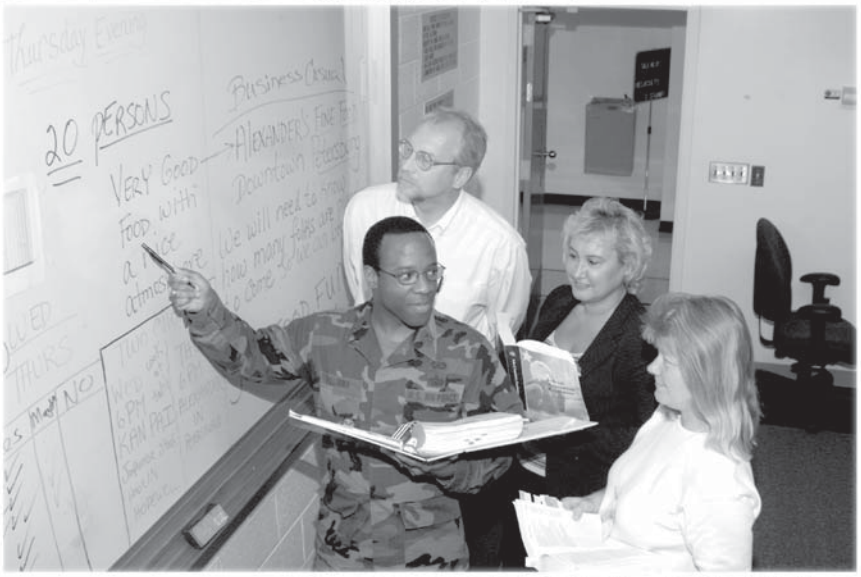
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MANAGING THE DEVELOPMENT OF TECHNOLOGY-BASED COURSES *SUCCESS FACTORS FROM EIGHT GOVERNMENT TRAINING COURSES*

John Bennett, Ellen Bunker, and Kurt Rowley

A study was conducted to determine whether success factors identified in traditional higher education distance learning research literature were important to technology-based course development efforts at Defense Acquisition University (DAU). The study included a literature review, a list of candidate success factors from the literature, data collected through interviews with eight faculty course development managers, and data analysis to correlate findings with the research literature. The study indicates that many of the success factors found in the literature were also important to management of the DAU course development projects. A number of additional success factors identified were important for the DAU courses and may be important for other distance education development environments. Recommendations for development managers of distance education courses are proposed.

Defense Acquisition University (DAU) is a corporate university charged with training the Department of Defense (DoD) acquisition workforce. This study investigated success factors for managing the development of eight technology-based courses at DAU and identified success factors that may be relevant to ongoing and future DAU course development efforts. The courses studied (see Table 1) range from entry-level courses taken on-line with no required instructor interaction to higher-level courses using sophisticated threaded storylines and hybrid (on-line and classroom) components. These eight courses were selected because they are representative of the courses that won DAU two consecutive U.S. Distance Learning Association (USDLA) Awards for Excellence in Distance Learning Programming for 2000 and 2001. In addition, they have been successfully deployed, meet or exceed all educational and administrative requirements, and cover the range of instructional designs and delivery modes DAU uses in most of its courses.

Table 1. DAU Course Summaries

Course	Students per Year[1]	Course Hours (Online/ Classroom)[2]	Development Time[3]	Training Certification Requirements Met	Course Description
Fundamentals of Systems Acquisition Management (ACQ 101)	10,500/yr	25/0	13 months (Oct 97-Nov 98)	Level I DAWIA* training certification in Acquisition Management. Required course for multiple career fields	• Integrated entry-level course covering eight functional career fields. • Lessons and exams accessed via the internet.
Intermediate Systems Acquisition Course (ACQ 201A/B)	5,000/yr	40/36	18 months (Jul 99-Mar 01)	Level II DAWIA* training certification in Acquisition Management. Required course for multiple career fields	• Intermediate level integrated course. • Scenario-based hybrid design using both internet-based and classroom (5 days) delivery modes.
Introduction to Acquisition Workforce Test and Evaluation (TST 101)	2,000/yr	30/0	18 mos (Jan 99- Oct 00)	Level I DAWIA* required training certification for Test and Evaluation career field	• Entry level course with lessons and exams accessed via the internet.
Basic Software Acquisition Management (SAM 101)	700/yr	19/0	10 months	Does not provide DAWIA* training certification (course targets students from all DAWIA* career fields and levels)	• Internet-based distance learning course for all levels of learners. • Not a certification course.
Program Manager's Tools Course (PMT 250)	720/year	56/24 (Virtual Classroom)	3 months for 65% solution, 7 months for 85% solution	Level II DAWIA* training certification in Program Management career field	• Unique hybrid design. • Internet based DL (8 lessons) followed by synchronous four-day virtual classroom using phone conferencing and LMS file sharing tool (Forum).

[1] Students per year figures are approximate.
[2] Course hours based on course design estimates.
[3] Development time obtained from Course Manager interviews. Generally, from the time the development contract was awarded to the start of the first production offering.

* Defense Acquisition Workforce Improvement Act (DAWIA)
** Business, Cost Estimating, Funds Management (BCF) functional area
Note: 100 series courses are entry-level, 200 series courses are intermediate level, and 300 series course are advanced level.

(continued)

Table 1. DAU Course Summaries (continued)

Course	Students per Year[1]	Course Hours (online/ classroom)[2]	Development Time[3]	Training certification requirements met	Course Description
Program Management Office Course (PMT 352)	700-1000/yr (first offerings started in June 02)	50/232	18 months total (DL fielded in 12 months)	Level III DAWIA* training certification in Program Management career field	• Hybrid design. • Integrated advanced-level course. • 10 modules of internet-based distance learning. • 12 scenario-based exercises over six weeks in the classroom. • LMS used to access classroom material and exams.
Fundamentals of Earned Value Management (BCF 102)	700/yr	60/0	About 20 months	Level I DAWIA* training certification in BCF** career field	Internet based distance learning modules for entry-level instruction in Earned Value Management
Acquisition Business Management (BCF 211)	170/yr	20 to 30/37	About 8 months	Level II DAWIA* training certification in BCF** career field	• Hybrid design, intermediate level course. • Students must pass three tests online within 60-day window. • Review material (no structured lessons) provided online as prerequisite to five-day classroom portion.

[1] Students per year figures are approximate.
[2] Course hours based on course design estimates.
[3] Development time obtained from Course Manager interviews. Generally, from the time the development contract was awarded to the start of the first production offering.

* Defense Acquisition Workforce Improvement Act (DAWIA)
** Business, Cost Estimating, Funds Management (BCF) functional area

Note: 100 series courses are entry-level, 200 series courses are intermediate level, and 300 series course are advanced level.

The process for managing the development of these courses mirrors the weapons system acquisition process. Both start with requirements generation and progress through concept, design, content development and programming, testing, and deployment. Interviews with the eight course development managers (all DAU faculty members with practitioner experience in systems acquisitions),

confirmed that many of the course development success factors are directly related to commonly accepted systems acquisition and program management techniques.

The distance education literature reports many success factors related to managing the development of technology-based university-level courses. Those most commonly cited include effective use of changing technologies, sufficient resources for course development and operation, creating educationally sound and engaging course designs, effective staffing, detailed planning, identifying and accommodating the needs of instructors and students, and ensuring sufficient technical expertise.

"The researchers used success factors described in distance learning research to help guide data collection."

Much of the existing information focuses on technology-based traditional university training. Compared to traditional universities, corporate universities face unique challenges. Because the corporation typically pays employee salaries while they are students at the corporate university, the training must be as efficient as possible. Also, the training investment is expected to transfer directly into job performance. These are strong incentives for creating effective learning environments that minimize employee time in the training environment.

The researchers used success factors described in distance learning research to help guide data collection. Interviews were conducted with the DAU course development managers, followed by analysis of data. The success factors identified from the literature review were then compared with success factors developed from the DAU interviews to determine which factors are common to both and which are unique to DAU. A set of proposed recommendations for distance learning program managers was developed from the results of the study. The study provided a strong grouping of success factors and recommendations that should apply to DAU as well as to management of the development of distance learning courses at similar institutions.

BACKGROUND

From the inception of formal DoD systems acquisition training in 1971 until the late 1990s, students have traveled to a DAU classroom location to attend courses. Students from more than 50 miles away incur temporary duty costs (travel, lodging, meals) that are paid by DAU. Until recently, class durations ranged from three days to 20 weeks. In response to downsizing and cost concerns in the mid-1990s, DAU developed a strategy to take advantage of emerging technologies and join the movement toward technology-based distance learning (commonly known as E-learning).

In the context of this study, a technology-based course is one that requires students and instructors to use the Internet and computer-based technologies to access and/or manage some or all aspects of the course. With contractor support, a unique Learning Management System (LMS) called the Virtual Campus was developed in 1998 in anticipation of hosting requirements for the to-be-developed Internet-based distance

learning courses. Since 1998, more than 18 technology-based courses (commonly known as on-line courses) have been developed by DAU, and more are planned. The number of graduates for each course ranges from several hundred to more than 10,500 students per year. Collectively, over 20,000 students graduate annually from these courses. The shift to on-line courses has significantly reduced the time students spend in the classroom environment, along with the associated costs.

Both mandatory and optional technology-based training courses are offered to over 130,000 Department of Defense acquisition workforce personnel in 11 career paths. Some courses are conversions from classroom courses, some are new courses designed specifically for the on-line environment, and some utilize a combination of new and existing material. The first courses were designed for Internet-based distance learning, with no physical classroom required. Later course designs, known as "hybrids," included both an Internet-based portion and an in-residence classroom portion. Table 1 summarizes the eight courses studied for this research project.

Review of Distance Learning Literature

The review identified success factors critical to managing the development of technology-based courses in the traditional university environment. General categories of success factors related to managing the development of distance education courses provided a basis for the development of a research protocol for interviewing course managers at DAU. The success factors identified in the literature review were then compared with success factors identified during analysis of the DAU interview transcripts.

Due to the immense body of knowledge related to distance education, selection criteria for the search were very narrow, focusing on reports of success factors for the management of distance education development projects. The search favored empirical results from controlled studies where possible. Additional sources that reflected collection of data from experienced distance educators were also included.

"Both mandatory and optional technology-based training courses are offered to over 130,000 Department of Defense acquisition workforce personnel in 11 career paths."

A summary of common problems related to innovation with on-line distance learning (Robinson, 2001) provided a useful method for success factor categorization. Based on the experience of 426 distance educators, Robinson classified distance education course issues related to innovation, leading to the four general categories of *resource availability, organizational issues, human resource capacity*, and *technology capabilities*. These four categories were used to organize success factors found in the literature.

Resource Availability

Resource issues figure prominently in the literature. Among the resources commonly identified as lacking during distance education course developments are time, funding, personnel, and a sufficient technology support infrastructure. Several authors

(Alexander, MacKenzie, & Geissinger, 1998; Brigham, 1992) cite the importance of instructional support services, as well as providing sufficient working time and realistic production deadlines, as success factors. Robinson (2001) points out that distance education projects are often underfunded as well as being too small in scope to be financially viable, suggesting that giving projects proper scope is necessary for success.

Organizational Issues

Organizational success factors are often tightly interwoven with an organization's structure and culture, and may be difficult to implement in some situations, especially when introducing innovation into the organization. However, when the development team considers certain factors, distance learning project outcomes can be enhanced. For example, distance education courses require unique internal coordination and administrative practices (Robinson, 2001). Research shows that descriptions of processes for determining course content and the approval of that content must identify clearly the people to be included in the process (Brigham, 1992). In addition, the organization must provide appropriate technical support (Alexander, MacKenzie, & Geissinger, 1998) and consistent organization-wide strategies for the use of technology in teaching and learning (Bates, 2000). Wagner (1995) identified the need for adequate organizational learner and instructor support. Finally, consideration of the overall attitudes of administrators, faculty, and staff toward the use of technology must be part of the course development (Brigham, 1992; Volery, 2001).

"Human resource capacity is tightly intertwined with other resource and organizational issues."

Human Resource Capacity

Human resource capacity is tightly intertwined with other resource and organizational issues. Several primary human resource issues were found in the literature. For example, development teams must produce quality materials and support the instructional requirements of a distance education environment (Brigham, 1992). Likewise, it is helpful to apply systematic and analytical methods of course design and development (Alexander, MacKenzie, & Geissinger, 1998); Wagner, 1995). The design and development needs require course developers to go beyond general conceptual planning and think through the details involved in a distance course (Robinson, 2001).

In an analysis of 104 Australian technology-based learning projects, Alexander, MacKenzie, and Geissinger (1998) determined that the instructional staff must address specific student needs, use the technology to enhance learning in ways not previously possible, use a sound and well-integrated instructional strategy, include learner support, and design assessments appropriate for technology-based delivery. A proper balance must be present between the capabilities of the instructional staff and the technical and instructional support staff (Volery, 2001), leading organizations with less technical support to invest additional resources in staff development.

Technology Capabilities

A broad range of technological success factors are identified in the literature

reviewed. Availability of adequate technical support is mentioned repeatedly and is tightly interwoven with the resource, organizational, and staffing issues described above. Lopez and Nagelhout (1995) note three success factors for the use of technology in on-line education: reliability, quality, and richness. Alexander, MacKenzie, and Geissinger (1998) note numerous technology success factors including software testing, software development expertise (where relevant), copyright issue resolution, and student access to hardware and software. Bates (2000) noted that there is a tension between the need for student technology access and equity of access to higher education. Bates also made the interesting note that due to the high and recurrent investment cost in technology, the use of new technologies may not provide overall cost savings.

The literature indicates that not all course developments end successfully, and failures can often be traced back to poor understanding at some level of how to balance the factors discussed above, or even ignorance of some of those factors.

Data Collection and Analysis Methods

The research design was largely qualitative and used guided interviews as the primary means of data collection. The interview protocol was designed to facilitate the exploration of the course managers' experiences and relate them to the general issues identified in the literature review. The interview protocol was validated with an initial interview conducted jointly by two researchers. A single researcher conducted all remaining interviews. All interviews were recorded and transcribed for the analysis.

The interview questions (see Appendix) were designed to provide field-based inputs from the eight DAU developmental course managers sufficient to allow the comparison of their experiences with the success factors identified in the literature. The interview questions were organized into three groups: stakeholder issues (organizational category issues), team-level issues in the development process (human resources issues), and course-level issues (resource availability and technology issues).

The interview method was face-to-face with follow-on contact for clarification. Data analysis included identification of 99 independent issues in the transcripts followed by organization of those issues into themes and then into candidate success factors. The course managers reviewed the results and a post-hoc analysis correlated the data with results of the literature review. As part of the post-hoc analysis, the DAU course managers reviewed the initial list of 10 most commonly occurring factors and their relative rankings. Based on their feedback, the initial list of 10 was reduced to eight by eliminating some redundancies.

"The research design was largely qualitative and used guided interviews as the primary means of data collection."

Results

The eight success factors, derived from the interview data, are described below:

1. *Effectively blending technologies* — This success factor includes researching and

analyzing available technologies and the most efficient mix of technologies, and considering methods of blending on-line and classroom delivery methods. Also included is understanding the impact of future changes driven by new technology. At DAU, entry-level courses typically require minimal instructor resources, while higher-level courses may have more interactive designs (e.g., blended (hybrid) on-line/classroom components), which require more resources.

2. *Technical configuration control* — This includes document version control, harmonization of design and development versions, and assurance of source documentation for all materials. Key challenges of configuration control for course developers were managing, tracking, updating and documenting the assignment of learning objectives to materials, creating test items based on the learning objectives and course content, and effectively managing developmental and production courseware releases. Real world policy changes must also be rapidly incorporated into courses, even as material is being developed, which adds to the configuration control challenge.

"Ineffective design strategies will not hold a student's interest in an on-line environment."

3. *Project planning and management techniques* — This involves defining overall course requirements and learning objectives *before* developing the course design; making management tradeoffs to achieve the optimum balance between cost, schedule, and quality; developing baselines and metrics for the course development; continually tracking and monitoring the course's progress against those baselines; and making changes as necessary to ensure adequate progress and performance. These techniques are also critical to the success of any systems acquisition.

4. *Meeting student needs with instructional design strategies* — This success factor is particularly critical for distance learning or hybrid courseware. Ineffective design strategies will not hold a student's interest in an on-line environment. Data from the DAU interviews show that effective strategies include the use of problem-based and scenario-based training mechanisms along with storylines integrated across part or all of the course. Several courses employ a highly blended strategy that uses the on-line part of the course to prepare students to work effectively in the classroom as part of a team. Other important design factors include planning adequate student time for course completion, matching the course level with the students' expected level of preparedness, and providing efficient and usable resources to the students (some of these are not directly controlled by the course developer, but can often be indirectly influenced).

5. *Availability of Subject Matter Experts (SMEs)* — Ideally, full-time SMEs are dedicated to the project. This was a

big issue for the ACQ and PMT courses since they required SMEs from many different departments. The interview data indicate that there was chronic under-estimation of the SME time required in most of the eight courses studied. In several cases, the orientation of faculty supervisors toward traditional classroom instruction made them reluctant to provide adequate SME support for on-line development. Organizing faculty schedules to allow sufficient time for SME support while fulfilling numerous other commitments was also a constant challenge.

6. *Effective use of testing and evaluation* — This includes early usability testing, periodic demonstrations to organizational stakeholders, formative testing during design, and pilot testing by both instructors and students. Some courses faced major challenges because of unforeseen firewall issues and Internet access issues that did not show up in testing and were not adequately considered during the course development. Early test planning with updates as necessary and feedback of results into the ongoing development are important elements of this success factor.

7. *Staffing and teaming* — This includes ensuring a proper skill mix and a sensible ratio of workers to supervisors, a positive and supportive work culture, protecting the team from distractions, collocation of team members where possible (this included both government and contractor personnel), and careful selection of working team member combinations. Most DAU managers emphasized the importance of an integrated team with clearly defined and well-understood processes for decisionmaking and content reviews (both internal and external). Early inputs from all team members on critical design and content decisions and effective and timely communication methods were identified as important elements of team processes. Collocation of contractor and Government personnel, which enhanced communications efficiency, was very important for ACQ 201 and both PMT courses due to their tight schedules, complex storylines, unique designs, and integrated content.

"Early inputs from all team members on critical design and content decisions and effective and timely communication methods were identified as important elements of team processes."

8. *Long-term technology support* — This success factor is similar to the challenges facing a program manager when considering interoperability and technology issues for a weapons system acquisition. It includes long-term technology planning, consideration of future requirements for interoperability of operating systems, ease of maintenance, and compatibility of courseware with future releases of plug-ins. These issues must be initially considered early in the development and revisited often as the course matures. Several of the DAU courses had to be partly redeveloped because of inadequate technology support.

For example, TST 101 was technically crippled when a new version of Flash software was widely distributed because an incompatible productivity tool was used during courseware programming. Because some of these early experiences, later courses used simpler, less volatile technology and had fewer problems in this area.

Once the eight DAU success factors were identified, each was rated by importance to each of the DAU courses included in the study. A rating of 1–5 was assigned to each

Table 2. Impact of Success Factors by Course
Success Factor Ranking Matrix

Courses \ Success Factors	Blending Technologies	Configuration Control	Project Management	Instructional Design	SME Availability	Test & Evaluation	Staffing/ Training	Long-term Technology*
Fundamentals of Systems Acquisition Management	3	5	5	4	4	5	4	4
Intermediate Systems Acquisition	5	4	5	5	4	4	5	3
Introduction to Acquisition Workforce Test and Evaluation	5	4	5	3	4	3	2	2
Basic Software Acquisition Management	3	5	2	3	4	5	3	3
Program Manager's Tools Course	4	4	5	3	5	4	5	4
Program Management Office Course	5	4	4	4	5	4	5	3
Fundamentals of Earned Value Management	5	4	4	5	3	3	3	5
Acquisition Business Management	5	4	4	4	2	3	3	3
Average Rating	4.4	4.3	4.1	3.9	3.9	3.9	3.8	3.4
Rank	1	2	3	4 (tie)	4 (tie)	4 (tie)	5	6

* Values for the long-term technology support success factor reflect the impact during development of each course. However, since the interviews were conducted, this factor has become a major issue for all courses due to the shift in DAU technology policy to address firewall, bandwidth and support issues, as well as the move in 2002 toward a new, standardized, Shareable Content Object Reference Module (SCORM) compliant Learning Management System.
KEY: 5-SF had major impact on course, 4-SF had significant impact on course, 3-SF had some impact on course, 2-SF had minimal impact on course, 1-SF had no impact on course

success factor for each course studied, and the results were tabulated. Table 2 shows the relative importance of each of the success factors to each of the eight courses.

Analysis of the transcripts indicated that course-related factors such as complexity of content and design, and course length, as well as non-course factors such as the background and personalities of key players, affected success factor rankings. Furthermore, changes in environmental elements during these course developments included:

- significant DAU organizational structure changes,
- management personnel turnover,
- increased LMS maturity and reliability, and
- increased levels of technical competence for both faculty and students.

All these factors influenced our results to some degree, but those effects are not specifically analyzed or addressed in this study.

Discussion

The initial and post-hoc data analysis of the information provided by the eight DAU course development managers confirmed that the success factors in the literature were generally important to the DAU course developments. The most noticeable similarity between the DAU results and the literature reviewed is the overall categories of success factors. Both address issues related to human resources and technology. The literature focuses on organizational issues, while the DAU results focus more on program management issues. This may be an expected outcome when one considers the program management office (practitioner) background of the course development managers and the similarities of course development and program management processes.

"The most noticeable similarity between the DAU results and the literature reviewed is the overall categories of success factors."

The study also revealed some noteworthy differences between the literature and DAU success factors. A focus on financial resources was less evident in the DAU environment. One possible reason for this difference is that the level of funding available to a corporate university such as DAU may be generally sufficient for the outlined mission of the organization, whereas traditional universities may allocate fewer resources to their technology-based course developments. Another interesting difference is the DAU emphasis on course design and development process issues such as technical configuration control, availability of SME time, the use of an integrated development team, and effectively blending technologies. While some of the same issues are present in the literature, they tend to fall under the human resources category, suggesting the possibility that course design and development at traditional universities may differ from the semi-independent course development project teams common at DAU.

Recommendations for Developers of Technology-Based Education Courses

Based on the DAU interview results and the distance learning literature, we developed a list of recommendations for

managers of distance learning development programs. While these recommendations are not all-inclusive, they supplement and in some cases parallel, recommendations found in the literature. They are particularly applicable to DAU, but should also constitute a relevant list for course developers in other environments as well.

1. If you determine that technology-based delivery for part or all of your course is appropriate, do not let a specific technology drive the course design. Instead, spend time up front determining educational objectives and developing an educationally sound instructional design. Follow this with market research to determine the most effective use of supporting technologies.

2. Allocate sufficient resources for effective configuration control throughout the course development process. This includes implementing processes for managing, tracking, updating, and documenting:
   - allocation of learning objectives to content,
   - assessments based on learning objectives and course content,
   - software versions, and
   - developmental and production courseware releases.

   Strong configuration control is particularly important for courses with dynamic content. Every team member must understand their role in configuration management and dedicate some of their time to configuration control.

3. Develop project management processes that support requirements-based development. These processes include early definition of learning objectives and course requirements (prior to course design activities); baseline tracking systems that allow managers to track cost, schedule, and quality issues; regular reviews of progress; and adjustments to project plans and management objectives based on these reviews.

4. Use interactive, reality-based instructional techniques such as problem- or scenario-based learning, team-based training, and cases and stories. These techniques are decidedly more engaging to students than traditional presentation approaches, particularly in a distance learning environment, and can be used with a variety of blended delivery technologies.

5. Allocate sufficient subject matter expert time for distance learning development project. This study showed that the time necessary for SME review of materials is often underestimated, yet SME input is critical to the success of any course. Faculty SMEs often do not know how to provide effective, timely support for technology-based course developments unless they have experience; so be prepared to train SMEs and plan for a learning curve with inexperienced SMEs. Also, make SMEs integral to the development team. This is especially important for courses with integrated, multi-subject material or with content that must be integrated

across different parts of the course (such as long storylines).

6. When testing distance learning environments, be sure that the test is conducted under conditions as close as possible to the actual production course environment. Often, problems go undetected during testing because the system was not stressed to the levels experienced by full student loads. A comprehensive test plan is important to eventual smooth operation of the course. Also, test often and at multiple stages of the course development. Be sure to test both the educational and technical aspects of the course, using both faculty and students.

7. Carefully control the staffing and development team arrangements. Critical issues include location of team members, managing distractions to the team, and implementing integrated product team strategies that allow all team members to provide inputs early in the development process. Effective multi-modal communication is essential, especially if team members are not co-located. Establish and promulgate clear processes for ensuring timely submission and review of materials. Revisit processes periodically and any time performance metrics indicate poor results, and make appropriate changes based on team inputs.

8. When making technology decisions, be sure to consider the long-term viability of your choices. Expect changes in technology and availability of support, and try to be conservative in expectations of the future of new or novel technologies. Use the experiences of previous course developers to avoid pitfalls.

CONCLUSIONS

This study determined that success factors identified in the traditional higher education distance learning literature are relevant to managing the development of distance education courses at DAU. These factors fall into the categories of resource availability, organizational issues, human resource capacity, and technology capabilities. Funds availability was one factor emphasized in the literature, but not as evident in the DAU data. The DAU data also identified additional success factors that were important to the DAU course managers, but were not emphasized in the in other environments. These include a focus on technical configuration control, availability of SME time, the use of an integrated development team, and effectively blending technologies.

"When making technology decisions, be sure to consider the long-term viability of your choices."

The study suggests that the professional education focus of DAU is partly responsible for the importance of the additional success factors identified, therefore the list of success factors may be applicable to institutions similar to DAU (in particular, corporate universities). Future research should elaborate the role of these additional success factors and clarify mechanisms for their

application in ongoing distance education development projects.

A list of recommendations for managers of technology-based course developments was created based on the DAU interview data. These recommendations should be applicable to institutions similar to DAU, and possibly are more generally applicable to other environments.

John Bennett, a retired Navy pilot and government program manager, is a professor of systems acquisition management at the Defense Acquisition University's Capital and Northeast Campus (formerly known as the Defense Systems Management College) at Fort Belvoir, VA. During the past six years, he has been directly involved in all phases of the development, testing, and implementation of a diverse range of technology-based courses — acting as subject matter expert, course designer, and development manager. Bennett holds both bachelor's and master's degrees in engineering. He is a designated DoD acquisition professional and is certified at DAWIA Level III in the program management career field.

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APPENDIX
DATA COLLECTION PROTOCOL

Protocol Questions for Success Factor Research — These questions formed the basis of interviewer-interviewee interactions. Most of the questions were not asked directly, but were used as a resource to help guide the discussion.

Set I: Course-level decisions

A. Describe how the course development project began.
   1. Who made the decision to include technology-based training?
   2. What/who influenced the decision?
   3. What constraints did that place on you?
   4. What initial decision led to important successes later in the project?
   5. What would have helped make the process smoother?

B. Describe the resources (time, budget, personnel) available to you.
   1. Who determined the level of resources?
   2. Who managed resources?
   3. How appropriate was the level of resource for the project?
   4. What was most successful about the allotment of resources?
   5. What would have helped make the development work progress more effectively?

C. Describe the development of the course design and structure.
   1. How was the main instructional strategy chosen? How were learning outcomes (objectives) selected?
   2. Who participated in these decisions?
   3. How did these decisions (or lack of decisions) influence development work?
   4. What would have made the process better?
   5. What worked best in the process?

D. Describe the process for choosing the type of technology (or mix of technologies).
   1. How was the technology(ies) determined?
   2. How did this influence the development and design?
   3. What difficulties did you have with the technology during the course development process?
   4. What worked well?

Set II: Team structure, function, and purpose

A. Group and team structure
   1. Describe the team composition.
   2. Were the team members good followers?

3. Did team members have adequate competence in their domain?
4. Describe the team's group process, was the team able to:
   a. Work under ambiguous conditions
   b. Tolerate ill-defined and emergent solutions
   c. Make decisions and live with constraints regarding solutions
   d. Be flexible to changing staff levels, personnel, schedules, tool availability, or other variables
5. How well was the team process supported during the project (time, resources, organizational structure)?
6. What technologies were used to support the team processes?
7. How was the team organized, and how was that organization maintained or adapted?

B. Group and team functions
1. How was the project vision shared with the team (initial course design and prototypes)?
2. What was the team involvement in definition of training problems?
3. What was the role of the team in determination and updating/maintaining of learning objectives throughout the development process?
4. What was the level of team involvement in selecting and designing/organizing the instructional approach?
5. What was the level of team involvement in selecting the technology and media?
6. What was the team involvement in the vendor selection process?
7. Describe typical working interpersonal relationships between team members.

C. Group and team objectives, goals, or purpose
1. What was the role of the teaming arrangement within the greater organization (why use the teams, managing impact of new technologies on training organizations, etc.)?
2. What was the scope of the teaming arrangement within the greater organization (involvement of upper management of both vendor and government, SMEs, developers, organization of the project)?
3. What was the team involvement in quality standards for all stages of product development?

Set III: Stakeholder roles and characteristics

A. Describe the primary stakeholders for the government.
1. Who are they?
2. What requirements and constraints were delivered to you with the project?
3. How did senior management convey their concerns and requirements?
4. How did senior management influence the work you did on the project?

B. Describe the learners.
   1. Who are they? What did you know about them at the start of the project?
   2. How did you interact with them?
   3. What role did learner evaluation play in the project?
   4. How did learners influence the work you did on the project?

C. Describe colleagues (not mentioned under section two) that were important during the development of the project.
   1. What were their roles?
   2. How did you interact with them?
   3. How did they influence your work?

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