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The Prospects for Increasing the Reuse of Digital Training Content

Michael G. Shanley, Matthew W. Lewis, Susan G. Straus,
Jeff Rothenberg, Lindsay Daugherty

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1776 Main Street, P.O. Box 2138, Santa Monica, CA 90407-2138

1200 South Hayes Street, Arlington, VA 22202-5050

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Summary

Distributed learning (DL) offers the promise of self-paced learning and training at any time and in any place, as well as new technologies for developing and delivering content and tracking student performance. Although demand for DL is increasing, DL still represents a small percentage of all learning and training, in part because of the high cost of developing and maintaining electronic-learning (e-Learning) materials. Development costs for DL might be reduced if digital content could be reused on a large scale—i.e., if existing digital content could be used to produce new content or applied to a new context or setting. One option for encouraging widespread reuse is to create and link learning object repositories—i.e., searchable databases in which digital content is stored in the form of learning objects and accessed by others to create new course content.

In 2006, RAND was asked to examine how the Advanced Distributed Learning (ADL) Initiative and the Department of Defense (DoD) more broadly might encourage reuse through the use of learning object repositories and the eventual emergence of a learning object economy. The study's primary focus was on the extent to which incentives and other enablers currently are and might be used to encourage training development (TD) organizations to develop a reuse mechanism (especially the supply side of it) supported by repositories. Four key questions guided the research:

1. To what extent are TD organizations currently engaged in reuse at this stage of technological development?

2. To what extent do organizations find reuse a worthwhile investment?
3. To what extent do disincentives to wider sharing of learning objects impede reuse?
4. To what extent do organizations know how to implement a reuse strategy?

To answer these questions, we conducted structured telephone interviews in late 2006 and early 2007 with individuals within a wide range of large TD organizations in both DoD and foreign defense organizations, as well as in other U.S. government organizations, the commercial sector, and academia. We also conducted site visits and more-extensive interviews at two of these organizations. In addition, we reviewed studies on incentive issues in the knowledge management literature and on reuse efforts in the domains of software and materiel development. Additionally, we interviewed experts in various aspects of reuse strategies (e.g., experts in digital rights management).

Key results of the study follow.

We Identified Five Types of Reuse in Training Development Organizations

Our initial research found that TD organizations used three primary strategies in pursuing reuse:

1. The *top-down (coordination-driven) approach*. The TD organization collaborates with other TD organizations on course design or otherwise coordinates so that e-Learning courses can reach wider audiences.
2. The *reusable learning object (RLO) approach*. The TD organization designs and reuses digital content as independent objects, complete with learning objective(s), interaction, and assessment.
3. The *bottom-up (asset-driven) approach*. The TD organization reuses digital assets (e.g., images, sound, video) directly in learning.

Our interviews revealed two additional strategies:

1. *Concept reuse.* The TD organization reuses pedagogical approaches, including instructional methods, task decomposition approaches, and assessment methods. This reuse strategy is similar to a researcher's use of papers on related research as models for the design of a new study.
2. *Structural reuse.* The TD organization adopts some type of development structure, be it as simple as a template or style sheet or as complex as a content management environment (e.g., one of the commercially available learning content management systems that allow users to create and reuse digital learning assets and content within a common authoring environment).

Reuse Is Occurring, But Reuse Based on the Reusable Learning Object Approach Is Relatively Rare, and Technical Challenges Will Take Time to Overcome

We found that, at the time of our interviews, the RLO approach to reuse was less prevalent than the top-down or bottom-up approaches. Roughly 20 percent of the organizations interviewed reported successful reuse with the RLO approach. This number seems particularly low, given that we sought out organizations having the greatest experience with reuse. In contrast, 70 percent of the TD organizations reported using the bottom-up (asset-driven) approach, and 85 percent used some form of the top-down (coordination-driven) approach. Although some reuse approaches involved sophisticated collaboration, the most prevalent form overall was simple redeployment of entire courses.

One reason for low use of the RLO approach is that although technical standards for sharing content are well established, adoption of these standards is not yet complete, and improvements in interoperability are still needed. Moreover, authoring technologies and content management systems (CMSs) are evolving but are not yet to the point of being cost-effective for a wide range of potential users. In general, we concluded that technologies that support reuse are in the earliest stage

of the technology-adoption life cycle, and progress toward widespread adoption is likely to be relatively slow.

Given the technical challenges that potential reusers presently face, we think it important that the concept reuse approach not be overlooked. Concept reuse needs to be acknowledged so that it can be measured and documented as part of the early success with reuse and can be supported in the design of large-scale repositories. In particular, since the success of concept reuse depends on being able to quickly locate content and explore it for possible emulation, there is a need for a capability that quickly searches for and accesses content or content summaries for inspection.

Significant Returns from Reuse Are the Exception, and Successes Will Remain Difficult to Predict

Our interviews suggest that few TD organizations view their return on investment (ROI) from reuse as anything more than modest, even after several years of pursuing an RLO-based reuse approach. Only 25 percent of the organizations interviewed estimated a positive ROI in line with their expectations, and these organizations typically used either the top-down or the bottom-up approach to reuse, or both. The majority of organizations estimated that they had achieved lower than expected returns, and 35 percent reported no savings at all or a net loss.

Two organizations reported large savings from efforts to restructure their development environment—i.e., from structural reuse. These results mirror case study findings from the commercial sector that show large savings from adopting technologies that automate the reuse of content in multiple delivery formats (e.g., online courses, job aids, instructor guides, lesson plans).

For many organizations, the decision to bypass an RLO-based reuse strategy appears to make sense economically. Implementation of an RLO-based reuse initiative requires significant up-front investment and organizational change, and any returns are at best years away and by no means guaranteed. For example, the demand for existing content

has proven in many contexts to be too small to justify the investment in reuse. Moreover, service to immediate customers can sometimes be compromised by the redirection of efforts and resources toward reuse outside those customers' interests. Finally, other approaches for reducing development costs, including rapid authoring methods and internal process improvements, can sometimes promise greater returns with lower risk and investment than can a reuse strategy.

Because the use of learning object repositories is still at an early stage of development and not yet a proven method for reducing development costs, we did not consider the option of creating a true learning object economy involving payback to originators of materials. Instead, we focused on creating the conditions in which a repository system whose content would be free to potential users would work. Given the relative dearth of large repositories for e-Learning at the time of our research, one strategy we used was to examine reuse markets and repository mechanisms outside e-Learning to identify potential insights on successful reuse strategies that might apply to e-Learning. We found that these more mature markets for digital content have had mixed success with reuse and that they point to factors critical to success. For example, we found that success requires a relatively large potential market for reuse in order to generate a payoff that warrants investment. Further, some successful markets, such as the multibillion-dollar commercial Web-based visual and audio programming industry, suggest that even if demand is nominally present, one must have a high-quality product to attract a large consumer base. Other markets or instances of repository reuse, both commercial and government, have seen much more limited use, at least in part because of high transaction costs. For example, information in the much more modestly used Defense Audiovisual Information System (DAVIS) is relatively difficult to access and, once accessed, is difficult to customize.

The large commercial software industry, of which e-Learning is only a small part, has long attempted to foster reuse and can provide insights on how to develop conditions for creation of a learning object economy. Reusable software content can take many forms, including subroutines, functions, macros, libraries, objects, and design patterns. Whereas there have been notable successes in reusing software, achiev-

ing a positive ROI from reuse has been the exception in the software development industry and has proven difficult to predict. For example, one significant stumbling block to creating more-general software with a wide market for reuse has been the corresponding need for reusers to more heavily customize the output to fit their particular situations. The greater the cost of customization, the less economically viable the strategy of reuse. Areas in which software can be general enough to have a wide market for reuse while, at the same time, requiring minimal customization for most reusers have been discovered, but these areas—known as “sweet spots”—have not been numerous.

Another obstacle has been the multiple ways in which content can be organized, or “factored,” to achieve the end goal. For example, software can be designed by dividing material by order of execution (phases), type of data, type of operation, or “tier.” Having a similar factorization is important for reuse, because changing the factorization of otherwise appropriate content typically makes the prospect of reuse cost prohibitive. In e-Learning, the need for customization and the challenges involved in factorization are likely to be even greater than in the general software market. E-Learning embeds not just functionality, but also terminology, semantics, world view, pedagogy, subject matter, disciplinary context, and numerous other elements that may be crucial to the effectiveness of training and learning. Potential users of e-Learning software have expressed an especially great need to customize its capabilities.

The results from early experiences and the challenges likely to occur in the future both suggest that the success of an effective distribution system for learning objects will depend critically on the extent to which TD organizations are convinced of its value and the degree to which early adopters of reuse are able to realize and report positive returns. Thus, we recommend that ADL make ROI from reuse a specific area of near-term focus, comparing the current and prospective returns and risks of this strategy with those of other available options for reducing production costs. Further, we recommend that this focus be at the forefront of ADL’s efforts to support e-Learning reuse, since other measures will make little sense unless a positive outlook for potential payback can be established.

Besides conducting research, ADL might employ strategies to foster the success of and positive perceptions of reuse. First, to build the economic case for reuse, ADL should seek to broaden the definition of reuse and document payoffs based on that wider view. This would mean supporting all five reuse approaches identified in our study, including recognizing and measuring concept reuse and structural reuse, as defined above.

Second, ADL can directly support organizations that are considering a reuse strategy for e-Learning by helping them learn to selectively design for reuse. Reuse experience in areas outside of e-Learning suggests that factors associated with a higher probability of success and reuse sweet spots include the presence of a big potential market for future reuse, the feasibility of reuse within and among organizations, and the potential for resolution of factorization issues. Acceptable balances between generalizability of content and the ability to customize and between high quality and low transaction costs are two additional factors.

Third, ADL might invest in high-profile pilots that illustrate the critical factors for achieving a positive ROI for learning object reuse. For example, ongoing efforts in military acquisition, medical training, or other areas might lead to opportunities for research measuring the ROI in promising areas. ADL might also promote research on reuse-related ROI by developing additional survey data and metrics within the planned DoD-wide registry for e-Learning content—the Advanced Distributed Learning Registry (ADL-R).

Disincentives to Sharing Are Currently a Secondary Challenge to Reuse but Could Threaten Future Successes

We also examined potential disincentives to reuse that may arise within organizations through stakeholders' reluctance to share learning objects or to reuse content created by others. Although many of the TD organizations we interviewed noted some reluctance to reuse among particular stakeholder groups, these tendencies were typically not cited as a critical factor impeding development of a reuse initiative. For example,

only one TD organization cited disincentives as the “greatest obstacle” to reuse. Moreover, the most commonly cited disincentive among stakeholders, “Do not see significant benefits in reuse,” appeared to be closely related to the ROI issue discussed above, and applied to both production of content and reuse of others’ content. Another disincentive to designing for reuse among organizations’ developers was the significant work involved (e.g., in producing metadata) that would be uncompensated and potentially at the expense of current customers (e.g., if they had to wait longer for products).

Finally, a moderate number of organizations noted that while custom content developers hired by TD organizations were currently cooperative and occasionally proactive, if reuse were to expand significantly, developers would lack sufficient incentives to comply with the “spirit of reuse”—i.e., to produce a sufficient amount of highly reusable content—because they would not accrue the profit from others’ use of the content they created.

We expect that if large repositories become more prevalent and reuse becomes more common, disincentives to sharing content and reusing the content of others may go from being secondary obstacles to being a more significant problem. Research in knowledge management (i.e., the processes that organizations use to manage their intellectual assets) provides the foundation for this expectation. In addition to identifying obstacles to sharing information, as noted above, this literature shows that individuals and organizations are sometimes reluctant to use the knowledge of others. The predominant reason cited in our interviews for this reluctance was the effort required to revise content before it can be used for new purposes.

Other research shows that reluctance to reuse can also stem from concerns about the reliability of the material borrowed, fears of losing credit for ideas, and fear of becoming expendable. These issues were not of great concern among our interview respondents, who typically did not consider their training materials to be valuable intellectual assets. However, as the demand for learning objects grows, these incentive issues may become more prevalent.

Creating incentive mechanisms to counter stakeholder reluctance is key to motivating desirable behavior within large organizations. A

variety of strategies might be used to create incentives for reuse, including measuring and rewarding the sharing and use of content, cultivating an organizational culture that favors reuse, assigning roles or providing support in a way that promotes reuse, tailoring technical systems to enable reuse, and using mandates or financial pressure to stimulate reuse.

One mechanism for addressing incentive issues is the high-level directive that requires reuse efforts within DoD: “Development, Management, and Delivery of Distributed Learning,” DoD Instruction 1322.26, June 16, 2006. However, although this mandate will undoubtedly lead to larger DoD repositories of content and will nominally provide increased opportunities for reuse, it is unlikely to work well by itself. In addition to not addressing the potential disincentives discussed above, it may introduce further challenges. For example, two elements—the lack of general knowledge on how to design for reuse and the ease of complying with the “letter” but not the “spirit” of the directive—may lead to the flooding of repositories with content of little potential for reuse, thereby increasing the difficulty of finding truly reusable material. This could damage the perceived value of the emerging ADL-R at a time when supporting positive perceptions is critical to the success of an emerging learning object economy. Thus, supporting initiatives aimed at creating appropriate incentives may well be needed for the DoD directive to succeed.

ADL might pursue various options for stimulating additional incentive mechanisms for sharing content. Our earlier recommendation—that ADL work to raise the visibility of the potential ROI from reuse—applies to the entire area of incentives, not just to those relating to financial return. In addition, ADL might play an educational role by supplying TD organizations with information on how to foster positive organizational values among employees and providing training on how to design for reuse. Development of recognition systems, monetary and otherwise, might also help to encourage reuse. Furthermore, prior to the emergence of alternative business models, ADL might pursue more buy-in from custom content developers through appropriate policy and contract changes. For example, ADL might allow developer identification and contact information to be used in metadata so that highly

reusable repository postings can serve as advertising and marketing tools. Finally, an investigation of incentive mechanisms appropriate to TD organizations could be pursued in the pilot demonstrations suggested above.

Organizational Processes for Implementing Widespread Reuse Will Need Extensive Development, Starting with Strategic Planning

Implementation of an RLO-based reuse strategy within a TD organization can require significant internal changes (e.g., with regard to the instructional design approach, business model, degree of collaboration with other organizations, use of technology, and other processes). Our interviews identified implementation issues as the greatest obstacle to overcome—much more important, for example, than issues related to technology or e-Learning standards. For organizations we interviewed whose reuse efforts had stalled or been abandoned, the need for strategic planning and increased collaboration were the most significant obstacles; for organizations that had had some success with reuse, metadata and repositories were the most notable obstacles.

These results suggest that organizations face a progression of challenges based on how far they have come in the change-management process. Some organizations are stuck at the beginning of the process (establishing a strategic plan), whereas others are more focused on how to implement an established plan. In the future, after large public repositories have been established, other obstacles might become prominent. What is clear from our study is that despite several years of effort, organizations are relatively early in the process of change, and much more development needs to occur.

Organizational experts note that effective implementation of a reuse strategy demands a supportive environment. Within TD organizations, support personnel are needed to facilitate collaboration between subject matter experts and technical staff. Internal guidelines for effective reuse are also important. Across TD organizations, the formation of repository communities can greatly increase the potential for reuse.

Such communities will need subject-specific standards and guidelines for reuse processes, along with a common language for metadata and metrics for measuring success. Guidelines that help organizations co-produce courses will also be needed.

Successful collaboration is also required for reuse success, whether the goal is to co-produce courses or to form effective repository communities. Such collaboration can often require a significant time investment. Collaboration can be aided by mechanisms to ensure communication, information sharing, and the development of trust. Successful collaboration may also require mandates, when appropriate, as well as the promotion of culture/values, involvement of sponsors, and engagement of neutral third parties to facilitate communication and prevent or reduce conflict.

We recommend that ADL support processes for implementing reuse strategies. ADL might take the lead in facilitating the creation of new reuse communities and support research documenting lessons learned about how to effectively implement reuse. ADL might also provide consultants to assist organizations that want to collaborate to foster reuse strategies.

ADL Can Encourage the Reuse Option for Reducing Development Costs by Taking a Proactive Approach

ADL should aid the development of a viable market for reusing learning objects by focusing on a key enabler—the perceived value of reuse. ADL can provide this service in two key ways: by helping organizations engaged in making an initial decision about whether and when to invest in reuse determine the potential for reuse and the conditions leading to its greatest payoff, and by increasing its support to early adopters that have already begun implementing their reuse strategies. The recommended approaches, as described above, are as follows:

- Broaden definitions of reuse and redefine success through the use of metrics and surveys.

- Invest in high-profile pilot programs to identify conditions with the highest potential payoffs for reuse.
- Conduct or sponsor research to evolve guidelines for implementing reuse strategies.
- Evolve ADL's role as a neutral trusted advisor to TD organizations.

ADL might also sponsor research efforts to develop a better understanding of how reuse efforts can be supported. Possible projects are (a) an evaluation of approaches for improving search capabilities for digital training content; (b) development of additional metrics for ADL-R's scorecard to capture costs and benefits to both contributors and seekers of content; (c) an evaluation of the evolution of the "DL supply chain" over time in order to predict the interventions that could speed up the process to rapidly produce high-quality content at low cost; (d) focused case studies of current, high-profile efforts to maximize reuse of training content and document emerging lessons learned and sweet spots for different types of reuse; (e) development of guidelines and a decision tool to help project/program leaders determine the likelihood of successful reuse.

These actions may not be enough to create a viable market for reusable e-Learning content (e.g., cost savings may prove to be too small), but they may well be necessary if promising reuse efforts are to successfully emerge and realize their wider potential in the near term.