

Resident and student education in otolaryngology: A 10-year update on E-learning

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Background and Objectives

E-learning, in its most rudimentary form, is the use of internet-based resources for teaching and learning purposes. In surgical specialties, this definition encompasses the use of virtual patient cases, digital modeling, online tutorials, as well as standardized video and imaging. As new technological frontiers rapidly emerge, e-learning may be an effective alternative to traditional teaching. Here we present a systematic review of the literature assessing specifically the efficacy of e-learning for otolaryngology education. We also discuss the relevance of these programs for both medical students and residents within the field.

Methods and Materials

This review was conducted following guidelines defined in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement (PRISMA). Inclusion criteria were as follows:

- 1) Interventional studies involving an e-learning program, software, or curriculum
- 2) Subjects include otolaryngology students or residents
- 3) Studies published in English, in peer-reviewed journals

We conducted a systematic literature search in four databases: PubMed, Embase, Web of Science and the Cochrane Library. Our search strategy had three concepts. The concepts were linked together with the AND operator: (1) e-learning; (2) otolaryngology education; and (3) medical students or residents. Results were limited to articles published from January 1, 2005 to August 13, 2015.

Search Algorithm

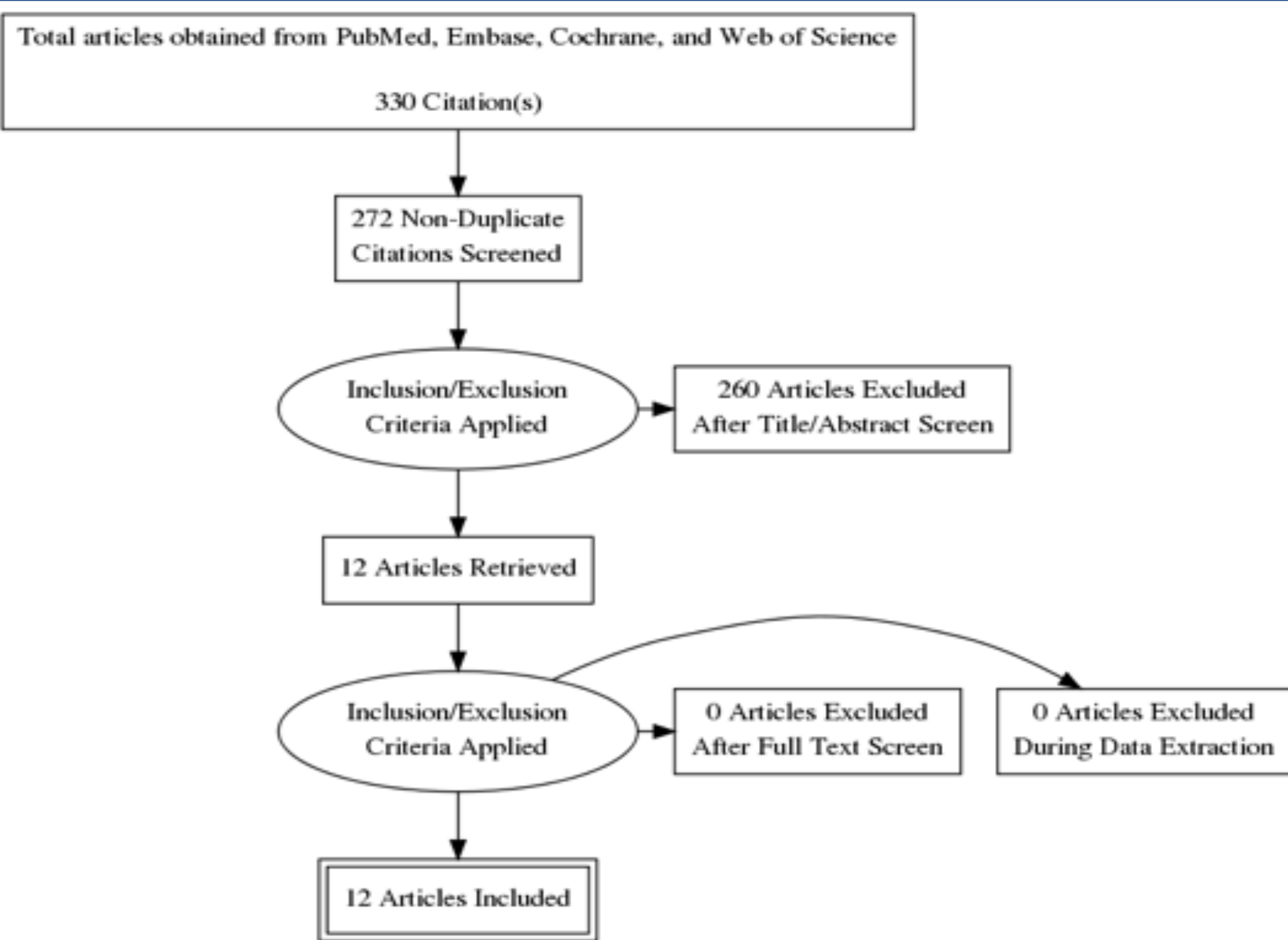


Figure 1. Using the search criteria, a total of 330 articles were identified. After removal of duplicates, 272 studies underwent abstract review. From these, 260 articles were excluded based on our pre-defined criteria. A total of 12 studies were selected for full review.

Results

Included studies were divided into 2 main categories:

Group I: Medical students and otolaryngology education

There were 8 total studies with medical student subjects: 5 prospective RCT, 2 cohort studies, and 1 quasi-randomized study. These covered a range of outcomes including performance on written examination, student satisfaction with their learning modality, or a combination of the two. Most studies compared conventional learning approaches against online lectures, interactive modules, software modules and blended learning programs. Within 5 of the 8 total studies in Group I, e-learning was demonstrated to be superior to the control.

Group II: Residents and otolaryngology education

There were 4 total studies with resident subjects: 3 prospective RCT and 1 prospective cohort study. The studies included a variety of e-learning interventions focused primarily on improving clinical skills. In all 4 studies e-learning was shown to be superior to more traditional techniques.

Authors	Participants	Methods and Results	Limitations
Al-Khatib et al. ¹	29 Residents	Prospective randomized control trial in which accuracy of otitis media with effusion (OME) diagnosis was assessed after training with pneumatic video-otoendoscopic examination (VOE) or still images. Diagnostic accuracy was significantly better in the pneumatic VOE group at 91% versus 78% for the control (p=0.003).	Conditions idealized for intervention, may have overstated benefit of VOE due to higher quality of imaging. Long-term retention of improved diagnostic accuracy rates not analyzed.
Beyea et al. ²	25 Residents	Prospective randomized control trial in which residents were taught Particle Repositioning Maneuver (PRM) using one of three interventions: 1) small group PRM instruction (SG); 2) standard classroom instruction (CI); and 3) Web-based learning module (WM). Found that after 7 days, test pass rates for the WM group was comparable to SG instruction, and superior to standard CI for teaching PRM when evaluated by a trained observer.	Small sample size. Groups were not controlled for procedure practice and independent study between day 0 and 7. Residents were aware that they were participating in a research study and this may have encouraged practice and extra studying.
Cabrera-Muffly et al. ³	37 Residents	Randomized trial in which otolaryngology residents were divided into two groups; one with access to online otolaryngology training modules and the other with no access. After one-year otolaryngology training examination (OTE) scores were obtained and compared to those of the previous year. Scores in the sections of pediatric otolaryngology, otology, and facial plastic surgery improved significantly only among residents with access to the modules (p=0.03, p=0.02, and p=0.02 respectively). All respondents rated the videos as very helpful, with a rating of 4 out of 5 on a Likert scale.	Small number of videos tested. Resident survey had low response rate at 22%. Potential confounding factors affecting OTE scores were not or could not be eliminated.
Grasl et al. ⁴	117 Medical Students in experimental group, 119 Medical students in comparison group	Prospective comparison group, quasi-experimental design. Students rotating on their otolaryngology elective were either selected to receive traditional lectures or access to the web-based blended learning "Unified Patient Project" (UPP) concept. Student satisfaction with the UPP was lower than with face-to-face teaching. Pre-test knowledge was accessed by a 24-question multiple choice questionnaire. Subjects at the 75th percentile on pretest knowledge had an average post-test score 8.7% higher in the experimental group when compared to the control (p=0.03). For subjects at the 25th percentile on pre-test knowledge, post-test scores were 8.1% lower in the experimental group when compared to the control. (p=0.03).	Pre-test knowledge was not controlled. Limited subject matter. Students were quasi-randomized, with experimental group exhibiting lower pre-test values. No control for student collaboration or study material complexity.
Hu et al. ⁵	100 Students	Prospective randomized control trial. After creation of a three-dimensional (3D) educational computer model of the larynx, students were randomly assigned to either the 3D computer model group or the standard written instruction (SWI) group. Score on a 20-question laryngeal anatomy test and student opinion was analyzed. The SWI group scored significantly higher than did the 3D group (76% vs. 67% respectively, p=0.031), but students subjectively preferred the latter group to the former.	Highly heterogeneous sample. Long-term retention was not analyzed. Intervention was not evaluated for validity and efficacy.
Kandasamy et al. ⁶	55 Medical Students	Prospective randomized controlled trial. Students were assigned into two groups: group A was given a computer-assisted instruction (CAI) module and group B was presented with review articles. After one week, students completed randomized pre- and post-tests on pediatric stridor, and a questionnaire. Group A had a 10.2% higher mean post-test score and spent less time studying (9.06 vs. 25.5 minutes) than those in group B (p<0.001). 88% of survey respondents preferred CAI over the review articles.	Survey response rate was 66%. Students were aware of study hypothesis. Differences in quality and quantity of content between the study materials were not controlled for.

Table 1. A sampling of the studies we reviewed.

Discussion

E-learning has significant potential for improving otolaryngology education, both at the student and resident level. Of the 12 studies included within this review, nearly all reported either improved objective performance in academic or clinical measures and higher satisfaction with the use of e-learning materials when compared to traditional teaching methods. Furthermore, these results were demonstrated in both medical student and, more pronouncedly, resident cohorts. Our review describes the large array of educational modalities relevant to otolaryngology training and how these modalities enable students and residents to influence their own education.

Conclusions

As the landscape of medical education continues to change, students and teachers must also, adapt accordingly. E-learning resources have the potential to effectively improve otolaryngology education. While the current literature appears to support this claim, additional investigation is needed in order to concretely determine the role e-learning will play in the evolution of surgical education. Future work must include larger prospective randomized studies comparing e-learning modalities to traditional preclinical and clinical education. Furthermore, these should specifically pertain to otolaryngology training, as such literature is exceedingly sparse. As the volume of data addressing the role of e-learning in otolaryngology increases, so too will the need for larger, more comprehensive systematic reviews and meta-analyses.

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