United States Lifeguard Standards Coalition
Evidence Review

On the following pages, you will find a primary question (and in some cases ancillary questions), reviewed by the United States Lifeguard Standards Coalition (USLSC), the draft consensus recommendation of the USLSC, and the Scientific Review Forms (usually two) that detail the specific evidence upon which the consensus recommendation was based.

In most cases, for each question, two independent investigators researched existing evidence, including scientific research and other material, related to the question. Each investigator then completed a Scientific Review Form, listing the evidence and an evidence summary. The level and quality of evidence was rated using a standardized evidence evaluation process. The evidence reviewed included, but was not limited to, the following:

a. Population-based studies
b. Epidemiological studies
c. Case-control studies
d. Historic research
e. Case studies
f. Large observational studies
g. Review of past research summaries, and
h. Extrapolations from existing data collected for other purposes

The scientific reviews were presented to the entire USLSC. Each topic was presented, discussed and critiqued by the assembled experts until consensus was reached.

You are invited to comment on this question (as well as the others) and particularly whether you believe that the evidence adequately supports the consensus recommendation. If you are aware of any additional evidence (e.g. scientific research) that was not considered by the Lifeguard Standards Coalition, please list that evidence in your comments. In any comments you choose to make, please be sure to cite the line number, if you are referring to specific wording of the item.

Before commenting, please review the document in full. This includes an initial document, which contains the question or questions investigated and the consensus recommendation. This is followed, in most cases, by two Scientific Review Forms, which list the evidence that was considered in arriving at the consensus recommendation.

Thank you for your time and consideration in reviewing this question. The deadline for comments is December 12, 2009.

ONLINE LEARNING

Question

- Can basic life support (BLS) skills and selected lifeguard skills (eg, vigilance, scanning) and knowledge (eg, professional expectations, content knowledge) needed for adequate lifeguard performance be acquired as effectively through online learning as by traditional face-to-face instructional techniques?

Introduction

Distance learning media and technologies continue to expand rapidly, and more and more content, information, and skills are being delivered online. Entire major curricula at both the undergraduate and graduate levels are being delivered and diplomas earned completely online (ie, web-*based* learning). In fact, several institutions (eg, University of Phoenix) deliver all their courses and degree programs through web-based instructional pedagogies, while most other traditional "brick and mortar" institutions are rapidly expanding their online curricula.

Several areas of professional training (eg, firefighting) currently use a variety of *blended* instructional approaches and pedagogies (ie, web-*assisted*) to deliver knowledge and skills. Much ongoing professional development and training occurs using either entirely web-based online courses and workshops or some web-assisted instruction. Most recently, venues such as Second Life, Web 2.0, and even digital games such as *Wii* and *PlayStation,* are being used for digital media instructional purposes. The effectiveness of many contemporary web-based and web-assisted approaches has been studied extensively over the past decade. The most recent studies document that the use of well-designed web-assisted instructional components offer the potential for expanding the breadth and depth of learning available in a wide range of fields and disciplines, possibly including resuscitation and lifeguarding skills plus water safety knowledge.

Previous literature reviews and Consensus on Resuscitation Science and Treatment Recommendations (CoSTR) publications suggest that an online program could be developed to teach selected resuscitation and lifeguarding knowledge and skills. In fact, such blended online learning programs already exist, but all may not meet reasonable evaluation criteria.

Selected resuscitation skills to be learned online could include rescue breathing in or out of the water, single rescuer CPR, dual rescuer CPR, use of an automated external defibrillator (AED), use of a bag valve mask, oxygen administration, suction, or intubation. Selected lifeguarding skills, such as vigilance and scanning skills that require extensive practice, are acquired only on the job after certification might be acquired and practiced extensively using online learning. Various educational techniques may not have the same efficacy for every skill; this review focused on BLS, CPR, AED training, lifeguard scanning, and other content knowledge.

In practice, the concept of "online learning" is represented by a variety and range of techniques. Several companies offer "accredited" online training for CPR, AED, and BLS. Some of these fully web-based programs require viewing a presentation followed by filling in

a computer-graded test. Other programs, fitting the definition of blended online learning, require face-to-face interaction with an instructor after completing the online portion.

If the primary role of an instructor is evaluation, then the "acquisition" (ie, initial learning and practice) of a skill online can be separated from testing offline. Blended learning schemes for resuscitation skills may or may not include the use of a mannequin in video-assisted self instruction. Current web technology also can support real-time interactive voice and visual communication between a participant and an instructor, with various applications available via webcam or at a remote education center.

It must be considered whether selected resuscitation and lifeguarding skills can be learned effectively via self-instruction guided by a video presentation, whether the video is mailed to the participant, downloaded from a computer, or viewed interactively on a computer. Additional considerations include whether a mannequin is an essential component of the learning process and at what stage, if any, direct or remote interaction with an instructor is needed for training, feedback, and/or evaluation.

Six alternative hypotheses, adapted from CoSTR worksheets, have been derived from the original resuscitation question:

1. No differences exist in effectiveness of BLS and lifeguard skill acquisition, practice, and 6-month retention between traditional face-to-face and online instructional methods.
2. Traditional instructional methods (face-to-face lecture/demonstration/practice) are more effective in BLS and lifeguard skill acquisition, practice, and 6-month retention than all online instructional methods.
3. Interactive computer instructional methods are more effective in BLS and lifeguarding skill acquisition, practice, and 6-month retention than traditional face-to-face and other online methods.
4. Video self-instruction methods are more effective in BLS and selected lifeguarding skill acquisition, practice, and 6-month retention than traditional face-to-face or other online instructional methods.
5. A written BLS and lifeguarding test score adequately reflects competence in performing BLS and lifeguarding skills.
6. Other BLS or lifeguarding tests can be developed to validly, reliably, and objectively assess BLS and lifeguarding skills.

Because of time constraints reported to be related to the willingness of candidates to spend time earning their lifeguard certifications, the total length (ie, face-to-face contact time) of lifeguard courses has decreased by up to 50% over the past 27 years in some programs. The degree to which this decreased course length as well as number and type of skills has changed the competencies of lifeguards in general is unknown, but anecdotal evidence suggests that contemporary lifeguards, in fact, may possess poorer fitness and swimming skills as well as lifeguard content knowledge.

As it does for other professional development and in-service training programs, online instruction and learning offers the potential for adding standardized as well as individually modified web-assisted components to lifeguard training courses and subsequent in-service training. Acquisition of additional skills (eg, observational and scanning skills), higher

degrees of competency (eg, victim recognition), and improved delivery of both knowledge and skill (eg, using online knowledge testing) may provide a solution to current restrictions in initial course lengths.

This review focuses on some of the existing evidence about web-assisted learning related to knowledge and skills in a variety of academic domains and then extrapolates the evidence to its potential use in BLS and lifeguard training courses.

Evidence Summary

Primary information related to the question of acquisition of resuscitation skills was obtained from a review on BLS instructional methods of CoSTR 2005 recommendations and worksheets. Limited web searches were conducted using "online CPR" and similar key words. The primary source for the expanded review for all lifeguard skills and knowledges relied on a 2006 published report from a project, *The Effects of Traditional versus Web-Assisted Instruction on Learning and Student Satisfaction*, funded by the Andrew Mellon Foundation. The project was composed of a meta-analysis of existing literature on web-based instruction and a 3-year experimental study using technology to teach a basic communication course.

CoSTR studies:

"Educational Methods: Acquisition and retention of skills are poor after conventional CPR training. Evidence for and against several resuscitation training methods was reviewed, highlighting the need for further research."

"Effective BLS Instructional Methods: Consensus on Science. Nineteen randomized mannequin studies and one extrapolated study showed considerable variability in BLS skills acquisition and retention with the use of different instructional formats (video instruction, computer-assisted instruction, and traditional instruction). Four randomized studies using mannequins indicated that one video instruction program (a self-instructed synchronous "watch-while-you-practice" program) achieved better skills acquisition and retention than other educational formats. One randomized study of adult learners using mannequins showed that a brief video self-instruction program produced CPR skills performance equivalent to or better than traditional training."

"Effective BLS Instructional Methods: Treatment Recommendation. Instruction methods should not be limited to traditional techniques: newer training methods (eg, "watch-while-you-practice" video programs) may be more effective. Training programs should be evaluated to verify that they enable effective skills acquisition and retention."

Different studies are inconsistent with regard to what instructional technique is more effective than another. Most of the currently available evidence was included in that review. Articles published since the CoSTR results, eg "Effectiveness of a 30-min CPR self-instruction program for lay responders: a controlled randomized study" by Lynch et al in *Resuscitation* 2005;67(1):31-43, are unlikely to change the "treatment" recommendation given above.

Note that existing studies are not definitive or comprehensive. Regardless, the CoSTR recommendations are pertinent to the question of online learning. Presumably any

instructional technique, including specific online programs, could be acceptable if it included recommended evaluation criteria and resulted in most participants meeting the criteria. Any program without acceptable evaluation criteria or with poor success rates would be suspect. A useful question for future review is: Are there objective criteria for evaluating the effectiveness of (online) learning programs for resuscitation skills for lifeguards?

Benoit studies:

The results of the extensive meta-analysis and the subsequent experimental study (covering six university terms) concurred that there were no significant differences in academic performance between web-assisted and face-to-face instructional techniques.

Small significant decrements in student satisfaction associated with web-assisted instruction were reported in *Part 2 of the Benoit Study*, due in large part to difficulty/inconsistency in access to the electronic media. Over time, that dissatisfaction disappeared as the availability of electronic resources and access was solidified and as student skills in using electronic media improved.

In the meta-analysis, studies since 2002 demonstrated an increased likelihood of significantly greater performance increments associated with web-assisted instruction than with face-to-face instruction. The authors inferred that the improvement in online technology and access plus student familiarity with and wider use of technology accounted for the recent differences.

Extrapolation to lifeguard training:

Because of perceived unwillingness of prospective lifeguard candidates to enroll in lengthy courses, most current lifeguard courses provide neither sufficient in-class time for higher level skill and knowledge acquisition nor for actual skill practice of key observational skills (ie, scanning, victim identification) that have been identified as critical skills needed by lifeguards. Acquisition of critical skills through professional development/ in-service training relies exclusively on the knowledge, commitment, and resources of individual employers rather than on demonstrated exit competencies provided by the training agency.

The current observational/scanning competency of lifeguards is unknown because of a lack of controlled research. Anecdotal evidence reports varying degrees of scanning vigilance and competency among lifeguards (eg, Hunsucker, 2007; in press).

Web-assisted technology could provide the opportunity to promote acquisition of lifeguard observational skills without adding to face-to-face course time. Online modules could not only provide criterion-referenced drill and practice opportunities, but also assess student competence while simultaneously collecting and gathering data for establishing baseline lifeguard competencies in various knowledge and skills.

Other course content (knowledge domain) plus assessing mastery of that content (eg, via online knowledge quizzes and tests) could be provided effectively online without adding face-to-face time to courses. Online knowledge testing can be organized as formative (sometimes called “drill and practice”) evaluation in which candidates can repeatedly take tests or quizzes (with questions drawn randomly from a large pool or bank of questions) until the candidate reaches a desired level of mastery. Further, online discussion boards can actually enhance the amount of active learning time (ALT) in which learners are engaged as

opposed to more passive time spent in traditional classroom lecture-based instruction. Online instructional components would have the option of being provided before, during, and/or after the face-to-face portions of a lifeguard training course.

Standardizing the mode of instructional delivery for selected lifeguard course content by using online methodology could enhance the degree of acquisition of course content and ensure more uniform lifeguard knowledge and skills.

Limitations and caveats

- Adequate and reliable access to web-based resources is critical for student learning and satisfaction (which is related to motivation).
- Pilot testing of all online resources is extremely important to discover potential "bugs" and problems.
- Initial reaction to online learning, especially by nontraditional candidates and those with less experience and skill with online and electronic media, may be more negative, but should change positively with time and experience.
- Not all content is appropriate for online learning (eg, acquiring and improving actual performance skills such as swimming strokes and rescue techniques).
- Blended, or web-assisted, approaches are an excellent choice for complex and skill-based learning such as lifeguard training.

Studies that identified the efficacy of online instruction in BLS, CPR, and AED resuscitation skills were reported in the CoSTR 2005 studies. In contrast, no direct studies were reported regarding the efficacy of acquisition of other non-resuscitation lifeguarding skills using online instructional methods. The above summary extrapolated from studies of other knowledge content and disciplines. At least one proprietary lifeguard agency already is using online training, but to date no published research has described or documented the success or failure of those efforts.

In summary, evidence from 20 studies (LOE 2E) reviewed in CoSTR 2005 worksheets document variability in BLS skills acquisition and retention when learning is provided for various responders through different instructional formats. Five studies with learners using mannequins and videos showed performance equivalent to or better than traditional techniques.

Therefore, it is recommended that computer-assisted instruction may be used for resuscitation training for lifeguards when objective evaluation criteria are provided by training agencies as an *option*.

Further, based on a meta-analysis (LOE 1bE) and a large scale intervention study (LOE 2E), agencies that train lifeguards can consider that online web-assisted elements may effectively be added to lifeguard training courses *as an option* without any significant detriment in learning selected knowledge or skills. Expert opinion suggests that the acquisition of selected lifeguard skills (eg, scanning, vigilance) plus content knowledge may even be enhanced through the appropriate use of online learning and assessment technology.

Future research:

- Replicated experimental studies comparing face-to-face and online (web-based) teaching of specific lifeguard skills and knowledge (eg, scanning, victim identification, resuscitation skills, content knowledge) are needed either before *or* as an integral part of actively introducing online elements into lifeguard training.
- Subsequent and systematic research is needed to determine the degree of blended, or web-assisted, content that results in optimal learning.
- Experimentation is needed to create an optimal balance between face-to-face and online learning and assessment.
- Determination of objective criteria is needed for evaluating the effectiveness of (online) learning programs for resuscitation skills for lifeguards.

Consensus Recommendation

Lifeguard training agencies may provide online instruction of selected BLS and lifeguarding skills and content knowledge as part of lifeguard training certification programs as an option.

NOTE: **Any recommendation regarding online learning made in 2008 will need to be reexamined annually because online technology continues to evolve rapidly.**

Recommendations and Strength:

Standards:

Guidelines:

Options:

- Provide online training for selected BLS and lifeguarding skills and content knowledge with documented objective assessment of lifeguard candidates.

No Recommendations:

Unites States Lifeguard Standards Coalition
Scientific Review Form

Authors: David Bell Stephen Langendorfer, Ph.D.	**Organizations Representing:** Boy Scouts of America; American Red Cross (respectively)
Original Question: Can resuscitation skills needed for the victim of the drowning process be acquired through online learning?	**Date Submitted:** November 26, 2007

Question and Sub-Questions:
This should include the major question originally planned and any changes which occurred during the review process. Please also list any original sub-questions and the changes and those added during the review process.
Original Question: Can resuscitation skills needed for the victim of the drowning process be acquired through online learning?

Alternate Question 1: Can Basic Life Support (BLS) skills be acquired through online learning as effectively as by traditional instructional techniques?

Alternate Question 2: Can selected lifeguard skills (e.g., vigilance, scanning, resuscitation) and knowledge (e.g., professional expectations, content knowledge) needed for adequate lifeguard performance be acquired effectively through online learning?

Sub-question: If *yes*, is online learning of selected lifeguarding skills able to be acquired as effectively or more effectively as in face-to-face sessions?

Introduction/Background:
Provide any relevant background on the subject and the need to address this question.

With the expansion of distance learning media and technologies, more and more content, information, and skills are being delivered using online venues. Entire major curricula both at the undergraduate and graduate levels in higher education now are being delivered and diplomas earned completely on-line (i.e., web-based learning). Several institutions (e.g., University of Phoenix) deliver all their courses and majors through web-based instructional pedagogies and most other "brick and mortar" institutions are rapidly expanding their online curricula.

Several areas of professional training (e.g., firefighters) currently employ *blended* approaches (i.e., web-assisted) to the delivery and acquisition of knowledge and skills through the combined, or blended, use of online and face-to-face pedagogies. In fact, much on-going professional development and training occurs using either entirely web-based online courses and workshops or web-assisted instruction. The effectiveness of web-based and web-assisted approaches has been studied extensively in the past decade. It is obvious that the use of well-designed web-*assisted*, or blended, instructional components offers the potential for expanding the breadth and depth of learning available in a wide range of fields and disciplines including resuscitation, lifeguarding, and water safety knowledge and skills.

Previous literature reviews and CoSTR publications suggest that an online program could be developed to answer the question about effectively teaching and learning selected resuscitation and lifeguarding in the affirmative. In fact, such blended online learning programs already exist. On the other hand, certain existing online services may not meet reasonable evaluation criteria.

Selected resuscitation skills to be learned online could include rescue breathing in or out of the water, single rescuer CPR, dual rescuer CPR, AED use, bag valve mask use, O_2 administration, suction, insertion of oral airways, etc. Various educational techniques may not have the same efficacy for every skill. Since other research questions and reviews deal with suction and oxygen use, this portion of the review will focus on BLS, CPR, AED training.

In practice, the concept of "online learning" is represented by a variety and range of techniques. An internet search for "online CPR" revealed several companies offering "accredited" online training for CPR, AED, and BLS. Some of these fully web-based programs only require viewing a presentation followed by filling in a computer graded test. Others, fitting the definition of *blended online learning*, require face-to-face interaction with an instructor subsequent to completing the online portion.

If the role of an instructor is simply evaluation, then the current wording of the question under review implies that the "acquisition" (i.e., initial learning and practice) of a skill online can be separated from offline testing. Blended learning schemes for resuscitation skills may or may not include the use of a manikin in video assisted self instruction. Current web technology also can support real time interactive voice and visual communication between a participant and an instructor, with various applications available either at home with a webcam or at a remote education center distant from the instructor. Any generic recommendation rearding online learning made in 2007 easily will need revisiting as the technology continues to evolve.

One element of the question appears to be whether selected resuscitation skills can be learned effectively via self-instruction guided by a video presentation, whether or not that video is mailed to the participant, downloaded from a computer, or watched interactively on a computer. Corollary questions include whether a manikin is an essential component of the learning process and at what stage, if any, remote or direct interaction with an instructor is needed for training, feedback, and/or evaluation.

Several *alternative* hypotheses, adapted from CoSTR worksheets, may be derived from the original resuscitation question:

- H_1. No differences exist in effectiveness of BLS skill acquisition, practice, and 6 month retention when comparing traditional face-to-face and online instructional methods.
- H_2. Traditional (face-to-face lecture/demonstration/practice) instructional methods are more effective in BLS skill acquisition, practice, and 6 month retention compared to all on-line instructional methods.
- H_3. Interactive computer instructional methods are more effective in BLS skill acquisition, practice, and 6 month retention than traditional face-to-face and other online methods.
- H_4. Video self-instruction methods are more effective in BLS skill acquisition, practice, and 6 month retention than traditional face-to-face or other online instructional methods.
- H_5. A written BLS test score adequately reflects competence in performing BLS skills.

Due to reported time constraints related to the willingness of candidates to spend time earning their lifeguard certifications, the length (i.e., face-to-face contact time) of lifeguard courses has diminished by up to 50% over the past 27 years (e.g., American Red Cross, 1981; 2007). This reduction in the length of courses has limited the number and type of skills and knowledge being taught and learned by lifeguards. The degree to which this reduction in course length as well as number and type of skills has altered the competencies of lifeguards in general currently is unknown, but anecdotal evidence suggests that contemporary lifeguards, in fact, may possess poorer fitness and swimming skills as well as lifeguard content knowledge.

As with other professional development and in-service training programs, on-line instruction and learning offers the potential for adding standardized as well as individually-modified web-assisted components to lifeguard training courses and subsequent in-service training. Acquisition of additional skills (e.g., observational and scanning skills), higher degrees of competency (e.g., victim recognition) and improved delivery of both knowledge and skill (e.g., using on-line knowledge testing) may provide a solution to current restrictions in initial course lengths.

This scientific review focuses on some of the existing evidence about web-assisted student learning related to knowledge and skills in a variety of academic domains and then extrapolates the evidence to its potential use in lifeguard training courses.

Evidence Identification and Review

List the approach to gathering evidence. This should include any electronic databases searched with the terms used and numbers of articles found and reviewed. Also list any reports, prior evidence reviews analyzed and/or position papers evaluated.

Primary information related to the question of acquisition of resuscitation skilled was obtained from a review of CoSTR 2005 recommendations and worksheets. (See reference below.) Limited web searches were conducted using "online CPR" and similar key words.

The primary source for the expanded review for all lifeguard skills and knowledges relied on a 2006 published report from a project, *The Effects of Traditional versus Web-Assisted Instruction on Learning and Student Satisfaction*, funded by the Andrew Mellon Foundation. Authors of the report included Pamela J. Benoit, William L. Benoit, Jeffrey Milyo (all from the University of Missouri) and Glenn J. Hansen from the University of Oklahoma. The project was composed of a meta-analysis of existing literature on web-based instruction and a three year experimental study using technology to teach a basic communication course.

Additional database searches are on-going using Academic Search Premier, Sport Discus, Nexus and Lexis, and E.R.I.C.

Some academic journals dealing with web-based and web-assisted instruction or that include significant research articles addressing on-line learning:
Journal of Asynchronous Learning Networks
Journal of Interactive Online Learning
Journal of Instructional Psychology
Journal of Instructional Technology
Journal of Research on Technology in Education

Summary of Key Articles/Literature/Reports/Data Found and Level of Evidence

(Please fill in the following table for articles that were used to create your recommendations and/or guidelines)

Author(s) and Year published	Full reference	Summary of Article (if abstract available, first paste abstract and then provide your summary	Level of Evidence (Using table below)
CoSTR 2005, Section 1, Part 8, Effective BLS Instructional Methods	*Circulation* 2005 Vol 112, Issue 22, Supplement, Nov 29, 2005 AHA www.c2005.org Worksheets W185A, W185B, W192	Nineteen randomized manikin studies and one extrapolated study showed considerable variability in BLS skills acquisition and retention with the use of different instructional formats (video instruction, computer-assisted instruction, and traditional instruction). Four randomized studies using manikins indicated that one video instruction program (a self-instructed synchronous "watch-while-you-practice" program) achieved better skills acquisition and retention than other educational formats. One randomized study of adult learners using manikins showed that a brief video self-instruction program produced CPR skills performance equivalent to or better than traditional training.	Level 2 E
Pamela J. Benoit, William L. Benoit, Jeffrey Milyo, and Glenn J. Hansen	*The Effects of Traditional versus Web-Assisted Instruction on Learning and Student Satisfaction*	The purpose of Part One of the report was to investigate the effects of web-assisted instruction, compared to traditional (i.e., face-to-face) instruction on two key outcomes: student learning in the class and student satisfaction. RQ1: Is web-assisted instruction associated with greater learning in the course than traditional instruction in the literature? [RQ2: related to student satisfaction] A meta-analysis of 28 studies with 2361 participants was conducted. Statistical analyses used correlation coefficients (r) instead	Part 1: Level 1bE

Benoit, et al. (2006)		of Cohen's d. The overall weighted mean effect size was small and not statistically significant. Effect sizes across studies were heterogeneous and the date of the study was a moderator variable with the most recent studies having stronger effect sizes. Part Two assessed 2062 undergraduates in a basic communication course over 6 semesters to measure a variety of variables. No significant differences occurred between traditional and web-assisted courses except on student satisfaction.	Part 2: Level 2E

Level of Evidence	Criteria
Level 1a	Population based studies, randomized prospective studies
Level 1b	Large non-population based epidemiological studies, meta-analysis or small randomized prospective studies
Level 2	Prospective Studies which can include controlled, non-randomized, epidemiological, cohort or case-control studies
Level 3a	Historic which can include epidemiological, non-randomized, cohort or case-control studies
Level 3b	Case series: subjects compiled in serial fashion without control group, convenience sample, epidemiological studies, observational studies
Level 3c	Mannequin, animal studies or mechanical model studies
Level 4	Peer-reviewed works which include state of the art articles, review articles, organizational statements or guidelines, editorials, or consensus statements
Level 5	Non-peer reviewed published opinions, such as textbooks, official organizational publications, guidelines and policy statements and consensus statements
Level 6	Common practices accepted before evidence-based guidelines or common sense
Level 1-6E	*Extrapolations* from evidence which is for other purposes, theoretical analyses which is on-point with question being asked. Modifier E applied because extrapolated but ranked based on type of study.

Studies of student learning referenced in Benoit, et al. Part One meta-analysis:

Anstine, J., & Skidmore, M. (2005). A small sample study of traditional and online courses with sample selection adjustment. *Journal of Economic Education, 36*, 107-127.

Barak, M., Dori, Y.J. (2005). Enhancing undergraduate students' chemistry understanding through project-based learning in an IT environment. *Science Education, 89*(1), 117-139.

Benbunan-Fich, R., & Hiltz, S.R. (1999). Educational applications of CMCS: Solving case studies through asynchronous learning networks. *Journal of Computer-Mediated Communication* [online], *4*(3). Available http://www.ascusc.org/jcms/vol4/issue3/benbunan-fich.html.

Bobham, S.W., Deardorff, D.L., & Beichner, R.J. (2003). Comparison of student performance using web and paper-based homework in college-level physics. *Journal of Research in Science Teaching, 40*(10), 1050-1071.

Frederickson, N., Reed, P., & Clifford, V. (2005). Evaluating web-sponsored learning versus lecture-based teaching: Quantitative and qualitative perspectives. *Higher Education, 50*, 645-664.

Garland, D., & Martin, B.N. (2005). Do gender and learning style play a role in how online courses should be designed? *Journal of Interactive Online Learning, 4*, 67-81.

Kearns, L., Shoaf, J., & Summey, M. (2004). Performance and satisfaction of second-degree BSN students in web-based and traditional course delivery environments. *Journal of Nursing Education, 43*(6), 280-284.

Maki, W.S., & Maki, R.S. (2002). Multimedia comprehension skill predicts differential outcomes of web-based and lecture outcomes. *Journal of Experimental Psychology: Applied, 8*, 85-98.

Maki, R.H., Maki, W.S., Patterson, M., &Whitaker, P.D. (2000). Evaluation of a web-based introductory psychology course: I. Learning and satisfaction in on-line versus lecture courses. *Behavior Research Methods, Instruments, & Computers, 32*, 230-239.

Nichols, J., Shaffer, B., & Shockey, K. (2003). Changing the face of instruction: Is online or in-class more effective? *College and Research Libraries, 64*(5), 378-388.

Peterson, C.L., & Bond, N. (2004). Online compared to face-to-face teacher preparation for learning standards-based planning skills. *Journal of Research on Technology in Education, 35*, 345-360.

Pucel, D.J., & Stertz, T.F. (2005). Effectiveness of and student satisfaction with web-based compared to traditional in-service teacher education courses. *Journal of Industrial Teacher Education, 42*, 7-23.

Ridley, D.R., & Husband, J.E. (1998). Online education: A study of academic rigor and integrity. *Journal of Instructional Psychology, 24*(3), 184-188.

Ryan, M., Carlton, K.H., & Ali, N.S. (1999). Evaluation of traditional classroom teaching methods versus course delivery via the World Wide Web. *Journal of Nursing Education, 38*, 272-279.

Sankaran, S.R., Sankaran, D., & Bui, T.X. (2000). Effect of student attitude to course format on learning performance: An empirical study in web vs. lecture instruction. *Journal of Instructional Technology, 27*, 66-73.

Schulman, A.H., & Sims, R.L. (1999). Learning in an online format versus an in-class format: An experimental study. *T.H.E. Journal, 26*(11), 54-56.

Scheets, N.A., Gunter, P.L. (2004). Online versus traditional classroom delivery of a course in manual communication. *Exceptional Children, 71*, 109-120.

Schimazu, Y.M. (2005). Language course taught with online supplemental material: Is it effective? *Education, 126*, 26-36.

Steinweg, S.B., Davis, M.L., & Thompson, W.S. (2005). A comparison of traditional and online instruction in an introduction to special education course. *Teacher Education and Special Education, 28*, 62-73.

Summers, J.J., Waigandt, A., & Whittaker, T.A. (2005). A comparison of student achievement and satisfaction in an online versus a traditional face-to-face statistics class. *Innovative Higher Education, 29*(3), 233-250.

Taradi, S.K., Taradi, M., & Radic, K. (2005). Blending problem-based learning with web technology positively impacts student learning outcomes in acid-base technology. *Advances in Physiology Education, 29*, 35-39.

Teng, Y., & Allen, J. (2005). Using Blackboard in an educational psychology course to increase pre-service teachers' skills and confidence in technology integration. *Journal of Interactive Online Learning, 3*, 1-12.

Thirunarayanan, M.O., & Perez-Prado, A. (2001/2002). Comparing web-based and classroom-based learning: A quantitative study. *Journal of Research on Technology in Education, 34*(2), 131-137.

Wang, A.Y., & Newlin, M.H. (2000). Characteristics of students who enroll and succeed in psychology web-based classes. *Journal of Educational Psychology, 92*, 137-142.

Waschull, S.B. (2001). The online delivery of psychology courses: Attrition, performance, and evaluation. *Teaching of Psychology, 28*, 143-147.

Wegner, S.B., Holloway, K.C., & Garton, E.M. (1999). The effects of Internet-based instruction on student learning. *Journal of Asynchronous Learning Networks, 3*, 98-106.

Summary Table of Evidence

Place all the evidence listed in the previous sections in one of the following three columns using the follow approach:

65. *Place each article or report in one of the columns and in its own row*
66. *List articles with highest level of evidence first*
67. *In box place name of lead author and in parenthesis year published*
68. *In addition in each box put a one to two sentence summary of how the article either supports, opposes, or has no position with regard to the question(s)*

Supportive of Recommendation	Opposing Recommendation	No Position
CoSTR 2005		
Benoit, et al. (2006) Part 1		
Benoit, et al. (2006) Part 2		

Textual Summary of Evidence:

Please provide a textual summary of the all of the evidence reviewed and explain in detail how these lead to the guidelines, recommendations and/or options which you are proposing

CoSTR studies:

The following quotes are obtained from the CoSTR review of BLS instructional methods:

"Educational Methods: Acquisition and retention of skills are poor after conventional CPR training. Evidence for and against several resuscitation training methods was reviewed, highlighting the need for further research."

"Effective BLS Instructional Methods: Consensus on Science. Nineteen randomized manikin studies and one extrapolated study showed considerable variability in BLS skills acquisition and retention with the use of different instructional formats (video instruction, computer-assisted instruction, and traditional instruction). Four randomized studies using manikins indicated that one video instruction program (a self-instructed synchronous "watch-while-you-practice" program) achieved better skills acquisition and retention than other educational formats. One randomized study of adult learners using manikins showed that a brief video self-instruction program produced CPR skills performance equivalent to or better than traditional training."

"Effective BLS Instructional Methods: Treatment Recommendation. Instruction methods should not be limited to traditional techniques: newer training methods (e.g., "watch-while-you-practice" video programs) may be more effective. Training programs should be evaluated to verify that they enable effective skills acquisition and retention."

CoSTR results recognize the need for further research since different studies are inconsistent with regard to what instructional technique is more effective than another. Most of the currently available evidence was included in that review. Articles published since the CoSTR results, e.g. "Effectiveness of a 30-min CPR self-instruction program for lay responders: a controlled randomized study" by Lynch et al in *Resuscitation, Volume 67, Issue 1, October 2005 pages 31-43*, are unlikely to change the "treatment" recommendation given above.

Note that existing studies are not definitive or comprehensive. For example, the paper listed above supports the effectiveness of a training program for single rescuer CPR but does not address dual rescuer CPR.

The CoSTR recommendations are pertinent to the question posed by the Lifeguard Standards Coalition. Presumably any instructional technique, including specific online programs, will be acceptable if it includes recommended evaluation criteria and results in most participants meeting the criteria. Any program without acceptable evaluation criteria or with poor success rates would be suspect. A useful question for future review is: Are there objective criteria for evaluating the effectiveness of (online) learning programs for resuscitation skills for lifeguards?

Benoit studies:
The results of the extensive meta-analysis and the subsequent experimental study (covering 6 university terms) concurred that there were no significant differences in academic performance between web-assisted and face-to-face instructional techniques.

Small significant decrements in *student satisfaction* associated with web-assisted instruction were reported in Part 2, due in large part to difficulty/inconsistency in access to the electronic media. Over time, that dissatisfaction disappeared as the availability of electronic resources and access was solidified and student skills in using electronic media on-line improved.

In the meta-analysis, studies since 2002 demonstrated an *increased likelihood* of significantly greater performance increments associated with web-assisted instruction than with face-to-face instruction. The authors inferred that the improvement in on-line technology and access plus student familiarity with and wider use of technology accounted for the recent differences.

Extrapolation to lifeguard training:
Because of perceived unwillingness of prospective lifeguard candidates to enroll in lengthy courses, most current lifeguard courses do not provide sufficient in-class time for higher level skill and knowledge acquisition nor do they allow time for actual skill practice of key observational skills (i.e., scanning, victim identification) which have been identified as critical skills needed by lifeguards. Acquisition of critical skills through professional development/ in-service training relies exclusively on the knowledge, commitment, and resources of individual employers rather than on demonstrated exit competencies provided by the training agency.

The current observational/scanning competency of lifeguards is unknown due to a lack of controlled research. Anecdotal evidence reports varying degrees of scanning vigilance and competency among lifeguards (e.g., Hunsucker, 2007; in press).

Web-assisted technology could provide the opportunity to promote acquisition of lifeguard observational skills without adding to face-to-face course time. In fact, on-line modules not only could provide criterion-referenced drill and practice opportunities, but also assess student competence while simultaneously collecting and gathering data for establishing baseline lifeguard competencies in various knowledge and skills.

Other course content (knowledge domain) plus assessing mastery of that content (e.g., via on-line knowledge quizzes and tests) could efficaciously be provided on-line without adding face-

to-face time to courses. On-line knowledge testing can be organized as formative (sometimes called "drill and practice") evaluation in which candidates can repeatedly take tests or quizzes (with questions drawn randomly from a large pool or bank of questions) until the candidate reaches a desired criterion or high level of mastery. Further, on-line discussion boards can actually enhance the amount of active learning time (ALT) in which learners are engaged as opposed to more passive time spent in classrooms while encountering traditional lecture-based instruction. On-line instructional components would have the option of being provided before, during, and/or following the face-to-face portions of a lifeguard training course.

Standardizing the mode of instructional delivery for selected lifeguard course content by using on-line methodology could enhance the degree of acquisition of course content and ensure more uniform lifeguard knowledge and skills.

Limitations/ caveats

The caveats provided by the Benoit et al. studies suggest that

- Adequate and reliable access to web-based and Internet resources is absolutely critical for student learning and satisfaction (which is related to motivation);
- Pilot (alpha- and beta-) testing of any and all on-line resources is extremely important in order to discover potential "bugs" and problems;
- Initial reaction to on-line learning, especially by nontraditional candidates and those with less experience and lower skill with on-line and electronic media, will be more negative, but will change positively with time and experience;
- Not everything is appropriate for on-line learning (e.g., acquisition and improvement of actual performance skills such as swimming strokes and rescue techniques);
- Blended, or web-assisted, approaches are the obvious choice for complex and skill-based learning such as lifeguard training.

Research absent to answer question:

Studies that identified the efficacy of online instruction in BLS, CPR, and AED resuscitation skills were reported in the CoSTR 2005 studies. In contrast, no direct studies were reported regarding the efficacy of acquisition of other non-resuscitation lifeguarding skills using online instructional methods. The above summary was extrapolated from studies of other knowledge content and disciplines. Reportedly, at least one proprietary lifeguard agency already is using on-line training, but to date no published research has described or documented the success or failure of those efforts.

Future research needed:

- Replicated experimental studies contrasting face-to-face and online (web-based) teaching of specific lifeguard skills and knowledge (e.g., scanning, victim identification, resuscitation skills, content knowledge) are needed either before or as an integral part of actively introducing on-line elements into lifeguard training.
- Obviously, subsequent and systematic research will be needed to determine the degree of blended or web-assisted, content that creates optimal learning.
- Experimentation will be needed to create an optimal balance between face-to-face and on-line learning and assessment.

Preliminary Brief Evidence Summary and Guideline Document Section:

Evidence from twenty studies reviewed in CoSTR 2005 worksheets document variability in BLS skills acquisition and retention when learning is provided for various responders through different instructional formats. Five studies with learners using manikins and videos showed performance equivalent to or better than traditional techniques.

Therefore, it is recommended that computer-assisted instruction may be used for resuscitation training for lifeguards in situations where objective evaluation criteria are provided by training agencies as an option.

Preliminary Guideline Document Section:

Place your suggested recommendations into one or more of the three categories listed below and then briefly summarize the issue, your overall recommendations including answers to the question which was addressed as we should included it in the final document

Recommendations and Strength (using table below):

Standards:

Guidelines:

Options: It is recommended that computer-assisted instruction may be used optionally for resuscitation training for lifeguards in situations where objective evaluation criteria are provided by training agencies as an option.

Further, agencies training lifeguards should consider that on-line web-assisted elements may effectively be added to lifeguard training courses without any significant detriment in learning selected knowledge or skills. In fact, some evidence suggests that the acquisition of selected lifeguard skills (e.g., scanning, vigilance) plus content knowledge may be enhanced through the appropriate use of on-line learning and assessment technology.

No Recommendations:

Guideline Definitions for Evidence-Based Statements

Statement	Definition	Implication
Standard	A standard in favor of a particular action is made when the anticipated benefits of the recommended intervention clearly exceed the harms and the quality of the supporting evidence is excellent. In some clearly identified circumstances, strong recommendation standards may be made when high-quality evidence is impossible to obtain and the anticipated benefits strongly outweigh the harms.	One should follow a strong recommendation unless a clear and compelling rationale for an alternative approach is present.
Guideline	A guideline in favor of a particular action is made when the anticipated benefits exceed the harms but the quality of evidence is not as strong. Again, in some clearly identified circumstances, recommendations may be made when high quality evidence is impossible to	One would be prudent to follow a recommendation but should remain alert to new information.

	obtain but the anticipated benefits outweigh the harms.	
Option	Options define courses that may be taken when either the quality of evidence is suspect or, level and volume of evidence is small or carefully performed studies have shown little clear advantage to one approach over another.	One should consider the option in their decision-making.
No recommendation	No recommendation indicates that there is a lack of pertinent evidence and that the anticipated balance of benefits and harms is presently unclear	One should be alert to new published evidence that clarifies the balance of benefit versus harm

Unites States Lifeguarding Standard Coalition
Scientific Review Form

Author: David Bell	**Organization Representing: Boy Scouts of America**
Question: Can resuscitation skills needed for the victim of the drowning process be acquired through online learning?	**Date Submitted: 11/26/2007**

Question and Sub-Questions:

Original: Can resuscitation skills needed for the victim of the drowning process be acquired through online learning?

Alternate: Can BLS skills be acquired through online learning as effectively as by traditional techniques?

Introduction/Background:

Previous literature reviews and CoSTR publications suggest that an online program could be developed to answer the question in the affirmative for certain skills. Such programs may already exist if "blended learning" fits the definition of "online". However, certain existing online services may not meet reasonable evaluation criteria.

Resuscitation skills could include rescue breathing in or out of the water, single rescuer CPR, dual rescuer CPR, AED use, B-V-M use, O2 administration, suction, insertion of oral airways, etc. Various educational techniques may not have the same efficacy for every skill. Since other research questions deal with suction and oxygen use, perhaps this topic should focus on BLS or CPR and AED training.

The phrase "online learning" needs definition. An internet search for "online CPR" reveals several companies offering "accredited" online training for CPR, AED, and BLS. However, some only require viewing a presentation followed by filling in a computer graded test. Others require later face-to-face interaction with an instructor, which is a combination sometimes known as "blended learning". If the role of the instructor is simply evaluation, then the current wording of the question implies that the "acquisition" of the skill online can be separated from offline testing, but that may not meet the original intent. Blended learning schemes may or may not include the use of a manikin in video assisted self instruction. Current web technology can also support real time interactive voice and visual communication between a participant and an instructor, with various applications available either at home with a webcam or at a remote education center distant from the instructor. Any generic recommendation on online learning made today could easily need revisiting as the technology evolves.

The basic question appears to be if skills can be effectively learned via self-instruction guided by a video presentation, whether or not that video is mailed to the participant, downloaded from a computer, or watched interactively on a computer. Corollaries include whether a manikin is an essential component of the learning process and at what stage, if any, remote or direct interaction with an instructor is needed for training, feedback and/or evaluation. The following hypotheses, taken from CoSTR worksheets, may be derived from the question:

1. Traditional (lecture/demonstration/practice) instructional methods are most effective in BLS skill acquisition and retention.
2. Interactive computer program instructional methods are most effective in BLS skill acquisition and retention.
3. Video self-instruction instructional methods are the most effective in BLS skill acquisition and retention.
4. A written BLS test score does reflect BLS skills competence.
5. No specific instructional method (e.g. traditional lecture/practice session; interactive computer programs, video self-instruction; simplified material) is more effective than any other with regard to BLS skill acquisition and retention at 6 months.

Evidence Identification and Review

Primary information obtained from review of CoSTR 2005 recommendations and worksheets. (See reference below.) Limited web searches conducted on "online CPR" and similar key words.

Summary of Key Articles/Literature/Reports/Data Found and Level of Evidence

Author(s) and Year published	Full reference	Summary of Article (if abstract available, first past abstract and then provide your summary	Level of Evidence (Using table below)
CoSTR 2005, Section 1, Part 8, Effective BLS Instructional Methods	Circulation 2005 Vol 112, Issue 22, Supplement, Nov 29, 2005 AHA www.c2005.org Worksheets W185A, W185B, W192	Nineteen randomized manikin studies and one extrapolated study showed considerable variability in BLS skills acquisition and retention with the use of different instructional formats (video instruction, computer-assisted instruction, and traditional instruction). Four randomized studies using manikins indicated that one video instruction program (a self-instructed synchronous "watch-while-you-practice" program) achieved better skills acquisition and retention than other educational formats. One randomized study of adult learners using manikins showed that a brief video self-instruction program produced CPR skills performance equivalent to or better than traditional training.	Level 2 E

Level of Evidence	Criteria
Level 1a	Population based studies, randomized prospective studies
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Level 3a	Historic which can include epidemiological, non-randomized, cohort or case-control studies
Level 3b	Case series: subjects compiled in serial fashion without control group, convenience sample, epidemiological studies, observational studies
Level 3c	Mannequin, animal studies or mechanical model studies
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Level 5	Non-peer reviewed published opinions, such as textbooks, official organizational publications, guidelines and policy statements and consensus statements
Level 6	Common practices accepted before evidence-based guidelines, or common sense
Level 1-6E	Extrapolations from evidence which is for other purposes, theoretical analyses which is on-point with question being asked. Modifier E applied because extrapolated but ranked based on type of study.

Summary Table of Evidence

Supportive of Recommendation	Opposing Recommendation	No Position
CoSTR 2005		

Textual Summary of Evidence:

The following quotes are obtained from the CoSTR review of BLS instructional methods:

"Educational Methods: Acquisition and retention of skills are poor after conventional CPR training. Evidence for and against several resuscitation training methods was reviewed, highlighting the need for further research."

"Effective BLS Instructional Methods: Consensus on Science. Nineteen randomized manikin studies and one extrapolated study showed considerable variability in BLS skills acquisition and retention with the use of different instructional formats (video instruction, computer-assisted instruction, and traditional instruction). Four randomized studies using manikins indicated that one video instruction program (a self-instructed synchronous "watch-while-you-practice" program) achieved better skills acquisition and retention than other educational formats. One randomized study of adult learners using manikins showed that a brief video self-instruction program produced CPR skills performance equivalent to or better than traditional training."

"Effective BLS Instructional Methods: Treatment Recommendation. Instruction methods should not be limited to traditional techniques: newer training methods (eg, "watch-while-you-practice" video programs) may be more effective. Training programs should be evaluated to verify that they enable effective skills acquisition and retention.

CoSTR results recognize the need for further research since different studies are inconsistent with regard to what instructional technique is more effective than another. However, most of the currently available evidence was probably included in that review. Articles published since the CoSTR results, e.g. "Effectiveness of a 30-min CPR self-instruction program for lay responders: a controlled randomized study" by Lynch et al in *Resuscitation, Volume 67, Issue 1, October 2005 pages 31-43*, are unlikely to change the "treatment" recommendation given above.

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Therefore, it is recommended that computer-assisted instruction may be used for resuscitation training for lifeguards in situations where objective evaluation criteria are provided by training agencies as an option.

Recommendations and Strength (using table below):

Standards:

Guidelines:

Options:

No Recommendations:

Guideline Definitions for Evidence-Based Statements

Statement	Definition	Implication
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Option	Options define courses that may be taken when either the quality of evidence is suspect or, level and volume of evidence is small or carefully performed studies have shown little clear advantage to one approach over another.	One should consider the option in their decision-making.
No recommendation	No recommendation indicates that there is a lack of pertinent evidence and that the anticipated balance of benefits and harms is presently unclear.	One should be alert to new published evidence that clarifies the balance of benefit versus harm

Attach Any Lists, Tables or Summaries Created As Part Of This Review

Unites States Lifeguarding Standard Coalition
Scientific Review Form

Authors: Stephen Langendorfer, Ph.D.	**Organizations Representing:** American Red Cross
Revised Question: Can lifeguard skills (including observation, resuscitation) needed for the victim of the drowning process be acquired through online learning?	**Date Submitted:** November 26, 2007

Question and Sub-Questions:
This should include the major question originally planned and any changes which occurred during the review process. Please also list any original sub-questions and the changes and those added during the review process.

[Can resuscitation skills needed for the victim of the drowning process be acquired through online learning?]

Can selected lifeguard skills (e.g., vigilance, scanning, resuscitation) and knowledge (e.g., professional expectations, content knowledge) needed for performing adequately as a lifeguard be acquired effectively through online learning?

If yes, is on-line learning of selected lifeguarding skills able to be acquired as effectively or more effectively as in face-to-face sessions?

Introduction/Background:
Provide any relevant background on the subject and the need to address this question.

With the expansion of distance learning media and technologies, more and more content, information, and skills are being delivered using on-line venues. Entire major curricula both at the undergraduate and graduate levels in higher education now are being delivered and diplomas earned completely on-line (i.e., web-based learning). Several institutions (e.g., University of Phoenix) deliver all their courses and majors through web-based instructional pedagogies and most other "brick and mortar" institutions are rapidly expanding their on-line curricula.

Several areas of professional training (e.g., firefighters) employ *blended* approaches (i.e., web-assisted) to the delivery and acquisition of knowledge and skills through the use of both on-line and face-to-face pedagogies. In fact, much on-going professional development and training occurs using either entirely web-based on-line courses and workshops or web-assisted instruction. The effectiveness of web-based and web-assisted approaches has been studied extensively in the past decade. It is obvious that the use of well-designed web-assisted instructional components offers the potential for expanding the breadth and depth of learning available in a wide range of fields and disciplines including lifeguarding and water safety.

Due to reported time constraints related to the willingness of candidates to spend time earning their lifeguard certifications, the length (i.e., face-to-face contact time) of lifeguard courses has diminished by up to 50% over the past 20 years. This constriction in the length of courses has reduced the number and type of skills and knowledge being taught and learned by lifeguards. The degree to which this reduction in course length as well as number and type of skills has altered the competencies of lifeguards in general currently is unknown, but anecdotal evidence suggests that contemporary lifeguards, in fact, may possess poorer fitness and swimming skills as well as lifeguard content knowledge.

As with other professional development and in-service training programs, on-line instruction and learning offers the potential for adding standardized as well as individually-modified web-assisted components to lifeguard training courses and subsequent in-service training. Acquisition of additional skills (e.g., observational and scanning skills), higher degrees of competency (e.g., victim recognition) and improved delivery of both knowledge and skill (e.g., using on-line knowledge testing) may provide a solution to current restrictions in initial course lengths.

This scientific review focuses on some of the existing evidence about web-assisted student learning related to knowledge and skills in a variety of academic domains and then extrapolates the evidence to its potential use in lifeguard training courses.

Evidence Identification and Review

List the approach to gathering evidence. This should include any electronic databases searched with the terms used and numbers of articles found and reviewed. Also list any reports, prior evidence reviews analyzed and/or position papers evaluated.

The primary source for the current review relies on a 2006 published report from a project, *The Effects of Traditional versus Web-Assisted Instruction on Learning and Student Satisfaction*, funded by the Andrew Mellon Foundation. Authors of the report included Pamela J. Benoit, William L. Benoit, Jeffrey Milyo (all from the University of Missouri) and Glenn J. Hansen from the University of Oklahoma. The project was composed of a meta-analysis of existing literature on web-based instruction and a three year experimental study using technology to teach a basic communication course.

Additional database searches are on-going using Academic Search Premier, Sport Discus, Nexus and Lexis, and E.R.I.C.

Some academic journals dealing with web-based and web-assisted instruction or that include significant research articles addressing on-line learning:
Journal of Asynchronous Learning Networks
Journal of Interactive Online Learning
Journal of Instructional Psychology
Journal of Instructional Technology
Journal of Research on Technology in Education

Summary of Key Articles/Literature/Reports/Data Found and Level of Evidence

(Please fill in the following table for articles that were used to create your recommendations and/or guidelines)

Author(s) and Year published	Full reference	Summary of Article (if abstract available, first paste abstract and then provide your summary	Level of Evidence (Using table below)
Pamela J. Benoit, William L. Benoit, Jeffrey Milyo, and Glenn J. Hansen	*The Effects of Traditional versus Web-Assisted Instruction on Learning and Student Satisfaction*	The purpose of Part One of the report was to investigate the effects of web-assisted instruction, compared to traditional (i.e., face-to-face) instruction on two key outcomes: student learning in the class and student satisfaction. RQ1: Is web-assisted instruction associated with greater learning in the course than traditional instruction in the literature? [RQ2: related to student satisfaction] A meta-analysis of 28 studies with 2361 participants was conducted. Statistical analyses used correlation coefficients (r) instead of Cohen's d. The overall weighted mean effect size was small and not statistically significant. Effect sizes across studies were heterogeneous and the date of the study was a moderator variable with the most recent studies having stronger effect sizes. Part Two assessed 2062 undergraduates in a basic communication course over 6 semesters to measure a variety of variables. No significant differences occurred between traditional and web-assisted courses except on student satisfaction.	Part 1: Level 1bE Part 2: Level 2E

Level of Evidence	Criteria
Level 1a	Population based studies, randomized prospective studies
Level 1b	Large non-population based epidemiological studies, meta-analysis or small randomized prospective studies
Level 2	Prospective Studies which can include controlled, non-randomized, epidemiological, cohort or case-control studies
Level 3a	Historic which can include epidemiological, non-randomized, cohort or case-control studies

Level 3b	Case series: subjects compiled in serial fashion without control group, convenience sample, epidemiological studies, observational studies
Level 3c	Mannequin, animal studies or mechanical model studies
Level 4	Peer-reviewed works which include state of the art articles, review articles, organizational statements or guidelines, editorials, or consensus statements
Level 5	Non-peer reviewed published opinions, such as textbooks, official organizational publications, guidelines and policy statements and consensus statements
Level 6	Common practices accepted before evidence-based guidelines or common sense
Level 1-6E	*Extrapolations* from evidence which is for other purposes, theoretical analyses which is on-point with question being asked. Modifier E applied because extrapolated but ranked based on type of study.

Studies of student learning referenced in Benoit, et al. Part One meta-analysis:

Anstine, J., & Skidmore, M. (2005). A small sample study of traditional and online courses with sample selection adjustment. *Journal of Economic Education, 36*, 107-127.

Barak, M., Dori, Y.J. (2005). Enhancing undergraduate students' chemistry understanding through project-based learning in an IT environment. *Science Education, 89*(1), 117-139.

Benbunan-Fich, R., & Hiltz, S.R. (1999). Educational applications of CMCS: Solving case studies through asynchronous learning networks. *Journal of Computer-Mediated Communication* [online], *4*(3). Available http://www.ascusc.org/jcms/vol4/issue3/benbunan-fich.html.

Bobham, S.W., Deardorff, D.L., & Beichner, R.J. (2003). Comparison of student performance using web and paper-based homework in college-level physics. *Journal of Research in Science Teaching, 40*(10), 1050-1071.

Frederickson, N., Reed, P., & Clifford, V. (2005). Evaluating web-sponsored learning versus lecture-based teaching: Quantitative and qualitative perspectives. *Higher Education, 50*, 645-664.

Garland, D., & Martin, B.N. (2005). Do gender and learning style play a role in how online courses should be designed? *Journal of Interactive Online Learning, 4*, 67-81.

Kearns, L., Shoaf, J., & Summey, M. (2004). Performance and satisfaction of second-degree BSN students in web-based and traditional course delivery environments. *Journal of Nursing Education, 43*(6), 280-284.

Maki, W.S., & Maki, R.S. (2002). Multimedia comprehension skill predicts differential outcomes of web-based and lecture outcomes. *Journal of Experimental Psychology: Applied, 8*, 85-98.

Maki, R.H., Maki, W.S., Patterson, M., &Whitaker, P.D. (2000). Evaluation of a web-based introductory psychology course: I. Learning and satisfaction in on-line versus lecture courses. *Behavior Research Methods, Instruments, & Computers, 32*, 230-239.

Nichols, J., Shaffer, B., & Shockey, K. (2003). Changing the face of instruction: Is online or in-class more effective? *College and Research Libraries, 64*(5), 378-388.

Peterson, C.L., & Bond, N. (2004). Online compared to face-to-face teacher preparation for learning standards-based planning skills. *Journal of Research on Technology in Education, 35*, 345-360.

Pucel, D.J., & Stertz, T.F. (2005). Effectiveness of and student satisfaction with web-based compared to traditional in-service teacher education courses. *Journal of Industrial Teacher Education, 42*, 7-23.

Ridley, D.R., & Husband, J.E. (1998). Online education: A study of academic rigor and integrity. *Journal of Instructional Psychology, 24*(3), 184-188.

Ryan, M., Carlton, K.H., & Ali, N.S. (1999). Evaluation of traditional classroom teaching methods versus course delivery via the World Wide Web. *Journal of Nursing Education, 38*, 272-279.

Sankaran, S.R., Sankaran, D., & Bui, T.X. (2000). Effect of student attitude to course format on learning performance: An empirical study in web vs. lecture instruction. *Journal of Instructional Technology, 27*, 66-73.

Schulman, A.H., & Sims, R.L. (1999). Learning in an online format versus an in-class format: An experimental study. *T.H.E. Journal, 26*(11), 54-56.

Scheets, N.A., Gunter, P.L. (2004). Online versus traditional classroom delivery of a course in manual communication. *Exceptional Children, 71*, 109-120.

Schimazu, Y.M. (2005). Language course taught with online supplemental material: Is it effective? *Education, 126*, 26-36.

Steinweg, S.B., Davis, M.L., & Thompson, W.S. (2005). A comparison of traditional and online instruction in an introduction to special education course. *Teacher Education and Special Education, 28*, 62-73.

Summers, J.J., Waigandt, A., & Whittaker, T.A. (2005). A comparison of student achievement and satisfaction in an online versus a traditional face-to-face statistics class. *Innovative Higher Education, 29*(3), 233-250.

Taradi, S.K., Taradi, M., & Radic, K. (2005). Blending problem-based learning with web technology positively impacts student learning outcomes in acid-base technology. *Advances in Physiology Education, 29*, 35-39.

Teng, Y., & Allen, J. (2005). Using Blackboard in an educational psychology course to increase pre-service teachers' skills and confidence in technology integration. *Journal of Interactive Online Learning, 3*, 1-12.

Thirunarayanan, M.O., & Perez-Prado, A. (2001/2002). Comparing web-based and classroom-based learning: A quantitative study. *Journal of Research on Technology in Education, 34*(2), 131-137.

Wang, A.Y., & Newlin, M.H. (2000). Characteristics of students who enroll and succeed in psychology web-based classes. *Journal of Educational Psychology, 92*, 137-142.

Waschull, S.B. (2001). The online delivery of psychology courses: Attrition, performance, and evaluation. *Teaching of Psychology, 28*, 143-147.

Wegner, S.B., Holloway, K.C., & Garton, E.M. (1999). The effects of Internet-based instruction on student learning. *Journal of Asynchronous Learning Networks, 3*, 98-106.

Summary Table of Evidence

Place all the evidence listed in the previous sections in one of the following three columns using the follow approach:

69. *Place each article or report in one of the columns and in its own row*
70. *List articles with highest level of evidence first*
71. *In box place name of lead author and in parenthesis year published*
72. *In addition in each box put a one to two sentence summary of how the article either supports, opposes, or has no position with regard to the question(s)*

Supportive of Recommendation	Opposing Recommendation	No Position
Benoit, et al. (2006) Part 1		
Benoit, et al. (2006) Part 2		

Textual Summary of Evidence:

Please provide a textual summary of the all of the evidence reviewed and explain in detail how these lead to the guidelines, recommendations and/or options which you are proposing

The results of the extensive meta-analysis and the subsequent experimental study (covering 6 university terms) concurred that there were no significant differences in academic performance between web-assisted and face-to-face instructional techniques.

Small significant decrements in *student satisfaction* associated with web-assisted instruction were reported in Part 2, due in large part to difficulty/inconsistency in access to the electronic media. Over time, that dissatisfaction disappeared as the availability of electronic resources and access was solidified and student skills in using electronic media on-line improved.

In the meta-analysis, studies since 2002 demonstrated an *increased likelihood* of significantly greater performance increments associated with web-assisted instruction than with face-to-face instruction. The authors inferred that the improvement in on-line technology and access plus student familiarity with and wider use of technology accounted for the recent differences.

Extrapolation to lifeguard training:

Because of perceived unwillingness of prospective lifeguard candidates to enroll in lengthy courses, most current lifeguard courses do not provide sufficient in-class time for higher level skill and knowledge acquisition nor do they allow time for actual skill practice of key observational skills (i.e., scanning, victim identification) which have been identified as critical skills needed by lifeguards. Acquisition of critical skills through professional development/ in-service training relies exclusively on the knowledge, commitment, and resources of individual employers rather than on demonstrated exit competencies provided by the training agency.

The current observational/scanning competency of lifeguards is unknown due to a lack of controlled research. Anecdotal evidence reports varying degrees of scanning vigilance and competency among lifeguards (e.g., Hunsucker, 2007; in press).

Web-assisted technology could provide the opportunity to promote acquisition of lifeguard observational skills without adding to face-to-face course time. In fact, on-line modules not only could provide criterion-referenced drill and practice opportunities, but also assess student competence while simultaneously collecting and gathering data for establishing baseline lifeguard competencies in various knowledge and skills.

Other course content (knowledge domain) plus assessing mastery of that content (e.g., via on-line knowledge quizzes and tests) could efficaciously be provided on-line without adding

face-to-face time to courses. On-line knowledge testing can be organized as formative (sometimes called "drill and practice") evaluation in which candidates can repeatedly take tests or quizzes (with questions drawn randomly from a large pool or bank of questions) until the candidate reaches a desired criterion or high level of mastery. Further, on-line discussion boards can actually enhance the amount of active learning time (ALT) in which learners are engaged as opposed to more passive time spent in classrooms while encountering traditional lecture-based instruction. On-line instructional components would have the option of being provided before, during, and/or following the face-to-face portions of a lifeguard training course.

Standardizing the mode of instructional delivery for selected lifeguard course content by using on-line methodology could enhance the degree of acquisition of course content and ensure more uniform lifeguard knowledge and skills.

Limitations/ caveats

The caveats provided by the Benoit et al. studies suggest that

- Adequate and reliable access to web-based and Internet resources is absolutely critical for student learning and satisfaction (which is related to motivation);
- Pilot (alpha- and beta-) testing of any and all on-line resources is extremely important in order to discover potential "bugs" and problems;
- Initial reaction to on-line learning, especially by nontraditional candidates and those with less experience and lower skill with on-line and electronic media, will be more negative, but will change positively with time and experience;
- Not everything is appropriate for on-line learning (e.g., acquisition and improvement of actual performance skills such as swimming strokes and rescue techniques);
- Blended, or web-assisted, approaches are the obvious choice for complex and skill-based learning such as lifeguard training.

Research absent to answer question:

No direct studies that identified the efficacy of online instruction in specific lifeguarding, or other psychomotor skills was located in the literature to date. The above conclusions are extrapolated from studies of other content and disciplines. There have been anecdotal reports, however, albeit with no research documentation, that some middle and high school physical education programs are being conducted on-line. Assessment has consisted solely of knowledge and amount of physical activity, not skill acquisition.

Reportedly, at least one proprietary lifeguard agency already is using on-line training, but to date no published research has described or documented the success or failure of those efforts.

Future research needed:

- Replicated experimental studies contrasting face-to-face and online (web-based) teaching of specific lifeguard skills and knowledge (e.g., scanning, victim identification, resuscitation skills, content knowledge) are needed either before or as an integral part of actively introducing on-line elements into lifeguard training.
- Obviously, subsequent and systematic research will be needed to determine the degree of blended or web-assisted, content that creates optimal learning.
- Experimentation will be needed to create an optimal balance between face-to-face and on-line learning and assessment.

Preliminary Guideline Document Section:

Place your suggested recommendations into one or more of the three categories listed below and then briefly summarize the issue, your overall recommendations including answers to the question which was addressed as we should included it in the final document

Recommendations and Strength (using table below):

Standards:

Guidelines:

Options: Agencies training lifeguards should consider that on-line web-assisted elements may effectively be added to lifeguard training courses without any significant detriment in learning knowledge or skills. In fact, some evidence suggests that the acquisition of selected skills (e.g., scanning, vigilance, and resuscitation) plus content knowledge may be enhanced through the appropriate use of on-line learning and assessment technology.

No Recommendations:

Guideline Definitions for Evidence-Based Statements

Statement	Definition	Implication
Standard	A standard in favor of a particular action is made when the anticipated benefits of the recommended intervention clearly exceed the harms and the quality of the supporting evidence is excellent. In some clearly identified circumstances, strong recommendation standards may be made when high-quality evidence is impossible to obtain and the anticipated benefits strongly outweigh the harms.	One should follow a strong recommendation unless a clear and compelling rationale for an alternative approach is present.
Guideline	A guideline in favor of a particular action is made when the anticipated benefits exceed the harms but the quality of evidence is not as strong. Again, in some clearly identified circumstances, recommendations may be made when high quality evidence is impossible to obtain but the anticipated benefits outweigh the harms.	One would be prudent to follow a recommendation but should remain alert to new information.
Option	Options define courses that may be taken when either the quality of evidence is suspect or, level and volume of evidence is small or carefully performed studies have shown little clear advantage to one approach over another.	One should consider the option in their decision-making.
No recommendation	No recommendation indicates that there is a lack of pertinent evidence and that the anticipated balance of benefits and harms is presently unclear	One should be alert to new published evidence that clarifies the balance of benefit versus harm