SAMPLE LESSONS LEARNED FROM ADVANCED DISTRIBUTED LEARNING EFFORTS

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ABSTRACT

With the prevalence of activity geared toward designing, developing, and delivering Advanced Distributed Learning (ADL), understanding the challenges and issues faced by ADL pioneers increases in importance everyday. Others forging into the ADL arena, as well as those who continue to strive to provide web-based training that lives up to the promises of being available anywhere and anytime yet instructionally sound, can benefit from the experiences of those who have worked on ADL efforts. The purpose of the current effort was to gather lessons learned information from Prototype ADL Efforts that were sponsored by the Joint ADL Co-Laboratory in Orlando, FL. This paper provides a brief description of the methodology utilized to obtain this lessons learned information, as well as a sample of lessons learned information that was gathered.

ABOUT THE AUTHORS

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BACKGROUND

The Department of Defense (DoD) and the White House Office of Science and Technology Policy (OSTP) launched the Advanced Distributed Learning (ADL) initiative in November 1997. The goal of the ADL initiative is to ensure access to high quality education and training materials that can be tailored to individual learner needs and made available whenever and wherever they are required. ADL has the potential for: reducing training costs, providing training on time and on demand, increasing training access, increasing availability of refresher training and job performance support, and increasing retention of learning. As a result, the Office of the Secretary of Defense (OSD) has established the Co-Laboratory Network to reach the goals of the ADL initiative.

The ADL Co-Laboratory Network consists of three laboratories. The ADL Co-Laboratory is located in Alexandria, VA and is chartered to facilitate the development of common standards for ADL and to promote interagency coordination and collaboration on ADL efforts. The Academic Co-Laboratory was established in partnership with the University of Wisconsin and the Wisconsin Technical College System and is chartered to outreach to academia in promoting collaborative development, demonstration, and evaluation of emerging distributed learning technologies. The Joint ADL Co-Laboratory is located in Orlando, FL and is chartered to develop techniques and guidance to implement ADL in the military services.

The Joint ADL Co-Laboratory has funded the development of 26 ADL prototypes to investigate a variety of issues related to ADL. These include, among other topics, determining how to effectively: convert legacy courses for delivery over the internet, incorporate adaptive training principles, utilize gaming technologies, and store and retrieve content objects. A complete listing of the 26 prototype efforts, as well as project summaries, are available from the Joint ADL Co-Laboratory website – www.JointADLColab.org

Crucial to understanding the impact of these prototype efforts is gathering data on the lessons learned throughout the prototype development process. These lessons learned data span the entire instructional systems design (ISD) process, including lessons that are learned from the initial analysis phase through those learned about implementation. When systematically gathered and integrated, this information will assist anyone working in the ADL arena, including: individuals developing web-based courses and tools, project managers who must make resource and scheduling decisions, and individuals and groups developing ADL standards and specifications, such as the Shareable Content Object Reference Model (SCORM).

This lessons learned information can help a large number of organizations within the military services that are tasked with converting legacy courseware to ADL and developing new ADL approaches. It can help them avoid costly mistakes and increase the efficiency and effectiveness of future ADL efforts. This paper briefly describes a methodology for systematically gathering these lessons learned data, as well as presents some of the results obtained by using this methodology across several of the existing prototypes.

Specifically, three basic types of lessons learned information are being collected as part of the larger effort: 1) return on investment data, 2) input on the utility of design guidelines, which are being developed by the Joint ADL Co-Lab, and 3) anecdotal experiences.

The anecdotal experiences are along the lines of "I wish I had known this before I started, because it would have made things easier and, therefore, it would be helpful for others to have the 'heads-up' about this as well." The lessons learned data collected related to these experiences is the subject of the current paper. If each individual involved in ADL reading this paper is able to draw upon just one of the sample lessons learned presented and, in turn, is able to benefit by saving time, costs, or anticipating unforeseen problems, the goal of this paper will have been achieved. Some of the lessons learned are more relevant to ADL content and software developers, others to those implementing ADL, others to SCORM developers, and still others to decision makers.

METHODOLOGY

A structured interview guide was developed and used to perform the interviews, all of which were conducted by the first author. In accordance with the interview guide, all available paperwork related to a given prototype was reviewed prior to the interview to target particular areas needing clarification. After explaining or reviewing the purpose of the interview and obtaining permission to record the interview and to use the information obtained in written documentation, the interviewer set the stage for the interview. That is, the interviewee was asked to "put on the hat" of someone in the future who might work on an ADL effort similar to that of the interviewee and to try to generalize his/her lessons to that target audience.

Questions asked ranged from overall lessons learned to those dealing with specific aspects of ADL, such as: decomposition of content into Shareable Content Objects (SCOs), instructional strategies, SCORM in general, metatagging, Learning Management System (LMS) issues, and implementation issues, to name a few. Interview questions were modified to address the specific goals and activities of each prototype effort. In addition, significant probing on the part of the interviewer was often required to ascertain the lesson that could be generalized to the overall ADL community. As a result, the interviews were loosely structured and tailored to each prototype effort.

Because prototype team members reside in various locations across the country, some were performed over the phone while others were done face-to-face. Permission to tape record the interviews was obtained in all but 3 cases. Permission to use the information contained in the interview in written documentation was obtained in all cases. Interviews ranged from about 29 min to 2 hr, with the average interview time being approximately 1.5 hr.

Every attempt was made to interview as many team members as possible, because each member of any given prototype holds unique lessons learned information. Interviews were initially conducted with the team's prototype manager, and follow-up interviews with other identified team members were then held and/or have been planned for a future date. Interviewees were both government employees and contractor employees.

Notes were taken during the interview and subsequently reviewed. Also, when taped, these tapes were reviewed. Detailed notes were taken based upon the tapes, and portions of the tapes were transcribed. Initial and subsequent notes were then reviewed and integrated both across a given interview and across interviews.

RESULTS

The following are a sample of the lessons learned obtained from 11 individuals spanning 7 of the prototype efforts. Lessons learned resulting from these interviews are intentionally written to maintain anonymity, including the use of the pronoun "he/his" exclusively when referring to interviewees.

The lessons learned clustered into several specific topic areas, including issues related to: 1) SCORM in General, 2) Front End Analysis of Content, 3) Decomposing Content into SCOs, 4) Metatagging, 5) Hyperlinks, 6) Graphics/Media, 7) LMSs, 8) Implementation, and 9) Programmatic Considerations. Before elaborating upon these specific results, several general lessons from conducting the current effort are discussed. First, perhaps one of the most important lessons that was learned in this effort pertains to gathering lessons learned data itself. That is, interviewees varied greatly in their responses to a request to quote them in written documentation. Some indicated that any part of their interview could be quoted, most asked for review of quotations, others explained that their quotes would need to be approved through the chain of their agency/company, and still others refused to be quoted due to potential implications for their agency/company (i.e., "this is politically sensitive,

we can't say this even though it's true"). As a result, even though they might provide greater specificity and thus more potential benefit to the reader, no direct quotations are used here. Second, some of the lessons learned are more objective or factual in nature, while others are more of the opinion variety. Every attempt was made to obtain data which formed the basis of a given opinion, but some are included here without such data because it is the authors' opinion that the information can still be useful. Third, there were cases when there were conflicting opinions among interviewees. Fourth, several of the sample lessons learned can really be seen more as issues and/or feedback about which others should be aware, but where currently no one solution has been identified. These were also included because the authors felt awareness of these issues is important for anyone working within the ADL arena. Fifth, some of the lessons learned are not only relevant to ADL but are included because those working on ADL efforts can benefit from this information as well. Sixth, some lessons learned span across multiple topic areas. Finally, lessons learned revealed themselves in interesting ways across the interviews. That is, a lesson learned on metatagging, for example, did not necessary emerge when specifically asked about metatagging. Lessons learned were instead often a compilation of what was discussed during the entire course of the interview. For the sake of brevity, none of these above issues will be discussed in the remainder of this paper. In the following section, the lesson learned is italicized and a very brief elaboration is provided for each.

SCORM in General

The evolving nature of SCORM hampered the initial ADL efforts trying to ensure conformance/compliance

More universally expressed than any other issue was the frustration on the part of interviewees with what they perceived to be a standard, which did not allow them to build instructionally sound content. Furthermore, the frustration extends to feelings that anything currently done according to the "standard" will need to be undone/redone in the future. The SCORM user community is crying out for more guidance regarding SCORM, as well as more realistic milestones of what can and cannot be expected in future versions of it. It is recognized that significant effort is underway to progress the state-of-the-art of SCORM, and this

feedback simply reiterates the importance of considering the requirements of all who work in ADL, including instructional designers and content developers.

Front End Analysis of Content

An effective and up-to-date needs analysis is perhaps more important within the emerging ADL environment than it ever has been when using more traditional instructional approaches

The prohibitive costs of creating just one screen that is "wrong" (let alone an entire course that "misses the mark") is one factor that makes this so. In addition, in a classroom setting, the instructor can engage in various activities to ameliorate the negative impact of a course that was developed/designed ineffectively, such as to add examples specific to the targeted audience when the course is too generic. However, asynchronous web-based content "is what it is" at any given instructional opportunity, and if it is "off the mark" the instructional opportunity is missed. ADL instructional developers are advised to take the time to do the initial needs analysis to target the training to their audience or to update the needs analysis, because it can both improve the quality of the training and save money in the long run.

It is important to involve multiple Subject Matter Experts (SMEs,) in the needs analysis process and when developing content, as well as those who have knowledge regarding the original content, when converting legacy courses

Those converting legacy courses should be aware that getting anywhere near complete documentation on the course is unlikely. Indeed, many legacy courses are PowerPoint presentations, where the knowledge resides in the instructor's head and is not documented. Therefore, learning objectives, etc., are not obvious or evident from what is documented, and these need to be reconstructed. It can therefore take a great deal of time and effort to "get the information out of the instructor's head" due to limited documentation. This addresses the importance of having someone who has knowledge about the original content as a SME during the conversion, as well as encouraging those working in ADL to improve documentation. Interviewing SMEs and those who have insight on the legacy content is critical to maintaining the integrity of the content and the development of

sound instructional strategies. Those working in ADL are advised to be aware that this is a difficult and time-consuming process and should plan accordingly.

Decomposing Content into Shareable Content Objects (SCOs)

A lack of guidance regarding what constitutes a "chunk" of reusable content continues to cause frustration among the ADL instructional developers, as well as to cause the creation of inconsistency across SCOs

A common theme discussed by interviewees was wanting to know "how big is a chunk?" and "how low do you go?" It was the opinion of some interviewees that content developers should not make this decision. Because of the inherent tradeoff between cost and increased granularity of content, best practices are needed to establish an optimal tradeoff between these two factors. Otherwise, there is little incentive to "go lower." If some content is chunked at the course level and other content at the individual screen level, the integration of content for reuse at a later date becomes more difficult. A guidance document to supplement SCORM is recommended, that provides concrete examples of "good" SCOs and conventions for developing them. Because several interviewees expressed that they rely on such examples to do their work, this document should provide multiple examples of "good" SCOs using different types of content.

Creating a SCO is harder than it seems and requires further guidance if we want content that is reusable

To be reusable, a SCO must be a stand-alone chunk of content. This means that it cannot rely on any other SCOs to be understood. Instead, a review of much of what has been developed as SCOs reveals that, for example, often acronyms are used in one SCO and not spelled out or defined in another, because "it was defined earlier." If a glossary were allowed to accompany the SCO, this could solve this particular problem. However, presently, according to SCORM, two SCOs cannot operate at the same time, so making the glossary an object would not work. On the other hand, if it is not an object, there is a risk that it would not be "moved" along with the other SCOs. This would mean that it would have to be defined as part of every SCO that references it,

which can become cumbersome and time consuming. Consideration should be given to devising a separate category within SCORM for content such as glossaries, help files, and the like, which could then be metatagged. It is also possible that the Packaging Specification within SCORM 1.2 will allow a glossary to be a Shareable Resource, which could be displayed on a screen as part of a SCO, and which could be metatagged. This deserves further attention.

Metatagging

Testing of storage and retrieval of content from a repository is needed

There is no evidence that metatagged data can be systematically and effectively retrieved to produce meaningful content. Even if it can be demonstrated that the computer professionals who developed the "tagging systems" can perform this task, this provides no evidence that instructional designers/developers, operational personnel, and others, can do the same. This requires systematic investigation. A "mini" repository developed expressly for testing purposes is suggested.

Instructional designers need to be provided guidance on SCORM rather than handed the document to read and "figure out", especially when it comes to the arduous process of metatagging

Interviewees expressed significant difficulty in understanding how to metatag and frustration in being unable to actually test whether their metatagging scheme was "correct". According to some of the interviewees, instructional designers and developers are not used to metatagging data. Team members should take the time to review SCORM together to understand its nuances, which can help to make the metatagging more effective. Furthermore, more top-down guidance to instructional developers is needed. As SCORM continues to evolve, the type of confusion evidenced on the part of some of the content developers interviewed here may occur less frequently. In the near-term, more workshops and other venues to educate instructional developers on the SCORM process are recommended. The trainers in such a workshop should include both SCORM subject matter experts, and psychologists, or instructional developers, who themselves have experience with, and understand, the challenges developers may face when working toward SCORM-conformance.

Greater clarity and definition for metatags is critically needed or else inconsistency and potential inability to use the tags to retrieve content will result

Similar to the previous lesson learned, interviewees described the difficulty they had with trying to discern the definitions of metatags and what information they were really being asked to provide. There was indication that teams are having difficulty being internally consistent with their metatagging scheme. This makes it highly likely that there will be considerable inconsistency that will result across efforts without greater clarity. Some interviewees also expressed doubt as to whether they themselves could retrieve the content that they tagged in the future from a repository, because the information was neither intuitive nor highly meaningful. Unless further guidance is provided in how to interpret the tags, those involved in ADL will continue to have difficulty, inconsistency will result, and there will be problems down the line when attempting to retrieve and reuse the content. Just as guidance on SCOs should supplement SCORM, guidance on defining and interpreting metatags is also recommended, complete with concrete examples.

Those developing ADL content may resist metatagging anything other than what is mandatory until further metatagging guidance is provided

Because of the time, cost, and difficulty involved in just metatagging what is currently mandatory, it is unrealistic to expect those implementing SCORM to go beyond the mandatory fields. A great deal of information about the content may therefore be lost, and it may not be possible to retrospectively ascertain that information. Therefore, the guidance document discussed above should include clarity regarding and examples of both mandatory and optional fields.

Hyperlinks

Consideration for how hyperlinks will be maintained both programmatically across ADL and for any particular ADL effort is needed

Including hyperlinks in content may result in problems during implementation. Websites change as does their content. At least one prototype found such problems with hyperlinks when content was reviewed at a later date. There needs to be a plan for how maintenance of the website will be handled within any given ADL effort as well as across ADL. This is not as simple as just having someone access a link used to ensure that it "works." The individual(s) must understand the content enough to recognize whether the link is still appropriate. A potential way to decrease the need for high cost and logistically difficult maintenance is to use links only as supplements to content by putting the main content within the content object/course itself. For example, a course on training leadership could provide a module on mentoring in many different ways. One approach would be to provide a hyperlink to a website where mentoring is listed on the main page. However, if the site changes and does not mention mentoring on the main page any longer (or lists another term, such as "coaching," instead), and the user is looking to see this when he/she has accessed the site, this can be confusing. An alternate approach would be to provide "sufficient" detail for the targeted audience within the course and to provide listings of web-sites, books, courses, etc., which could provide further detail when needed. Furthermore, design guidelines also suggest that hyperlinks can be distracting and should be kept to only those most critical.

Graphics/Media

Access to source graphics may not be available – and only source graphics should be stored in repositories

For one prototype in which an existing PowerPoint course was converted to an HTML format, exporting the graphics that were used out of PowerPoint and into the browser-based environment revealed degradation in the quality of the graphics. This is because at least some types of graphics are altered by PowerPoint rather than kept in their original format. The caution is that exporting graphics from utility applications may lead to degraded quality and unusable graphics. Furthermore, no documentation existed as to where the source graphics were obtained (they were largely downloaded originally from the web and no URLs were stored with the graphics – and even had they been documented, there is no guarantee that they would still be accessible). Those developing ADL content and designing reusable graphics assets are advised to plan ahead to obtain source graphics, or comparable graphics, that meet instructional goals, when source graphics are not available. This is also important to consider for repositories.

Care should be taken to ensure that the original source graphics are stored instead of a version exported from utilities when alteration of the graphic is possible.

Copyright and intellectual property rights may be an issue

One interviewee noted that copyright and intellectual property rights might be stricter when using graphics/media within ADL than in more traditional instructional settings, because the web allows a wider audience to have access to them. Because this may be the case, those working on ADL are advised to allow sufficient time in the project to explore copyright and intellectual property rights issues.

Learning Management Systems (LMSs)

Content may pass SCORM tests yet may need "tweaking" to get it to run in any given LMS

Because SCORM continues to evolve and, in turn, LMS vendors continue to work to have SCORM-conformant LMSs, those attempting to host SCORM-conformant content within an LMS should be aware that they might need to plan for some work on the part of their team to ensure that this functions properly rather than to expect a "plug and play system". As SCORM and LMSs continue to evolve and progress, this will hopefully become a moot issue. However, it is important for the ADL community to keep its eyes on this issue into the future

Licensing agreements tend to vary greatly in how they really work, which can lead to an unwanted surprise if not thoroughly investigated

There was at least one case in which licenses were purchased for an LMS with the assumption that a license was per student versus per course. This turned out to be an incorrect assumption in that particular case. Considering that some agencies may need to offer many different courses to students, this could make a big difference. Understanding the different licensing options available prior to purchasing a system can help to avoid missed expectations down the road. Those working in ADL are advised to take the time to do this homework.

A requirements analysis of how any given ADL content will be implemented should drive both the type of LMS purchased and which licensing agreement will best meet the intended needs

According to interviewees, some LMSs are perceived as more enterprise-level while others are more course-level. That is, as they explained, some LMSs are more tailored to tracking the detail of an individual student's progress, such as time spent per screen, etc., while others are better suited to track across students, authenticate and provide future verification of certification of students, etc. While some LMSs have the capability to do both, with large throughput, this can require large amounts of data storage, which in turn has the potential for slowing system performance. As one interviewee put it, understanding the functionality one really needs in an LMS can help to identify which LMS will work best to meet those needs. Individuals working in ADL are advised to take the time to do the necessary requirements analysis.

"Home-grown" LMSs may need to be modified to meet implementation needs

At least one example was provided in which an LMS was being used that had been previously developed specifically for another agency's use, where the agency had its own way of tracking students. Therefore, an interface for SSN, home address, email address, or other ways of tracking students, was not built into the system and this needed to be modified. Other similar issues may occur when using an LMS originally developed for a specific purpose. Those using such systems are advised to plan on reviewing the system to identify which, if any, modifications are required to meet their needs.

Implementation

Testing of the data being captured can help to ensure that it is really the data that is expected and that the capture is working appropriately

One interviewee provided an example in which his team intended to capture the student's email address as one way to identify the student, but it turned out that the LMS, in fact, did not actually capture this data as expected. The interviewee noted that there was some difficulty in identifying a couple of the students who had the same ID, and that the email could have discriminated this. The assumption was that this was being captured

when it really was not, and testing prior to implementation could have allowed for a fix. Similarly, another interviewee described how, during testing, it was found that the user was answering test questions correctly but the answers were being recorded as incorrect. Those working in ADL are advised to examine their data prior to implementation to ensure they are getting what they expect.

High-level policy decisions are needed to help the ADL community deal with issues of firewalls/security

One interviewee described how his team's contractor had difficulty in developing their content because many of the materials needed were not accessible to the civilian sector. Another interview described that there are some agencies and bases at which it is very difficult to download software without "going through a lot of hoops," even when the software is free. Avoiding plug-ins, such as video players and readers, may not be possible if one wants to maintain interactivity in the content. That is, if the user does not have the software to run media that add desired interactivity and convey the instructional message, a plug-in may be required, and if downloading of the plug-in is prohibited, this creates a large problem. Also, some interviewees noted that most vendors are moving to products, with which most machines come equipped, for running video, but this still does not completely solve the problem. In addition, an interviewee discussed how streaming video can also be a real problem, sometimes because a local policy has mandated that no streaming video is allowed and sometimes because of a firewall that does not allow it through – while at the same time, from higher up, the instructional developers are being told streaming is allowed. Furthermore, one interviewee explained that there has been a debate about whether to keep content restricted behind dot mil domains, because issues, such as the Privacy Act, cause a vendor hosted solution to be too risky. This significantly counteracts with the goal of delivering training that is available anywhere and anytime. Considerable effort is required to resolve these types of issues at the policy level or the goals of ADL will be compromised.

Even when anticipated, firewalls can continue to cause problems

One interviewee described how his team had previously encountered firewall problems and thought they had resolved these problems. However, upon a second implementation of the content, the firewall problem "blindsided" the team again. As a result, rather than using a chat room within the ADL effort, there has been consideration of using a bulletin board system instead, even though the incorporation of the chat room was perceived to add to the value of the instruction. Those working in ADL are advised to allow sufficient time to test for firewall problems prior to implementation as adjustments in instructional strategies and use of media may be similarly required.

A help desk can be beneficial to ensuring successful implementation

Two interviewees described how their team's ADL effort benefited greatly from having what one of them termed a "shakedown period." That is, they proactively called upon all students prior to the delivery of their course to ensure correct browser settings were used, all plug-ins were downloaded properly and functioning, questions were answered, etc. As a result, there was very little follow-up support needed. Even if an approach such as this is not feasible, having a live person to call upon can help to make the course run more smoothly, according to some interviewees. For those who will implement ADL efforts, consideration of how to deal with issues of support should be given early in the effort to plan for staffing of help desks, purchasing of call tracking software, and handling of other customer service-related issues.

Programmatic Considerations

When relying on another vendor's tools to complete an ADL effort, it is important to understand its functionality early in the effort rather than relying on a demo of the tool and expecting it to work as advertised

One interviewee provided an example in which another vendor's tools were being used to develop and deliver his team's web-based content, but his team did not have a copy of the tool at the beginning of the effort. Storyboards were developed based upon what instructional developers and programmers expected of the tool. One simple example of how the tool functioned differently than expected was that hot spots for test items required a rectangle instead of a circle. Once the team had the tool in hand, it became clear that these hot spots needed to be redone.

Because ADL works to exploit cutting edge technology, and because prototype efforts are geared to explore research issues, vendor tools used during prototype efforts may be expected to be in beta test form. Working with the tool early in an ADL effort can help to ensure that functionality matches expectations and can drive any modifications to the tools that are required to meet the intended needs. This could increase the efficiency of the effort.

An up-front investment in time to get all team members to discuss and understand SCORM prior to starting actual content development can pay dividends in the end

Interviewees commented that the SCORM document tends to be written more for software developers and programmers than for instructional developers. Several teams interviewed noted that they had assigned a software developer or programmer as their team's SCORM expert and that it was very important for the SCORM expert to work closely with the instructional developers to explain what could and could not be done to content in keeping with SCORM-conformance. Such an individual is particularly necessary because industry is still in the early stages of developing tools to support ADL content development. Teams working on ADL should consider that an initial investment on the part of the team to thoroughly discuss SCORM and the team member's roles in accomplishing the effort could pay dividends in the end. One instructional developer commented that he wished that he had spent two days learning just these issues prior to starting the actual work. Too often teams focus on "just getting the job done" due to time and resource constraints, but the upfront investment may save headaches and money in the long run.

It may help to get instructional designers and software developers/programmers to talk early in an ADL effort

Similar to the previous lesson learned, instructional designers/developers vary in the amount of experience they have with web-based instruction, and web software developers and programmers vary in the amount of experience they have working with design teams. Instructional developers also vary in the extent of their familiarity with HTML and other web-based technologies. Taking the time to get software developers and programmers to work closely from the beginning with the content developers can help clarify what can and cannot be done effectively over the web, and can explain web constraints such as those caused by bandwidth limitations. Instructional developers can then concentrate on how to make content as instructionally sound as possible given these constraints, and can ensure that software developers and programmers implement ISD principles. One interviewee explained some of the inefficiencies his team experienced when the designers and programmers worked on different project teams and not as closely as would have been optimal. Working together early in a project can help to avoid rework, thus saving time and money. The significance of this recommendation may be lessened in the future as ADL content development tools become robust and reliable enough to allow instructional designers and developers to create ADL without the aide of software professionals.

Multiple standards requiring compliance when delivering learning over the Internet may complicate ADL efforts

One interviewee explained that his agency is being tasked to ensure that all of the content it delivers over the Internet adheres to the Web Enabled Navy (WEN). Others who are working in Navy and Marine agencies, who are trying to comply with SCORM, may also need to comply with the WEN. The interviewee further noted that he is trying to work toward "de-conflicting" WEN and SCORM. Individuals working in ADL should be aware that there might be branch-specific guidance or standards to investigate when simultaneously attempting to comply with SCORM. Effort is needed to compile and integrate existing and proposed standards and specifications, as well as to get them out to the intended audience. The SCORM/WEN issue deserves targeted investigation as well to determine what exactly the WEN is, how it relates to SCORM, and whether or not "de-conflicting" is indeed needed.

SUMMARY/CONCLUSIONS

Gathering the lessons learned data through structured interviews revealed information that can be useful to a variety of individuals working in ADL, including content developers, software developers and programmers, program managers, SCORM developers, and policy decision makers. It also revealed important lessons regarding increasing the efficiency of gathering lessons learned information.

In addition to lessons that can be immediately applied, several technical challenges, programmatic issues, and policy issues were identified. These require systematic effort among the ADL community to resolve in order to advance the state-of-the-art in ADL. For example, Hays (2001) provided a theoretical perspective on ADL and identified how unresolved issues at higher levels perpetuate those at lower levels and vice versa. He outlined a plan for dealing with some of the ADL challenges by following a systems approach, and the lessons learned here support the need for implementing such a plan.

As SCORM evolves, as challenges are addressed, and as prototype efforts expand in nature, lessons learned will also evolve. Therefore, lessons learned should be continually updated to benefit the ADL community. Furthermore, in addition to the Joint ADL Co-Lab prototypes, much activity is occurring within other organizations. Lessons learned should also be gathered from this wider community. Other approaches to gathering this lessons learned data should also be explored, such as developing formal surveys based upon initial lessons learned, which can then be distributed to the wider audience. Using the web to provide access to lessons learned information could also help to ensure that a wider audience benefits from the information gathered. The authors welcome any lessons that *you* have learned.

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