learning during a preparatory learning phase is traditional; what new technologies bring to table are interesting new ways to deliver and to structure the training activity. These include enhancements to "stand-up" classroom training, Webinars (which are like stand-up training, but a distance, typically using the Web to transmit audio and slides), computer-based training software, and any other approach in a learner takes a signification chunk of time and devotes it explicitly to learning / preparation rather than to execution
    - **Performance Support delivered in the course of execution:** A key trend in the move toward agility is to shift more learning from up-front, "just in case" training courses to delivery of information and instruction in a just-in-time fashion in a way that is tightly interwoven with execution of the job role. The learner may not even think of themselves as having gone into any sort of special learning mode, but instead as receiving real-time coaching or assistance from a person or system. After-action reviews provide execution feedback as well, reinforcing positive behaviors and correcting execution missteps.

The 2x2 Learning Technologies Matrix below maps these dimensions out and provides helpful shorthand names to the four combinations that the matrix gives rise to. It is important to understand that each of the quadrants of this matrix really represents a constellation of related technologies, not a single approach. It is also exciting to keep in mind that the technologies in each quadrant are still evolving, that each promises to develop toward more powerful forms in the near-to-medium term future. Organizations looking to set forth on long-term trajectories toward increasingly agile operations will want to focus on the near-term future potential and current capabilities that lay the foundation for a successful long-term learning infrastructure.

Learning Technologies Matrix			
		***When* Learning is Delivered**	
		Training (Learning in preparation for performance)	**Performance Support** (Learning at the point of need)
***How* Learning is Delivered**	**Technology Delivered** (No human instructors in the loop)	**1. Courseware**	**3. Self-Service Performance Support**
	Technology Mediated (Human instructor in the loop)	**2. Virtual Classroom**	**4. Remote Mentoring**

Definitions:

1. **Courseware:** Self-contained training software that delivers instruction and assessment, usually via the Web.
2. **Virtual Classroom:** Combination of hardware and software that allows participation in an instructor-led training course without being co-located with the teacher.
3. **Self-Service Performance Support:** Help and advice systems used at the time of need, in the midst of performing a work task. Can be a stand-alone system or a component of a business application.
4. **Remote Mentoring:** Combination of hardware and software that allows a learner to get instruction from a human mentor at the time of need.

In the remainder of this white paper we will briefly highlight the value and the current state of the art of each of these constellations, describe some of the limitations of the existing technologies, and lay out the way ahead for each.

Courseware

By delivering training through self-contained media that does not require an instructor (or, generally, fellow students) to be in the loop at instruction-delivery time, courseware solutions all achieve several key goals:

- **Accessibility:** Courseware-based training solutions make learning opportunities more accessible than traditional classroom training sessions would be – generally providing anytime/anywhere delivery capability. Pervasive high-bandwidth wireless, increased local storage and mobile computing power create possibilities for delivering courseware to previously untapped channels such as deployed field personnel. Even for office employees, accessibility has increased to where new training material can be downloaded as frequently as it is produced.
- **Effectiveness:** Because courseware takes such varied forms, it is hard to generalize about effectiveness. It is worthwhile to subcategorize courseware according to two dimensions:
  1. **Media and production values:** the kinds of media and production values used; this can vary from purely text-based (which dominated in the technology's early days) to a mix of text, audio, and graphics, which can still be quite cost-effective, to products that make heavy use of high-quality graphics and full-motion video. The high-end production values can be quite costly, but can also contribute significantly to learner engagement.

2. **Form of learner interaction**: Independently of how rich the media is, courseware varies widely with regard to how the interactive potential of software is exploited.
    - **Tell and test:** One common paradigm is "tell and test" courseware, in which the system presents information, and then delivers test questions and scores the learner's responses.
    - **Limited simulation:** Another reasonably common paradigm, in which the learning experience consists of scenarios that are played out, are "limited learning-by-doing simulations" in which there are stop points in the scenario where learners can make choices on behalf of simulation character, and then can see what kind of consequences results from the choices.
    - **Immersive simulation:** A high-end interaction structure, which is fairly rare due to high development costs, can involve a fully functional learning-by-doing simulation in which the learner is more fully immersed in a role within the simulation, making a constant, sometimes continuous stream of choices, with the ability to follow any number of paths through the simulation. Innovations in this area have the greatest potential to provide breakthrough effectiveness at increasingly competitive costs. Emerging players focusing on creating reusable frameworks and mechanisms for robust immersive simulations hold much of the promise and attention for this market. While such innovations have high potential payoff, they also carry high development costs with potentially lower reusability than had been envisioned. This technology is yet to mature to the point where it can be applied, except in high-value contexts involving mission-critical skills.

- **Delivery Cost:** Courseware typically provides a dramatic reduction in the marginal per-learner cost of delivery. Although this advantage can sometimes be negated by the cost of developing a courseware solution, when the number of learners is large, the overall savings can be significant.
- **Interwoven Execution:** The type of learning environment created by courseware does not generally lend itself to fine-grained interleaving of learning with execution. However, because training can be delivered to any location, and because there is no time overhead caused by travel to the training location, courseware training can be naturally interwoven into day-to-day job execution in a slightly more coarse-grained way.
- **Finding relevant expertise:** While courseware requires considerable development time and expertise, it is prudent to supplement the development of courseware with finding expertise for future training or supplemental training for new roles. This can be achieved by integrating the courseware with enterprise services that connect learners to expert human mentors during and after the course.

Current contribution to agile workforce: By making it possible to do some basic-level training on an anytime/anywhere basis, courseware technology is making some important contributions to achievement of agile workforces. However, the Achilles heel of most courseware that is in place today is the relatively low quality, as perceived by users and measured in skill improvement. The best courseware can indeed be very engaging and very effective – in fact, by providing interactive simulations in support of learning-by-doing, the best courseware can be more engaging and effective than the typical instructor-led training course. But, unfortunately, because the cost of development can currently be prohibitive, high-quality courseware is fairly rare, typically limited to the most high stake, mission-critical skills, such as battle simulations and high-stakes business simulations.

Future directions for this class of technologies: Courseware makes its most dramatic contribution to operational agility when it is used to provide widespread access to types of learning experiences that would be either unavailable, or available to only a select few with traditional, low-tech learning methods. Future advances in this area will focus on:

1. Improving the learning experience – The best existing courseware shows that it is possible to create very engaging, effective learning experiences through this medium. New efforts in visualization and intelligent systems will make learning experiences increasingly rich and interactive, driving up the effectiveness of the content. The advent of Rich Internet Applications (RIA) makes it possible to deliver these high-end, interactive experiences as web applications; RIA provides the interactive richness of desktop applications, while making it much easier to maintain and update content without having to distribute a software update to many machines.
2. Decreasing the cost of development – The challenge is to bring the cost of developing high-quality courseware down sufficiently to make it broadly practical. One approach to doing this we believe will be to pursue a mass-customization, courseware-factory type of model, in which repositories of courseware design patterns and related methods and artifacts are reused to the greatest extent possible. Similarly, development tools that embed the patterns and facilitate their re-use will be a key to this future.
3. Increasing the granularity of content – Capturing more raw learning content, e.g., by analyzing software usage logs, or increasingly logs of physical activity that will be maintained by sensor-based systems, throughout of the execution of many business processes will drive learning experiences that are delivered in increments of minutes instead of hours. This, in turn, significantly increases the number of opportunities to deliver learning content to the worker.
4. Increasing the breadth of impact – Driving down costs enables both the ability of organizations to support similar experiences for less money and its ability to deliver learning experiences to previously underserved roles and organizations where the business case did not previously foot.

Virtual Classroom

When comparing the virtual classroom to self-contained courseware, several differences become apparent. These differences are partially aligned with the five requirements for training technologies we have outlined above:

- **Accessibility:** The requirement for synchronous instructor participation reduces the learners' flexibility with regard to when they can participate in training: courseware is virtually anytime/anywhere, whereas virtual classroom training only anywhere. The complexities of time zones and crowded schedules can make participation difficult, even when travel is not involved.
- **Delivery costs:** Once developed, courseware has almost zero cost to deliver (aside from the cost of the learner's time commitment). By contrast, each time a virtual classroom session is offered, it requires participation of an instructor.
- **Interwoven Execution:** Similar to courseware, this type of learning environment does not allow straightforwardly for just-in-time training. Again, however, the virtual classroom can be naturally integrated into day-to-day job execution.

- **Finding relevant expertise:** In this goal, virtual classrooms are similar to courseware; however, an additional difficulty is having to fit training delivery into the schedule of relevant experts.

Another important difference between courseware and the virtual classroom lies in **development costs**: Virtual classroom training is typically much less expensive to develop than self-contained courseware, requiring less production work. As we have discussed previously, especially for the high-end courseware models, development cost can be very high, and much of this is avoided by the virtual classroom approach, which is typically delivered using PowerPoint presentations identical to what would be used in a physical classroom session.

Virtual classroom technologies can contribute to workforce agility, and at a high level, some of the key contributions are similar to those made by courseware technologies:

- **Delivery costs:** by employing telepresence technologies such as video conferencing and screen-sharing, virtual classroom technologies allow learners to participate in training sessions from remote locations, which can dramatically reduce the time and the travel cost that would otherwise be involved in taking training courses.
- **Accessibility:** The option of participating in training opportunities without regard to where the instructor is located can be a crucial form of flexibility, which can make the overall training program more effective, first of all just by increasing participation rates and improving the timely participation. In addition, technology enables inclusion of the best instructors, rather than having to settle for instructors that happen to be available locally. The value of virtual classroom technologies is the ability to leverage the top experts and instructors available, and make courses led by them available to the entire workforce, regardless of its geographic distribution.
- **Effectiveness:** Assessing effectiveness is much more complex than assessing costs and accessibility. First, let us compare the current state of the virtual classroom to the physical classroom. It seems fair to say that virtual classroom technology is pretty good at supporting the basic presentation that makes up a classroom lecture, and for courses that consist essentially of an instructor's lectures (with questions, which are well-supported by most virtual classroom technologies), virtual participation can achieve a lot of the value of in-person attendance, and so comes out on top due to lower overhead. On the other hand, it is important to note that the best training classes involve more complex interaction, which is still difficult to fully recreate remotely. For example the best classes include:
    - More active learner participation in group activities involving intensive team interaction and collaboration.
    - Creation of persistent artifacts like flip-chart pages, available to the group for later discussion.
    - Extemporaneous reaction by the teacher to subtle cues from students, which are hard to get in current video-conferencing setup.

    To close the gap that still exists between the virtual classroom experience, and the best physical classroom experiences will require technologies that support these finer-grained interactions, supporting rich collaboration in learning exercises, storing and sharing learner-created artifacts, and supporting the informal communications channels that carry much of the learning that goes on during in-person sessions: Capturing more of the intangibles that are still associated with "face time" is going to be a key frontier. It is still much more difficult, for instance, for one

participant (including learner and instructor) to judge nuances of another participant's level of engagement of affective reaction.

When comparing virtual classroom effectiveness with courseware effectiveness, it again has to be acknowledged that the comparison is complex because there are so many different levels of quality at which courseware can be implemented. "Tell and test" courseware is generally perceived as less effective than "tell and test" instruction delivered through virtual classroom, because there is at least the theoretical possibility of interaction with the live instructor. On the other hand, both are fairly weak, or courseware involving highly engaging, realistic simulations is likely to excel both in terms of engagement and skill-building.

One point that might be worth making in summary is that the two technologies for training can be complementary: an approach that combines the two wisely can achieve benefits not easily achieved by the two separately. For example, it can be effective to use courseware to cover basics as "pre-work" before a virtual classroom session, and to select some key skills for investment in highly interactive, simulation-based training interwoven with virtual classroom sessions that cover the broader landscape at lower cost.

Current contribution to agile workforce: In recent years it has become much simpler and less expensive to support the remote collaboration environments necessary to support a virtual classroom setup; the overhead to participate in each virtual classroom setting is also getting lower, and it is now possible for folks equipped with a laptop, an inexpensive headset, and (optionally) a webcam to join a virtual classroom session without having any complex technical setup. As a result, particularly in many organizations with highly distributed workforces, the adoption rates on this technology are fairly high.

Future directions for this class of technologies: Virtual classroom has already achieved significant acceptance in certain organizations. As we discussed above, we expect that its use will increase even more in coming years, as richer applications that capture finer-grained interaction close the gap between the virtual classroom experience and the best physical classroom experience.

Self-Service Performance Support

Creating self-service performance support involves embedding learning resources into the environments in which workforce members execute their roles. At the simple end of this spectrum this can take the form of online manuals. At the more sophisticated levels, it can look more like intelligent assistants providing custom-tailored, context sensitive help within a job-related software application, or ultimately, an intelligent assistant that is embedded in the workspace itself.

Despite the wide range of possibilities in this space, we can again discuss the five requirements laid out above:

- **Accessibility:** Clearly, self-service performance support provides superior accessibility. For example, if training materials are permanently stored on employees' computers, they can be accessed any time and anywhere. Similarly, for computers with internet connectivity, online manuals are accessible at any time, and have the advantage that they can be updated frequently.

- **Effectiveness:** The effectiveness of just-in-time training is generally considered superior to "canned" training such as courseware, if the necessary training materials are readily available, meaning that the employee will easily find the information needed in a given situation.
- **Delivery cost:** As with courseware, training delivery comes with zero cost after it has been developed.
- **Interwoven execution:** Interwoven execution is the clearly stated goal of self-service performance support. If this is the top requirement of training, then self-service performance support will likely be the top choice of training material.
- **Finding relevant expertise:** As with the previous approaches, finding relevant expertise is paramount especially for rapidly changing learning situations and goals.

The form, range of coverage, sophistication, and the source of self-service performance support all seem to be in the midst of an important, accelerating evolution.

- **Past:** Not too long ago, self-service performance support was generally limited to static documents, primarily text based, residing on a PC. So the impetus for finding relevant learning resources, and relating them to the specific task at hand was almost entirely on the user, and online resources were typically only available to workers while they were in front of their PCs, and the help provided by those PC-based applications was largely limited to providing help about how to use the features of the application.
- **Present:** More recently it has become more common for help systems to become more context-sensitive, and to incorporate more rich media. And perhaps more important, we are beginning to see more workforce applications offering assistance, not just about how the application works, but also about how to perform the underlying job role performed with the application – for instance, not just about what button to push to submit a purchase order, but also about the organization's policies and procedures for purchase orders – as they apply to the particular order that is being placed. eManuals and product simulations of physical systems also help workers learn by doing in a safer, virtual environment.
- **Near Future:** When we project the current emerging trends forward, and add to the mix the emergence of increasingly capable mobile delivery platforms and wireless connectivity, we envision a near-term future with increasingly intelligent performance support assistants that do the following:
    - proactively suggest, and dynamically assemble context-sensitive help and advice;
    - bring in external knowledge from the network when needed;
    - leverage mobile technologies to deliver to learners wherever they are (not just when in front of a PC)

  What this adds up to is a vision of the job-execution environment in the future where the workforce is constantly supported with computer-delivered help and advice delivered as relevant, at the moment when it can most readily be put to use.

Many of the purely technological developments required to realize this future vision are clearly already being carried along by other commercial and consumer business drivers – for instance, the wireless connectivity needed to support delivery of performance support in the field will be developed for

many reasons having nothing to do with supporting learning. As these elements of the infrastructure fall into place, there will be demand for new kinds of technology specific to delivery of learning content within an agile operation. For example, if all performance-support content that will be used to help workforce members learn how to do their job is baked directly into the applications they use to do those jobs, then it will be necessary to update the applications every time the organization wants to change the guidance provided about details of policies, doctrine, and procedure.

Since an agile organization will want to tweak and rearrange its methods frequently, it will want to avoid baking the detailed guidance content into the workforce applications, and will instead want to bake in mechanisms for retrieving and assembling relevant learning content from sources external to the application, at run-time, based on the specifics of the tasks that the worker is performing. Instead of learning the content upfront, workers are trained to access the learning content as needed. The ultimate sources of the retrieved content might include both central content repositories maintained on an organization's intranet, or even external sources pulled in from the Internet.

For instance, a technician who is working to fix an apparatus might get performance support content pulled in from his organization's repositories reflecting the latest policies regarding when to repair versus replace, and he/she might also get help content that draws on content provided by the manufacturer. Performance support assistants will be able to draw on this content and assemble it dynamically if they can intercommunicate with the appropriate content sources through standard protocols and representations.

Remote Mentoring

In an ideal future world it might be possible for all learning needs to be met by a combination of the techniques discussed above – highly effective, targeted, up-front training combined with self-service performance support in which automated support assistance can get workforce members through any task that their training did not adequately prepare them for. But in the realistic near future, there are going to be times when a workforce member needs assistance from a live mentor who can explain a complex task in a way that is more comprehensive, more flexible than an automated system could. Particularly in the agile workforce context, where workers are very frequently being confronted with new kinds of tasks for the first time, it will be very important to deliver human mentoring to the workforce to support efficient and accurate on-the-job training.

Returning to the five stated requirements, we can see that remote mentoring is in several respects in sharp contrast the previously discussed technologies: while content-development costs may be quite low, clearly **delivery cost** tends to be higher for this technology than the previous ones, as it requires an expert to be essentially on stand-by. Similarly, **accessibility** is dependent upon expert availability. On the other hand, remote monitoring is likely to be the most **effective** of the discussed technologies, as it allows the learner to ask targeted questions relevant to the situation at hand. As with self-service performance support, the learning takes place during job execution, thus allowing for **interwoven learning.** This, combined with the likely high effectiveness, is the main advantage of remote monitoring. Finally, **finding experts** is often a big challenge for this type of learning approach: the virtual classroom requires only one expert, whereas remote monitoring may require experts in quantities proportional to the number of learners.

The technology for delivering remote mentoring for the business process tasks that office workers do on a PC (which now includes the a very large share of back-office and professional tasks) is now largely in place, even if the performance-support solutions that would be based on them are still developing toward maturity: Through a combination of Webcams, VOIP, remote desktop software, such as

Microsoft's Remote Assistance, or the open source VNC, it is possible for learners and mentors to quickly set up connections over which they can see and talk to each other, and "look over each other's shoulders" at a common virtual desktop, while learners ask questions and mentors provide demonstrations and explanations in return. There are still issues to be addressed to make the whole suite of technologies involved in such sessions easier to integrate and use. But the most important issue to be addressed in making remote mentoring more common may have less to do with supporting the actual mentoring sessions, and more to do with making the real-time match between learners and appropriate, available mentors who have the relevant expertise. Since remote mentoring is occurring in the midst of job execution, a key to making remote mentoring really useful is the ability to supply it quickly enough that the workflow is not too badly interrupted when the learner needs assistance. Agents that monitor learner activity and are then able to very rapidly dispatch requests for assistance to appropriate mentors and then put them on the scene (virtually) will be key to realizing the full potential of this technology.

While much of the underlying technology is in place to deliver remote mentoring for jobs done online, the challenges are greater for delivering remote mentoring to workers who are on the go, in the field. The connectivity challenges are gradually being met by wireless technologies, but there are other platform and sensor challenges: Workers in the field are not generally carrying a PC, they often have their hands and eyes occupied with the task at hand; and the tasks they need mentoring on often involve a fair amount of the physical context of their surroundings. So a general solution to providing remote mentoring in the field will require:

- A small, portable platform (e.g., a Pocket PC or Smart phone) that will not pose a physical burden to the workers who must carry it.
- Audio (and for some contexts video) technologies, which allow learners to hear (and perhaps see) the mentor's tutoring without having to dedicate their hands and eyes, which are likely to be occupied with tasks at hand, to receiving the tutoring.
- Sensors and uplink channels that allow the mentor to absorb enough of the context of the problem situation to provide effective mentoring. These might include cameras and microphones mounted on tools and clothing to allow the mentor to see and hear the environment. They might also include sensors that provide the mentor with telemetry on what the learner is doing: How much torque, for instance, the repair technician is applying to the wrench.

We envision that robust platforms for remote mentoring are coming, which include technologies for matching learners to mentors, for providing the mentors with appropriate telemetry and telepresence to understand the context in which mentoring is required, and the communication channels to allow learners to get instruction without disrupting the work processes. The component technologies are rapidly emerging, and it will be a matter of elbow grease and ingenuity – not rocket science - to create integrated platforms and solutions from those technologies. Because remote mentoring can contribute a lot toward achieving operational agility, organizations that want to develop operational agility will want to drive the development and deployment of these platforms to each portion of its workforce as soon as the level of maturity for the technologies that each respective portion needs reaches a minimum acceptable level. For workforce roles involving office work, this is a very near-term prospect; for roles that are performed in the field it will take a bit longer, but organizations which have high-value jobs to do in the field will find it advantageous to push that timeline forward as much as possible.

Conclusion

There is no one silver bullet that can take care of all the workforce learning advances needed to support operational agility. As we have tried to explain in this whitepaper, various workforce roles bring with them a variety of workforce learning challenges, demanding an arsenal of different learning-support technologies.

As depicted in the learning technologies matrix, a combination of self-contained computer-delivered approaches and computer-mediated approaches can be used to provide the best way to keep development costs and delivery costs to a minimum, while providing the maximum in both flexibility and effectiveness. In addition, a carefully-considered mix of up-front training and just-in-time performance support makes the best use of learner and instructor time and gives the organization the flexibility to support its workforce in a way that best enables it to take on new roles with a minimum of lead time. Organizations aggressively adopting these agile-workforce technologies gradually create a cultural shift as well; the workforce (including managers as well as on the line forces) into a flexible-workforce mindset which expects learning new roles frequently, welcomes those challenges as growth opportunities, and expects to be well-supported in the process of learning the new skills that they need.

Because all the groups of technologies discussed above are evolving rapidly, organizations that seek to achieve superior operational agility must devote some resources to monitoring the range of evolving options and doing frequent assessments of how their workforce-learning needs match the evolving state of learning technology. In the intensifying battle to be agile, the organization that watches closely and adopts the right technologies for their workforce, at the right time, will have the high performing edge.

At the Accenture Technology Labs, our vision for the future of learning technologies drives our research and development agenda for the applications we invent and the technologies in which we invest. For more information, visit http://www.accenture.com/technologylabs.

