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ARROYO CENTER

Enhancing Critical Thinking Skills for Army Leaders Using Blended-Learning Methods

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Summary

As the Army looks for more cost-effective, relevant, and timely means of delivering education and training, it has increasingly turned to distributed learning. Historically, technology-based distributed learning consisted largely of single-learner, self-paced interactive multimedia instruction. However, such methods may not be effective for all types of training and education, particularly those that involve teamwork; group communication; critical thinking; and joint, interagency, intergovernmental, and multinational operations. The Command and General Staff School's (CGSS's) Advanced Operations Course (AOC) is one example of a leader professional development course focused on Army Learning Model competencies. AOC focuses on developing junior field-grade staff officers' skills, including the wide range of complex cognitive skills involved in planning military operations, with students working collaboratively as members of an operational and tactical level staff. It is the second phase of Intermediate Level Education (ILE), building on the Common Core course.

CGSS offers AOC using both a traditional resident model and a model that the school refers to as *blended distributed learning* (BDL). AOC-BDL requires substantial instructor-student and student-student interaction but is completely distributed. That is, the course uses a computer-supported cooperative learning (CSCL) model with extensive synchronous and asynchronous collaboration among students and instructors, who are distributed geographically and across time zones. When charged with providing AOC to all Army branch officers in all regions of the world without affecting the personnel operating tempo, CGSS adopted a BDL model as a flexible approach to achieve through-

put and meet course goals. However, relatively little is known about the effectiveness of using a completely distributed approach to support the acquisition of critical thinking skills and related competencies.

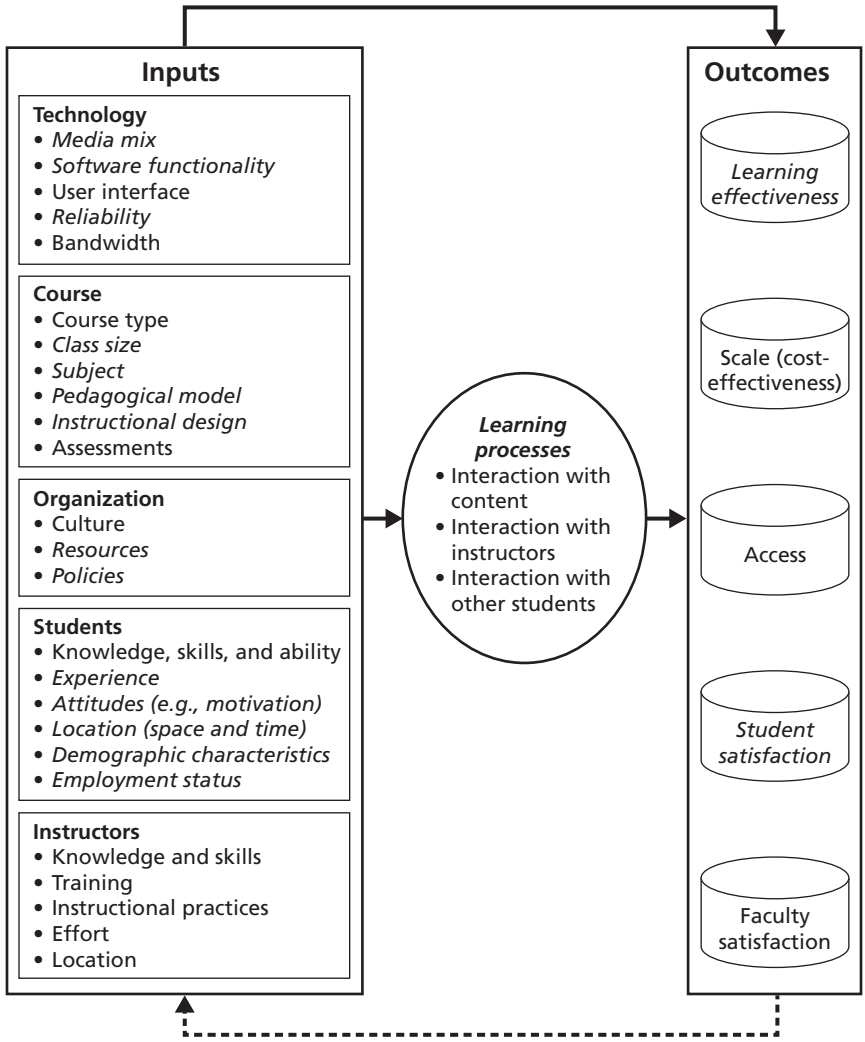
The purpose of the study was to build on prior RAND Arroyo Center research on the effectiveness of the delivery venues for the ILE Common Core by examining outcomes for AOC-BDL. This study had three objectives: to assess AOC-BDL effectiveness, to identify best practices in CSCL, and to use findings from these efforts to identify options for improving AOC-BDL. To conduct the study, we analyzed responses to exit surveys measuring student satisfaction and perceptions of course quality and impact and piloted a survey of former graduates who completed the 2009–2010 AOC curriculum sometime in the past two years. We also conducted a review of research literature on blended learning and conducted original case studies of blended learning programs in civilian higher education, military education, and industry.

We adapted Benbunan-Fich, Hiltz, and Harasim's (2005) online interaction learning model (see Figure S.1) as a conceptual framework for this study. Benbunan-Fich et al. posited that *input factors*, such as technology and course characteristics, influence *learning processes*, which in turn affect *outcomes*, such as learning and satisfaction.

The main components of the framework are as follows:

- **Inputs**: These comprise all the resources (including people) and contextual factors that contribute to the learning experience, including characteristics of technology, the course, instructors, students, and the organizational context.
- **Learning processes**: These are the ways through which people learn, e.g., the types and extent of interactions between students and course content, instructors, and other students (Moore, 1989).
- **Outcomes**: The framework includes the outcomes shown in Figure S.1 (learning effectiveness, scale or cost-effectiveness, access, student satisfaction, and faculty satisfaction). In this study, we focused primarily on two factors: learning effectiveness (as perceived by the students) and student satisfaction.

Figure S.1
Framework for Online Learning



SOURCE: Adapted from Benbunan-Fich, Hiltz, and Harasim, 2005.
NOTE: Items in italics are addressed in this report.

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The Blended Distributed Learning Advanced Operations Course

AOC-BDL was modeled after residential AOC, and the two venues are intended to be equivalent. Several course input factors are central to our analysis, conclusions, and suggested options for improvement in course design and delivery. These include the following:

- **Students.** The course includes students from both the active component and the reserve component (RC). Most students work full time and have families. Students typically complete the course requirements in addition to their normal work or duty day requirements and on weekends; therefore, they have many competing demands on their own time.
- **Course content and structure.** The course involves complex subject matter across multiple echelons and emphasizes peer collaboration and development of staff products. AOC develops the officer's abilities to analyze complex problems and recommend potential solutions and to build and ethically lead operational and tactical formations in a joint environment, among other goals. It has the equivalent of the 308 traditional classroom hours of instruction. To support a collaborative approach, AOC students are organized into 16-person groups called "staff groups," each of which is composed of officers representing as broad a mix of branches and operational experience as possible. Although some of the course content is completed individually, using interactive multimedia instruction (IMI), readings, and written assignments, a significant portion of the course uses virtual synchronous activities, including online classroom sessions (up to 20, two-hour sessions), and collaboration among students, to develop the staff products. Students are also required to participate in online threaded discussions about course topics.
- **Instructional technology.** A range of technologies supports synchronous and asynchronous instruction, including Blackboard's learning management system; Defense Connect Online (DCO), which is used for online synchronous interaction; IMI, also

referred to as computer-based instruction; simulations; and other communication media, such as email and telephone. Technologies that are supported by CGSS run in a "dotmil" domain.

- **Policy.** Department of the Army policy requires completion of the Common Core and AOC for promotion to lieutenant colonel in the active component and for promotion to colonel in the RC. Completion of both courses may also increase RC officers' potential for selection to many career-enhancing assignments. Unlike their colleagues in the resident course, students are not formally provided paid duty time to take AOC-BDL, and commanders are not required to allow students to take the course on duty time. Most students in this study reported working on discretionary time.

Satisfaction and Perceived Learning Effectiveness in AOC-BDL

In this section, we describe findings from a student survey administered at the end of AOC ("exit survey") and the results of a pilot survey given to former AOC-BDL graduates ("postgraduate survey").

Students Were Generally Satisfied with the Course

Responses to the exit survey indicate that nearly 80 percent of students felt that AOC-BDL achieved its core purpose. Most students gave favorable ratings to learning effectiveness for computer-based instruction and to operational topics, such as understanding joint force capabilities and limitations, the joint operational planning process, and change management processes. Most students also reported that they were satisfied with aspects of the learning environment, such as instruction quality and peer interaction and feedback, and they were generally satisfied with the course overall.

However, 50 percent of students in the exit survey and 29 percent of students in the postgraduate survey reported that they would not recommend the course to others. Although we do not have conclusive

evidence about the reasons for these responses, some possible alternatives are addressed next.

Students Noted Problems with Computer-Supported Collaboration for Learning

Students provided many detailed responses to open-ended questions about course design and delivery. A common theme in these comments, not reflected in other survey questions, pertained to issues with computer-supported collaboration and learning. As shown in Figure S.2, the preponderance of comments focused on the CSCL approach. While some comments were positive, the majority were negative. A number of students felt that face-to-face interaction was needed, particularly for such topics as the military decision making process (MDMP); the most common recommendation was to have a one- to two-week in-person exercise at the end of the course.

Students' Ratings of Course Effectiveness Suggest Improvement May Be Needed for Instruction of Some Course Topics

While students were satisfied with instruction for some operational topics, as described above, their ratings may indicate needs for improvement in general critical field-grade competencies. Among former graduates, approximately 40 to 60 percent reported small or no improvement in conducting MDMP, complex problem solving, organizational leadership, and oral and written communication (see Figure S.3). In addition, although most reported that the course prepared them to lead in Army and joint environments, students felt less prepared for operations in the international and interagency domains.

Some Students Emphasized that the Completely Distributed Environment Posed Challenges to Meeting Course Goals

Figure S.4 shows the negative sentiments about specific aspects of the CSCL approach. Most comments emphasized that the completely distributed environment impeded some course learning goals, such as

Figure S.2
Frequencies of Positive and Negative Comments—Exit Survey

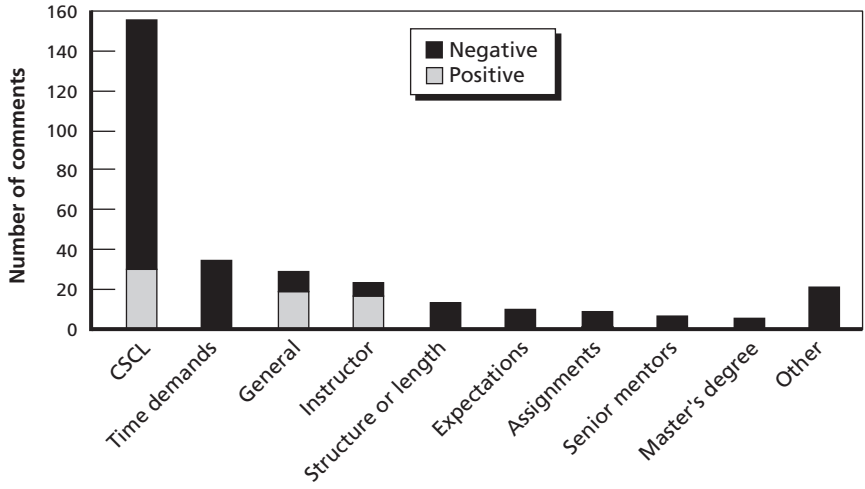

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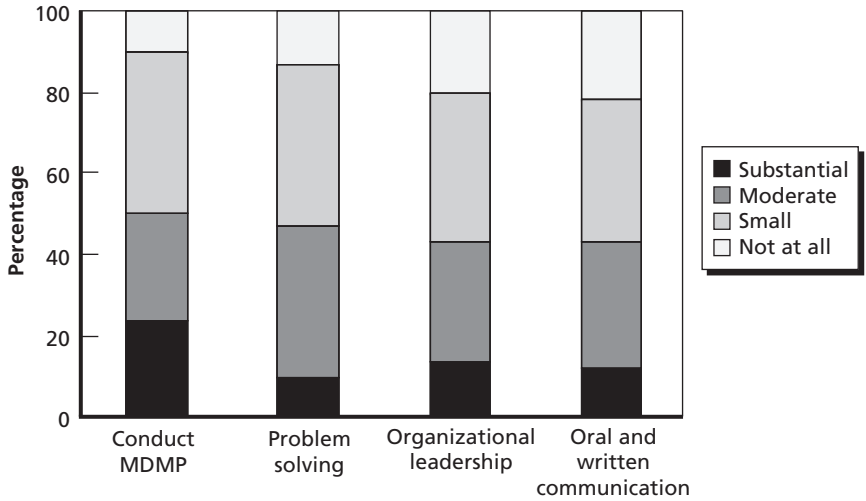
Figure S.3
Postgraduate Achievement of Critical Field-Grade Competencies



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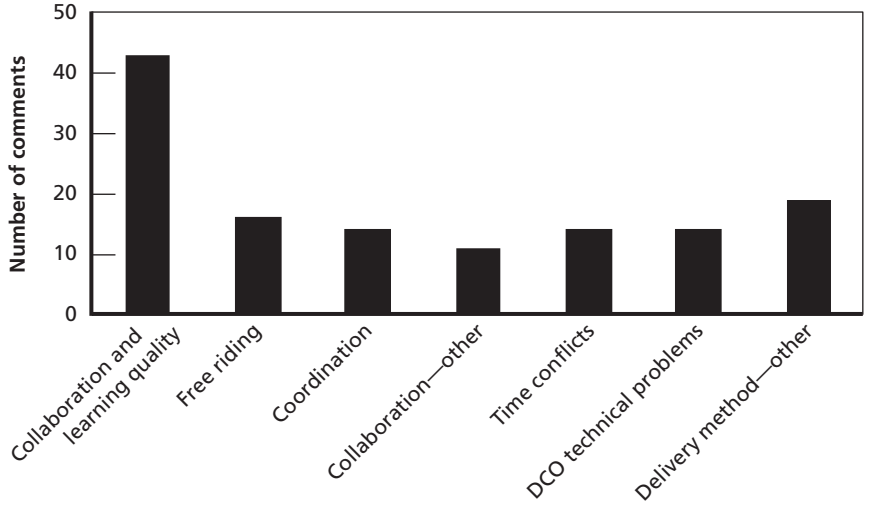
MDMP. Students also cited a variety of challenges to group coordination in terms of technology reliability and access, competing demands on their time, complexity of the coursework, and the challenges of working across time zones. Likewise, a number of the respondents in the postgraduate survey commented that face-to-face interaction was needed for truly effective learning and that, while the available technologies could support collaboration, conducting the MDMP process online was not beneficial. Although respondents reported being satisfied with peer feedback, students in both surveys noted other problems with collaboration, such as free riding (members not pulling their weight) and difficulties scheduling synchronous sessions with their teams.

The Reliability of Technology Posed Problems for Some Students

Approximately 30 to 40 percent of former graduates reported one or more problems with issues such as technical difficulties with computer-based instruction or reliable computer/Internet access. Not surpris-

Figure S.4
Specific Categories of Negative Comments About CSCL—Exit Survey



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ingly, technical issues, such as Internet access, were more problematic among students who were located outside the continental United States during part or all of the course. Similar questions in the exit survey showed that 13 to 23 percent of respondents had trouble accessing a reliable computer; playing audio, video, or animations; or accessing the course over the Internet. CGSS staff confirmed that technical problems with DCO and Blackboard were common.

Student Characteristics May Constrain Participation or Engagement in AOC-BDL

Several characteristics of the student population present obstacles to working on the course. Students reported substantial work and family commitments and responded that these responsibilities interfered with working on the course (or that working on the course was a distraction to performing their jobs). Only 14 percent of graduates reported that work or family commitments *did not* interfere with working on the course.

Peer Collaboration, Interaction with Instructor, and Student Motivation Most Strongly Associated with Course Outcomes

We conducted a series of analyses to examine associations among inputs, processes, and outcomes, where *outcomes* refers to overall satisfaction with the course and perceived learning effectiveness. There were several key findings. First, regarding input variables, whereas students' ratings of technology reliability were not associated with outcomes, work and family commitments were negatively associated with satisfaction (but not with learning effectiveness). Second, student motivation for taking the course was strongly associated with satisfaction and perceived learning effectiveness. Graduates who took AOC-BDL to improve their performance or professionalism were more satisfied and reported greater learning than those who took the course for promotion or another reason (e.g., to avoid moving or because they were told the course was required). Third, students' ratings of the quality of interaction with instructors and peers explained a substantial portion of outcome ratings beyond the effects of the input variables. Ratings of collaboration processes partially or fully mediated (accounted for)

the effect of inputs on outcome ratings. For example, work and family commitments had a negative effect on collaborative learning processes, which in turn affected satisfaction. These results highlight the importance of collaborative processes in the course.

Literature Review and Case Studies of BDL

Both the literature review and case studies focused on blended learning and distributed blended learning for adult learners in courses that address topics relevant to AOC (e.g., complex skills, collaboration). The literature review focused on empirical research published from 2007–2012, as well as seminal articles published prior to 2007; it also examined studies of virtual team collaboration. Our original case studies included Pennsylvania State University's (PSU's) World Campus, which offers 80 degree or certificate programs; the Naval Postgraduate School (NPS), an accredited graduate-level education and research institution run by the U.S. Navy; and Xerox's Service Delivery eXcellence, which teaches executives and managers service delivery and ways to solve service-related problems for clients and to expand business opportunities. We supplemented these original case studies with findings from published cases.

No Clear Advantage for Resident Instruction or Blended Learning, But There Are Few Examples of Effective All-Distributed BDL

A number of studies have investigated the use of various instructional media for adult learners. Many of these studies compared resident instruction and distributed learning and, for the most part, found no clear advantage for one medium or the other. Some recent meta-analyses concluded that distributed learning has an advantage, but many of the studies included in these analyses have methodological weaknesses, such as selection biases. Moreover, there are few studies of effective all-distributed BDL.

However, we did find a few examples of BDL relevant to AOC, including the award-winning Service Delivery eXcellence program at Xerox, which teaches leadership skills to executives and managers

around the globe; a pilot project to teach entrepreneurship education at three Canadian universities (Bisson et al., 2005); and a field experiment comparing face-to-face and online courses for community psychologists in Italy (Francescato et al., 2007). All three examples document successful delivery of BDL.

Instructional Design, Not Venue, Is Key Determinant of Effectiveness

Learning programs are effective when instructional strategies are designed to be compatible with human learning processes (Clark and Mayer, 2011). Thus, good instructional design will often differ according to the delivery medium used. Residential and distributed learning designs can differ along many dimensions, including instructional approach, collaborative practices, feedback mechanisms, and grading strategies.

Although scholars have concluded that blended learning and residential learning require different instructional designs, many experts believe that effective blended learning dealing with complex material requires some degree of in-person instruction (e.g., Bernard et al., 2004). In fact, standard definitions of blended learning (which include some face-to-face instruction) and the scarcity of BDL programs and research may be indications of the perceived need for some in-person instructional activities, particularly when teaching such skills as leadership.

New Technologies and Instructional Modalities Require Support to Be Effectively Adopted for Complex Learning

Instructors are more likely to adopt a technology if they anticipate that it will be beneficial to student learning, if it is easy to use, and if they have institutional support for its use. Our case studies document how institutions can support technology following the recommendations of Park and Bonk (2007a), e.g., by providing professional development for online teaching and by having instructional designers and media specialists available to work with faculty on course development. In addition, our case studies revealed that commercial-off-the-shelf and open-source software for learning management systems and collaborative activities can successfully support BDL.

Successful Programs Find Ways to Reduce Conflicts with Students' Other Commitments

Like AOC-BDL students, many adult learners lead busy lives and are geographically dispersed. We found that successful programs find ways to reduce conflicts with students' other commitments. Programs use two general approaches to address time commitments and time-zone differences. First, they tend to limit the use of synchronous modalities, for example, by offering either distributed learning *or* blended learning with a residential segment, but not BDL. This was the option the PSU programs preferred; directors and staff members said that they continue to use distributed learning rather than move to BDL because their students would resist the restrictions on their time imposed by the need to participate in synchronous online sessions. A second approach is to engage students' employers to dedicate time for students' coursework. For example, NPS requires that organizations employing prospective students agree to give students dedicated time for the course.

Virtual and Collocated Groups Can Achieve Comparable Outcomes Under the Right Circumstances

Numerous studies comparing outcomes of collocated and virtual groups show that collocated groups perform better on interdependent tasks, such as decisionmaking and problem solving, and express more positive outcomes, such as cohesion and trust, in the short term. However, when time is not constrained or when virtual teams interact over time, virtual teams "catch up" to collocated teams in performance and social outcomes. Nonetheless, there are a variety of important processes in collocated teams that are difficult to replicate in distributed groups, and, as a result, virtual teams sometimes interact in ways that inhibit collaborative learning.

Successful Programs Use a Variety of Methods to Foster Student Engagement and Success in Virtual Interactive Activities

Case studies describe options instructors use to engage students and help them succeed in virtual collaboration activities. First, many instructors train students to ensure that they know how to use the technology. Second, instructors can "scaffold" discussions and provide

timely feedback. For example, in the NPS Program Management master's program, instructors pose challenging questions in class or "cold call" on students to answer questions. Third, using small (rather than large) groups for interactive activities can alleviate free riding and facilitate interaction and coordination. Fourth, peer evaluations are used to increase accountability in teams.

Conclusions and Options for Improvement

AOC-BDL Has a Number of Strengths

In summary, AOC-BDL has a number of strengths. Despite significant constraints, most students report that AOC-BDL meets its core purpose. Furthermore, students give high ratings to items about the importance of student-instructor and student-student interaction, and students are consistently satisfied with their instructors. Students also report that most computer-based instruction lessons are effective. These indicators of success are more impressive in light of the fact that many students do not have a choice about the medium; that is, they cannot choose whether to attend the resident course or the BDL course. In contrast, educational institutions often give students a choice about enrolling in a resident or DL course; as a result, the relative effectiveness of these methods is often difficult to determine. CGSS's continuous improvement process is yet another strength in that it gives the school many opportunities to make needed adjustments to the course.

In addition to these strengths, participation in AOC-BDL provides some benefits that students in the resident course do not experience. Notably, by collaborating in virtual teams on complex tasks, students in AOC-BDL learn to work in situations that are increasingly common in operational environments and in other institutional settings.

Improvements Can Be Made

Despite these strengths, student responses indicate factors to consider in CGSS's continuous improvement process for AOC-BDL. Students'

ratings of learning effectiveness suggest the need for further investigation of instruction of critical field-grade competencies and leadership in a range of operational environments. For example, it would be beneficial to obtain input from students' commanders before and after the course with respect to knowledge, skills, and abilities in these areas.

More important, changes are needed to foster better collaboration among students to facilitate learning and coordination. Currently, AOC-BDL has a number of input factors in conflict, including complex subject matter, requirements for collaboration at a distance, use of technologies that are time consuming for collaboration, and students who have limited time available to devote to the course. Options for improvement in course design and delivery focus on alleviating the tensions among these factors.

Improving Course Design and Delivery

We present a number of options for improvement in course design and delivery, summarized in Table S.1. These options are based on an integration of survey results with best practices identified in case studies and the research literature. Suggestions address input factors including course design, student characteristics, technology, and organizational policy.

Modify Course Design

Adding a resident segment to the class offers the greatest potential for improvement in learning processes and outcomes and is consistent with student recommendations and best practices in military and civilian higher education. However, this change is also the most complicated in terms of scheduling and resourcing. Indeed, this option may not be feasible because of available infrastructure, costs, and operational manning requirements associated with temporary duty and course staffing. In light of these constraints, we argue that the remaining strategies become particularly important to consider.

A second option is to shift some collaborative activities to higher-level IMI (e.g., Level 3) and have fewer but more in-depth synchronous exercises, with more time spent reviewing plans, discussing the rationale for students' decisions, and evaluating alternative courses of

Table S.1
Summary of Options to Improve Course Design and Delivery

Strategy	Suggestion
Course design	Add a 1- to 2-week resident period at the end of the course to work on the most intensive collaborative activities
	Shift some collaborative activities to higher-level IMI or other assignments with iterative student-instructor interaction; have fewer but more in-depth synchronous exercises
	Implement peer evaluations
	Offer additional instructor facilitation to student groups and train students in team facilitation skills
Composition of student groups	Use smaller groups for team assignments and for larger group exercises
	Compose groups based on time zone
Organizational policy	Encourage chain of command or employers to provide dedicated time for training
Technology	Move to a dotcom domain
	Pilot alternative technologies for group collaboration and group online gaming and simulations

action. This approach might free some instructional resources, but IMI can be costly to develop and maintain. Alternatively, students could be given complex analytic individual assignments with iterative student-instructor interaction to foster complex thinking skills.

To increase accountability, CGSS could implement peer evaluations that would contribute to course grades. Better facilitation for student groups as they work on their assignments (from instructors, or by training the students themselves to facilitate) could also reduce free riding. These options are low cost and could be executed in the near term.

Change Composition of Student Groups

Using smaller groups, such as eight-person rather than 16-person staff groups for some exercises, would reduce free riding and alleviate some of the coordination challenges that students reported. CGSS should emphasize to instructors the importance of composing groups based

on time zone, and if a particular area of expertise needed for a group assignment is not available in a close time zone, providing a "stand-in" to serve in this role.

Affect Organizational Policy

It may be possible to reduce conflicts with job commitments by engaging students' employers (including commanders). This would entail finding ways to encourage commanders to provide duty time for required training. For RC students who work full time, CGSS could inform employers when an employee is taking the course, state expectations about what the student is required to do, and ask for support to allow the student to spend time on the course. Given that many of the skills addressed in AOC, such as problem solving, communication, and working in distributed teams, are relevant to a wide variety of jobs, the school might gain buy-in from employers by informing them how they can benefit from their employee's participation in the course.

Change Technology to Fit Course Design

Moving the course to a dotcom or dotedu domain could potentially alleviate some technology reliability issues that may inhibit access to the course. Hosting the course and tools for collaboration on a dotcom can also provide more options for collaborative technologies. For these reasons, Blackboard.com is being piloted with some staff groups, and CGSS anticipates moving to a dotcom domain entirely by 2014 (see Gould, 2013). A second suggestion is to continue to explore new technologies, including software for collaboration, as reported in our case studies, and technologies relevant to course content, such as online group games or simulations.

Expand Course Evaluation to Better Support a Continuous Improvement Process

Future evaluations of ILE courses should use a broader range of approaches. Although student assessments of their learning are often correlated with actual learning, survey responses are subjective. Future evaluations of AOC and other ILE courses should also analyze objective measures of learning, such as grades on assignments and tests. Because many of the competencies addressed in AOC are abstract, it

may be helpful to provide information to students to demonstrate their knowledge gain use a pretest-posttest approach.

It is important to note that the exit and postgraduate surveys were administered only to students who completed the course. In the future, CGSS should also assess the perceptions of those who drop out and their reasons for attrition. This omission is a key gap, given that the attrition rate is currently estimated at 25 percent. As a result of that high rate, survey responses likely overestimate the satisfaction and perceived learning effectiveness of the course. More important, the attrition rate significantly increases the cost of the course per graduate and keeps waiting lists unnecessarily long. Assessing reasons for attrition in more depth could lend additional urgency to the changes already suggested in this report or could lead to additional improvements in the course that could reduce the dropout rate.

Using multiple methods and data sources is important to provide information about different aspects of the course. Other sources of data for evaluation include

- data from commanders regarding graduates' job performance following AOC completion
- interviews or focus groups with students or faculty to obtain detailed feedback about the learning experience and recommendations for improvement
- Web-based analytics to investigate student use of online materials
- independent subject-matter experts' observation of class sessions.

Concluding Thoughts

This study identified important options to consider when training complex material using group collaboration that is entirely distributed. Because AOC-BDL objectives and instructional methods support Army Learning Model goals and because the course has many positive features, this blended learning approach should be considered for other courses. However, alternative approaches to collaboration are needed when course activities involve collaboration on complex mate-

rial. CGSS's experience and continuous development and evaluation efforts put the school in a position to identify such improvements and inform the Army training community about use of BDL for education and training.