**WORKSHEET for Evidence-Based Review of Science for Emergency Cardiac Care**

**Worksheet author(s)**
David L. Rodgers, EdD, NREMT-P  
Dr Andrew S. Lockey

**Date Submitted for review:** 18 March, 2009 – Revised from comments and discussion from New Orleans Meeting. COSTAR statement reflects agreement between two worksheets. Reformatted references to current format. Reformatted Endpoints.

Revised 30 July, 2009 according to notes from PM e-mail from 4 July, 2009.

Revised 02 Feb 2010 to consolidate worksheets into one document

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**Clinical question.**

<table>
<thead>
<tr>
<th>EIT-018B</th>
<th>&quot;In ALS providers undergoing ALS courses (P), does the inclusion of specific pre-course preparation (eg. e-learning and pre-testing) (I), as opposed to no such preparation (C), improve outcomes (eg. same skill assessment, but with less face to face (instructor) hands on training) (O)?&quot;</th>
</tr>
</thead>
</table>

**Is this question addressing an intervention/therapy, prognosis or diagnosis?**  
Intervention

**State if this is a proposed new topic or revision of existing worksheet:** New topic

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**Conflict of interest specific to this question**

Do any of the authors listed above have conflict of interest disclosures relevant to this worksheet?

Consultant to Laerdal Medical in the area of medical simulation

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**Search strategy (including electronic databases searched).**

Rodgers Search Strategy

Utilizing a university library master search engine, the following databases were searched:

- Academic Search Premiere
- CINAHL
- ERIC
- Health Source: Nursing/Academic Edition
- JSTOR Arts and Science Collection
- MEDLINE (CSA)
- MEDLINE (EBSCO)
- ProQuest Nursing and Allied Health Source
- PsycARTICLES
- PsycINFO
- PubMed Central
- Science Reference Center
- SpringerLink Contemporary
- Wiley InterScience

An independent search of Google Scholar was also performed

PubMed was also searched through the EndNote reference management software.

AHA Master Library was searched with EndNote reference management software.

All searches were “any field” searches unless otherwise noted.

- Pretest AND Effect – 60 (Combined database search)
- Pretest AND Effect – 143 (Google Scholar)
- Pretest AND Sensitization – 124(Combined database search)
- Pretest AND Predict – 119 (Combined database search)
- Advanced Life Support AND Prepare – 33 (PubMed)
- Advanced Life Support AND Pretest – 24 (PubMed)
- Advanced Life Support AND Predict – 136 (PubMed)
- Prepare AND Education (MeSH Major Topic) – 2103 (PubMed)
- Precourse AND Education (MeSH Major Topic) – 69 (PubMed)
- Pretest AND Education (MeSH Major Topic) – 1298 (PubMed)
- Advanced Life Support AND Education (MeSH Major Topic) – 453 (PubMed)
- ACLS and Education (MeSH Major Topic) – 110 (PubMed)
Education (Keyword) and Advanced – 126 (AHA Master Library)

Lockey Search Strategy

- "ALS course" OR "ACLS course" OR "ATLS course" OR "PLS course" OR "ILS course" OR "APLS course" OR "life support course":
  textword in title or abstract – 235 articles found on PubMed/Embase, 780 articles found on SCOPUS
- “Advanced Cardiac Life Support” as MESH term – 373 articles found
- Review of references from articles
- EMBASE “cited by” search strategy for two key papers from original search

Databases: PubMed, Embase, Cochrane, Endnote, Google Scholar, SCOPUS

Initial Search: September 2008

Subsequent Search: December 2009 – no further relevant studies identified

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**State inclusion and exclusion criteria**

Inclusion criteria were ranked in seven hierarchical levels and included (in order, highest rank to lowest):

1. Studies reporting impact of precourse activities on Advanced Life Support courses (ACLS, PALS, or ERC equivalent) on learner outcomes and impacting on instructor/student face-to-face time
2. Studies reporting impact of precourse activities on Advanced Life Support courses (ACLS, PALS, or ERC equivalent) on learner outcomes with no report on impact on instructor/student face-to-face time
3. Studies reporting impact of alternative course delivery mechanisms in Advanced Life Support courses (ACLS, PALS, or ERC equivalent) that impacted instructor/student face-to-face time but did not reference precourse activities

If studies related specifically to Advanced Life Support courses (ACLS, PALS, or ERC equivalent) were absent or inadequate in number, key articles from the following two inclusion criteria would be included:

4. Studies in the broader medical literature on the impact of precourse activities that could be extrapolated to Advanced Life Support courses (ACLS, PALS, or ERC equivalent)
5. Studies in the broader medical literature on the impact of alternative course delivery mechanisms that could be extrapolated to Advanced Life Support courses (ACLS, PALS, or ERC equivalent)

If studies related specifically to Advanced Life Support courses (ACLS, PALS, or ERC equivalent) or extrapolated studies from the broader medical literature were absent or inadequate in number, key articles from the following two inclusion criteria would be included:

6. Studies in the broader education literature on the impact of precourse activities that could be extrapolated to Advanced Life Support courses (ACLS, PALS, or ERC equivalent)
7. Studies in the broader medical literature on the impact of alternative course delivery mechanisms that could be extrapolated to Advanced Life Support courses (ACLS, PALS, or ERC equivalent)

Excluded studies related to BLC or CPR courses.

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**Number of articles/sources meeting criteria for further review:**

A total of 37 were included for further review. The number of articles corresponding to the inclusion criteria is listed below.

<table>
<thead>
<tr>
<th>Inclusion Criteria</th>
<th>Number of articles</th>
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<tr>
<td>E1. Studies reporting impact of precourse activities on Advanced Life Support courses (ACLS, PALS, or ERC equivalent) on learner outcomes and impacting on instructor/student face-to-face time</td>
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<td>E2. Studies reporting impact of precourse activities on Advanced Life Support courses (ACLS, PALS, or ERC equivalent) on learner outcomes with no report on impact on instructor/student face-to-face time</td>
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<tr>
<td>E3. Studies reporting impact of alternative course delivery mechanisms in Advanced Life Support courses (ACLS, PALS, or ERC equivalent) that impacted instructor/student face-to-face time but did not reference precourse activities</td>
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<tr>
<td>E4. Studies in the broader medical literature on the impact of precourse activities that could be extrapolated to Advanced Life Support courses (ACLS, PALS, or ERC equivalent)</td>
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<tr>
<td>E5. Studies in the broader medical literature on the impact of alternative course delivery mechanisms that could be extrapolated to Advanced Life Support courses (ACLS, PALS, or ERC equivalent) by reducing instructor/student face-to-face time</td>
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<tr>
<td>E6. Studies in the broader education literature on the impact of precourse activities that could be extrapolated to Advanced Life Support courses (ACLS, PALS, or ERC equivalent)</td>
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</table>

Numerous findings on initial
<table>
<thead>
<tr>
<th>Advanced Life Support courses (ACLS, PALS, or ERC equivalent)</th>
<th>return, selected key studies that included comprehensive reviews and metaanalysis</th>
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<tr>
<td>E7. Studies in the broader medical literature on the impact of alternative course delivery mechanisms that could be extrapolated to Advanced Life Support courses (ACLS, PALS, or ERC equivalent) by reducing instructor/student face-to-face time</td>
<td>0, Adequate findings in the medical literature</td>
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</table>
## Summary of evidence

### Evidence Supporting Clinical Question

<table>
<thead>
<tr>
<th>Level of evidence</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
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**Good**
- Schwid (1999) 821 E2

**Fair**
- Polgase (1989) 997 E3
- Jang (2005) 35 E4
- Clark (2000) 109 E5
- Flynn (1996) 19 E5
- Miller (1985) 173 E5
- Schlomer (1997) 249 E5
- Ryan (2007) 2251 E5
- Wiecha (2006) 647 E5

**Poor**
- Darr (2000) 116 E1
- Eliot (1996) 7 E2
- Patterson (1989) 244 E2
- Xie (1999) 117 E3
- Denton (2004) 329 E4
- Woodworth (2005) 77 E4
- Kinney (1997) 57 E5

**Level of evidence**
- E1. Studies reporting impact of precourse activities on Advanced Life Support courses (ACLS, PALS, or ERC equivalent) on learner outcomes and impacting on instructor/student face-to-face time
- E2. Studies reporting impact of precourse activities on Advanced Life Support courses (ACLS, PALS, or ERC equivalent) on learner outcomes with no report on impact on instructor/student face-to-face time
- E3. Studies reporting impact of alternative course delivery mechanisms in Advanced Life Support courses (ACLS, PALS, or ERC equivalent) that impacted instructor/student face-to-face time but did not reference precourse activities
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- E5. Studies in the broader medical literature on the impact of alternative course delivery mechanisms that could be extrapolated to Advanced Life Support courses (ACLS, PALS, or ERC equivalent) by reducing instructor/student face-to-face time
- E6. Studies in the broader education literature on the impact of precourse activities that could be extrapolated to Advanced Life Support courses (ACLS, PALS, or ERC equivalent)
- E7. Studies in the broader medical literature on the impact of alternative course delivery mechanisms that could be extrapolated to Advanced Life Support courses (ACLS, PALS, or ERC equivalent) by reducing instructor/student face-to-face time
Evidence Neutral to Clinical question

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<tr>
<td>Welch (1970) 605 E6</td>
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<td>Rizzolo (2002) 351 E4</td>
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E5. Studies in the broader medical literature on the impact of alternative course delivery mechanisms that could be extrapolated to Advanced Life Support courses (ACLS, PALS, or ERC equivalent) by reducing instructor/student face-to-face time
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## Evidence Opposing Clinical Question

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<th>Maki (2000) 230 E5</th>
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<td>Fair</td>
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6. Studies in the broader medical literature on the impact of alternative course delivery mechanisms that could be extrapolated to Advanced Life Support courses (ACLS, PALS, or ERC equivalent) by reducing instructor/student face-to-face time
REVIEWER’S FINAL COMMENTS AND ASSESSMENT OF BENEFIT / RISK:

Lockey Review Comments

Two papers were reviewed.

Gerard, 2006

This paper was the most pertinent one to the PICO question. It compared the cognitive and psychomotor performances of candidates attending a ‘Traditional PALS Course’ (3 day PALS plus Trauma course) with those undergoing an e-learning (Web-PALS) equivalent followed by a 1 day skills/testing course. There was no randomisation, convenience samples were used. All candidates entered were accounted for at the end and there was no crossover between the groups. The study was powered for a 2.5% difference in marks with 40 candidates in each arm (80% power with 0.05 significance level).

Moderators and candidates were not blinded but assessors were. The psychomotor tests (identical for both groups) were all videotaped and independently assessed by assessors blinded to which arm of the study they were from. The groups were similar in demographics. The only difference between the groups, other than the e-learning component, was that the trad-PALS group also had teaching on trauma.

Results:
MCQ: all passed on 1st attempt with 1.7% difference between groups (Trad>Web), conf 0.1-3.2
Psychomotor: Difference between groups 2% (Web>Trad), conf -2 to 6

Limits:
- Not randomised, ?selection bias
- Trad-PALS received trauma training as well ?reinforced some teaching points

Bottom Line: The PICO question relates specifically to ALS, not PALS, but the principles surrounding both courses are the same. Whilst not a randomised study, it does suggest that the cognitive and psychomotor outcomes are similar with an e-learning component and reduced face-to-face teaching.

Christenson, 1998

This paper looked at a multimedia version (MM) of an ACLS course when compared with a standard (ST) ACLS course. As with the Gerard paper, the outcomes measured were cognitive and psychomotor (MCQ and mock arrest). An “educationally important difference” was stated as being 10%, although there are no power calculations to support this. There was no randomisation, convenience samples were used. Some of the candidates were analysed in groups that they were not originally assigned to – it is unclear how many.

All assessments were videotaped and assessed by blinded assessors as well as on-site unblended assessors. It is difficult to assess whether the two groups were similar, other than the fact that they were all medical students in the final 4 months of their training. The two groups were treated equally.

Results:
MCQ: No difference between the two groups – 89.3%+-4.9% MM vs 89.3%+-4.8% ST
On-site psychomotor assessment: No difference – 14.1+-2.5 MM vs 14.1+-2.0 ST
Blinded psychomotor evaluation: Difference p=0.024 – 13.1+-2.9 MM vs 14.4+-2.9, however it is noted that the difference is only 1.3 marks out of 20 which is less than the required 10% for an “educationally important difference”.

Limits:
- Not randomised
- Novice learners only
- Psychomotor marking system not validated

Bottom Line: This paper looks at a multimedia variant of ACLS, but this still involves face-to-face tuition. The e-learning component does not reduce the amount of face-to-face time and technically is not pre-course learning. As such it does not exactly fit the criteria of the PICO question, but it is the only study addressing e-learning versus traditional learning for the ALS/ACLS course. It concludes that there is no real difference between the two modalities.
Rodgers Review Comments

The literature did not reveal many findings that directly related to all aspects of the question "In ALS providers undergoing ALS courses (P), does the inclusion of specific pre-course preparation (eg. e-learning and pre-testing) (I), as opposed to no such preparation (C), improve outcomes (eg. same skill assessment, but with less face to face (instructor) hands on training) (O)?" Only one study was found that met this question’s requirements. This study supported the question. Darr (2000) 142 (LOE 4) provided a descriptive case study of an alternative ACLS course format that included multiple preparatory options including attending optional lectures, viewing lectures on video tape, using an interactive computer-assisted instruction program, viewing a series of ACLS core case videos, and participating in teaching labs. This study was small (n=17) and did not evaluate learning outcomes; therefore it was classified as “poor” in its ability to address the question. The primary intent of the study was to evaluate learner attitudes on this flexible format as an optimal learning format. Most comments and survey responses reported learners favored this course format. Instructor to student face-to-face time was dramatically decreased and costs for this course format were 42% lower than the traditional ACLS course.

Several studies addressed individual components of the question – either addressing the impact of preparatory activities on ACLS outcomes or alternate course formats that reduced instructor to student face-to-face time during the course. Three studies (One LOE 1 Schwid (1999) 821 and two LOE 4 with poor quality, Elliott (1996) 7 Patterson (1989) 244) addressed course preparatory activities. All supported the question. Noteworthy among these was Schwid (1999) 821 who conducted a randomized control study evaluating a computerized screen-based simulator to textbook review. Expert scored videotape review of learner performance indicated significantly higher scores for the computerized simulation group over the textbook prepared course.

Four studies (One LOE 2 Gerard (2006) 649 and two LOE 4 Polglase (1989) 997, Xie (1999) 117 and one LOE5 Christenson (1998) 702,) examined alternate course delivery methods from the traditional ACLS course format. All four studies supported the question. Noteworthy among these were Christenson (1998) 702 and Gerard (2006) 649, both of whom utilized a computer-based alternative to the traditional course. Their findings indicated computer-based learning produced comparable learner outcomes with traditional course format. In both instances, instructor to student face-to-face time was greatly reduced.


As there were an adequate number of publications in the medical literature regarding alternative course delivery formats, a search of the broader education literature was suspended. The education literature was searched for studies on the use of preparatory strategies as only 11 publications were found in the medical literature on this component of the question. In the broader education literature, there were numerous returns on the search. These results were pared down to five key articles.
that included meta-analysis and in-depth review. It should be noted that much of this literature dates to the 1960s and 1970s and there has been very little substantial publication in this area in the past two decades.

Of note in this group is Hartley, Hartley (1976) 239. He examined the use of four preparatory strategies – pretest, behavioral objectives, overviews, and advance organizers. His conclusions stated that each strategy could positively impact on learner outcomes; however, there were limitations to their effectiveness based on the length and complexity of the instructional program and on the learners’ level of sophistication.

Specific findings by Hartley included:

**Pretests** –
- Use as a measure to define what student already knows so instructional time is not wasted in teaching previously acquired knowledge.
- Provides a sensitizing effect in preparing the learner what to watch for in the course. Alternatively, there may be a detrimental effect in the pretest if the material presented in the course but not referenced on the pretest may be discounted by the learner as unimportant.
- Produce a generally positive effect on learner outcomes.

**Behavioral Objectives** –
- Generate expectations on the part of the learner against which the learner can benchmark themselves as progress is made.
- Allows learners to study more effectively and not waste time on irrelevant information. Conversely, course information not included in the objectives may be ignored by the learner, even when that information may be considered important by the instructor.
- There was very little difference between general learning objectives (Tyler style) and specific learning objectives (Mager style) on learner outcomes.
- Training learners in the use of learning objectives does not impact learner outcomes. However, training instructors in the use of learning objectives does impact learner outcomes.
- Produce a generally positive effect on learner outcomes.

**Overviews** –
- Allow emphasis of key material in a condensed format
- Overviews need not be all at once; for processes that require steps, overviews prior to each step may be more effective.
- Overviews work better with facts as opposed to principles.
- Overviews include textual layout of course content in call-out boxes and highlighted headings, making typography layout of textual materials a contributor to learner outcomes.
- Produce a generally positive effect on learner outcomes.

**Advance Organizers** –
- Provide a conceptual framework that learners use to clarify upcoming tasks.
- Process-oriented rather than content-oriented (as with pretest, objectives, and overviews), supplying a broad framework.
- Often deployed as visual frameworks
- Helps learner fit new information into an existing cognitive structure.
- Majority of studies have shown positive impact on learning and retention.
- Are best used with above average learners

Hoogstraten, Hoogstraten (1979) 25, Hoogstraten (1980) 39, demonstrated another effect of pretests. These studies showed pretest wording could have an impact on the learners’ affect towards course material.

Welch, Welch (1970) 605 and Wilson, Wilson (1982) 249 both conducted extensive literature reviews on pretest effect and concluded that, while often weak, generally the inclusion of a pretest in experimental designs increases posttests scores.

Based on this review, the following conclusions can be made:

- Several forms of precourse preparation have the potential to positively impact learner outcomes in advanced level Emergency Cardiovascular Care courses, including electronically available materials (CD or Internet-based) and written materials (self-instructional materials).
- Alternative course delivery formats – most notably electronic course formats such as CD or Internet-based – are viable alternatives to traditional course formats that are more lecture based and may reduce instructor to student face-to-face time. However, it should be noted there are no studies available comparing the current versions of ACLS and PALS (post 2006 course release) with alternative delivery methods. The current versions of the course do not depend heavily on lecture presentation of course content, but are presented in a case-based format.
- Pretests in advanced Emergency Cardiovascular Care courses should provide a positive contribution to learner outcomes as a means of attention getting, identification of at-risk learners, self-evaluation of current knowledge deficits, and as an organizer for learners in identifying key material during the course. Additionally, care must be taken on pretest design to ensure that the pretest accurately reflects key course content as material not addressed in the pretest may be deemed unimportant by the learner. Pretest design may also impact learner affect and care must be taken in question design to state questions in a positive manner.

- Other preparatory strategies including the appropriate use of behavioral objectives, overviews, and graphic advance organizers have potential to impact learner outcomes, but more study is needed to evaluate their role in advanced Emergency Cardiovascular care programs.

**Acknowledgements:**
None

**Citation List**

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Year</th>
<th>Journal/Book</th>
<th>Volume/Issue/Chapter</th>
<th>Page</th>
<th>Title</th>
<th>LOE</th>
<th>End Point</th>
<th>Notes</th>
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<tr>
<td>Buzzell, P. R., V. M. Chamberlain, et al.</td>
<td>2002</td>
<td>Adv Physiol Educ</td>
<td>26(1-4)</td>
<td>21-9</td>
<td>&quot;The effectiveness of web-based, multimedia tutorials for teaching methods of human body composition analysis.&quot;</td>
<td>5 (Extrapolated to ECC programs), Good, Supports</td>
<td>E5 - Studies in the broader medical literature on the impact of alternative course delivery mechanisms that could be extrapolated to Advanced Life Support courses (ACLS, PALS, or ERC equivalent) by reducing instructor/student face-to-face time</td>
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<tr>
<td>Christenson, J., K. Parrish, et al.</td>
<td>1998</td>
<td>Acad Emerg Med</td>
<td>5(7)</td>
<td>702-8</td>
<td>&quot;A comparison of multimedia and standard advanced cardiac life support learning.&quot;</td>
<td>5, Good, Supports</td>
<td>E3 - Study reporting impact of alternative course delivery mechanisms in Advanced Life Support courses (ACLS, PALS, or ERC equivalent) that impacted instructor/student face-to-face time but did not reference precourse activities</td>
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<tr>
<td>Clark, L. J., J. Watson, et al.</td>
<td>2000</td>
<td>Resuscitation</td>
<td>44(2)</td>
<td>109-117</td>
<td>&quot;CPR '98: a practical multimedia computer-based guide to cardiopulmonary resuscitation for medical students.&quot;</td>
<td>5 (Extrapolated to ECC programs), Fair, Supports</td>
<td>E5 - Studies in the broader medical literature on the impact of alternative course delivery mechanisms that could be extrapolated to Advanced Life Support courses (ACLS, PALS, or ERC equivalent) by reducing instructor/student face-to-face time</td>
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<tr>
<td>Darr, L. R.</td>
<td>2000</td>
<td>J Contin Educ Nurs</td>
<td>31(3)</td>
<td>116-20; quiz 142-3</td>
<td>&quot;Advanced cardiac life support education: a self-directed, scenario-based approach.&quot;</td>
<td>4, Poor (small sample size, evaluated student attitudes instead of learning outcomes) Good, Supports</td>
<td>A - Studies reporting impact of precourse activities on Advanced Life Support courses (ACLS, PALS, or ERC equivalent) on learner outcomes and impacting on instructor/student face-to-face time</td>
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<td>Denton, G. D., S. J. Durning, et al.</td>
<td>2004</td>
<td>Teach Learn Med</td>
<td>16(4)</td>
<td>329-32</td>
<td>&quot;Is a faculty developed pretest equivalent to pre-third year GPA or USMLE step 1 as a predictor of third-year internal medicine clerkship outcomes?&quot;</td>
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<td>Eliot (1996) 7: &quot;An intelligent learning environment for advanced cardiac life support.&quot; <em>Proc AMIA Annu Fall Symp</em>: 7-11. End Point: Studies in the broader medical literature on the impact of precourse activities that could be extrapolated to Advanced Life Support courses (ACLS, PALS, or ERC equivalent) on learner outcomes with no report on impact on instructor/student face-to-face time</td>
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<td>4, Poor (detailed descriptions of data not available, proceedings publication)</td>
<td>Supports</td>
<td>B - Studies</td>
<td>Engum (2003) 67: &quot;Intravenous catheter training system: computer-based education versus traditional learning methods.&quot; <em>Proc AMIA Annu Fall Symp</em>: 7-11. End Point: Studies in the broader medical literature on the impact of precourse activities on Advanced Life Support courses (ACLS, PALS, or ERC equivalent) on learner outcomes with no report on impact on instructor/student face-to-face time</td>
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<td>5 (Extrapolated to ECC programs), Good</td>
<td>Supports</td>
<td>E5 - Studies</td>
<td>Flynn (1996) 19: &quot;Effect of three teaching methods on a nursing staff's knowledge of medication error risk reduction strategies.&quot; <em>J Nurs Staff Dev</em>: 12(1): 19-26. End Point: Studies in the broader medical literature on the impact of alternative course delivery mechanisms that could be extrapolated to Advanced Life Support courses (ACLS, PALS, or ERC equivalent) by reducing instructor/student face-to-face time</td>
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<td>5 (Extrapolated to ECC programs), Good</td>
<td>Supports</td>
<td>E5 - Studies</td>
<td>Fordis (2005) 1043: &quot;Comparison of the instructional efficacy of Internet-based CME with live interactive CME workshops: a randomized controlled trial.&quot; <em>JAMA</em>: 294(9): 1043-51. End Point: Studies in the broader medical literature on the impact of alternative course delivery mechanisms that could be extrapolated to Advanced Life Support courses (ACLS, PALS, or ERC equivalent) by reducing instructor/student face-to-face time</td>
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<td>2, Good</td>
<td>Supports</td>
<td>E3 - Studies</td>
<td>Goldrick (1990) 20: &quot;Infection control programmed instruction: an alternative to classroom instruction in baccalaureate nursing education.&quot; <em>J Nurs Educ</em>: 29(1): 20-5. End Point: Studies in the broader medical literature on the impact of alternative course delivery mechanisms that could be extrapolated to Advanced Life Support courses (ACLS, PALS, or ERC equivalent) by reducing instructor/student face-to-face time</td>
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LOE 5 (Extrapolated to ECC programs), Good, Supports  
End Point: E5 - Studies in the broader medical literature on the impact of alternative course delivery mechanisms that could be extrapolated to Advanced Life Support courses (ACLS, PALS, or ERC equivalent) by reducing instructor/student face-to-face time |
|-------------------|-------------------------------------------------|
No Abstract – In depth review article assessing the literature on the impact of pretests, behavioral objectives, overviews, and advance organizers on learning outcomes. Reported the following conclusions:  
1. A pretest might best be used in those situations in which students need to be alerted to what it is they do not know. Furthermore, the period of instruction should be relatively short in duration and possess a rather loose structure. Students should probably have a reasonable acquaintance with the topic prior to its formal presentation, and they might typically be of above average in intelligence. If the effectiveness of the instruction is to be assessed, pretest may also be useful (although, of course, one has to be aware of their instructional implications.  
2. Behavioral objectives, on the other hand, might best be used in situations in which students should be precisely informed of what it is they are to accomplish. They appear to be most suitable when they are used to preface quite long periods of instruction, which also might typically possess a dominant overall structure. Students should probably be within the middle-ability range, and quite possibly of an independent frame of mind.  
3. Overviews might best be reserved for those learning situations in which students need to be prepared for the learning task ahead. The task might typically possess little or no structure, yet students would benefit from being made familiar with the central arguments to be expounded. Overviews might also be best used when factual information is going to be presented to lower-ability students, or when concepts are principles are going to be presented to students of higher ability.  
4. Advance organizers would seem to be best reserved for situations requiring some sort of conceptual framework that students can subsequently use to help clarify the task ahead. The subject material should possess a dominant structure that can be readily integrated with the existing knowledge already possessed by the students. Learning tasks should be relatively short in duration. Finally, it is probably best if the students involved – whether adult or children – are of above average ability, maturity, and sophistication. (p. 259-260)  
LOE 5 (Extrapolated to ECC programs), Good, Supports  
End Point: E6 - Studies in the broader education literature on the impact of precourse activities that could be extrapolated to Advanced Life Support courses (ACLS, PALS, or ERC equivalent) |
LOE5 (Extrapolated to ECC programs), Good, Supports  
End Point: E6 - Studies in the broader education literature on the impact of precourse activities that could be extrapolated to Advanced Life Support courses (ACLS, PALS, or ERC equivalent) |
LOE5 (Extrapolated to ECC programs), Good, Supports  
End Point: E6 - Studies in the broader education literature on the impact of precourse activities that could be extrapolated to Advanced Life Support courses (ACLS, PALS, or ERC equivalent) |
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LOE 5, Good, Supports  
End Point: E4 - Studies in the broader medical literature on the impact of precourse activities that could be extrapolated to Advanced Life Support courses (ACLS, PALS, or ERC equivalent) |
LOE 5, Fair, Supports  
End Point: E4 - Studies in the broader medical literature on the impact of precourse activities that could be extrapolated to Advanced Life Support courses (ACLS, PALS, or ERC equivalent) |
LOE 5 (Extrapolated to ECC programs), Good, Supports  
End Point: E5 - Studies in the broader medical literature on the impact of alternative course delivery mechanisms that could be extrapolated to Advanced Life Support courses (ACLS, PALS, or ERC equivalent) by reducing instructor/student face-to-face time |
LOE 5 (Extrapolated to ECC programs), Good, Supports  
End Point: E5 - Studies in the broader medical literature on the impact of alternative course delivery mechanisms that could be extrapolated to Advanced Life Support courses (ACLS, PALS, or ERC equivalent) by reducing instructor/student face-to-face time |
LOE 5, Good, Supports  
End Point: E4 - Studies in the broader medical literature on the impact of precourse activities that could be extrapolated to Advanced Life Support courses (ACLS, PALS, or ERC equivalent) |
LOE 5 (Extrapolated to ECC programs), Poor, Supports  
End Point: E5 - Studies in the broader medical literature on the impact of alternative course delivery mechanisms that could be extrapolated to Advanced Life Support courses (ACLS, PALS, or ERC equivalent) by reducing instructor/student face-to-face time |
LOE 5, Good, Supports  
End Point: E4 - Studies in the broader medical literature on the impact of precourse activities that could be extrapolated to Advanced Life Support courses (ACLS, PALS, or ERC equivalent) |
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<tr>
<td>Patterson (1989) 244</td>
<td>Patterson, N. G. (1989). &quot;Preparation techniques for ACLS exam.&quot; Dimens Crit Care Nurs 8(4): 244-9.</td>
<td>LOE 4, Poor, Supports</td>
<td>End Point: B - Studies reporting impact of precourse activities on Advanced Life Support courses (ACLS, PALS, or ERC equivalent) on learner outcomes with no report on impact on instructor/student face-to-face time</td>
<td>Review of techniques to improve ACLS performance. Most significant recommendation was for learner to participate in an ECG review course.</td>
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<td>End Point: E3 - Studies reporting impact of alternative course delivery mechanisms in Advanced Life Support courses (ACLS, PALS, or ERC equivalent) that impacted instructor/student face-to-face time but did not reference precourse activities</td>
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