



Chest auscultation; easy to learn hard to say. Learning auscultation through multimedia.

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Teaching physical assessment in clinical science courses is a challenge under most circumstances. Access to suitable patients is not always possible in the time frames available. Evidence suggests that chest auscultation, while considered important, is not being learnt as part of the pre-service training of nurses and medical practitioners. Rather it is being left to on the job acquisition in an ad hoc manner. This paper discusses the implementation of one approach to meeting the challenges of teaching chest auscultation in such an environment. *The Physical Assessment: Practical Chest Auscultation CDROM* (Kerr 2001) is based on andragogy, enhancing motivation and flexibility in skills acquisition. Authentic heart and lung sounds are used to make a seemingly formidable challenge, easy.

Aims and learning outcomes

The aims of the Physical Assessment: Practical Chest Auscultation interactive CD-ROM are to:

- produce a safe, effective and fun learning resource to promote clinical confidence by enabling neophytes to develop auscultation skills at their own convenience and pace;
- offer authentic clinical sounds so the beginner may differentiate a range of normal and abnormal chest sounds; and
- equip learners with a better understanding of cardiopulmonary assessment, and application of theory to practice and provide them with progressive feedback on their clinical judgements.

Specific learning outcomes include:

- the correct use of a stethoscope, location of listening sites and better understanding of the thorax surface anatomy;
- describing cardiopulmonary blood flow and recognising normal heart and lung sounds;
- a basic understanding of cardiopulmonary pathology by differentiating some common heart murmurs and adventitious lung sounds; and
- correctly documenting auscultation findings through appreciating that diagnostic reasoning requires consideration of all relevant data and not datum in isolation.

Rationale: Need for new ways to learn chest auscultation

It is paradoxical using a computer to learn cardiopulmonary assessment skills given the low level of technology required to perform a bedside physical assessment. Chest auscultation is arguably the most difficult of physical assessment skills to master for several reasons; access to suites of real heart and lung sounds can present problems coupled with the fact that learners need to hear a large range of normal clinical sounds before they can accurately detect abnormalities. Using sick hospitalised patients to develop beginning auscultation skills is not only invasive but may also be ethically questionable. Fellow students or volunteers as 'pretend clients' can have limitations given their collegial intimacy.

The educational foundation for *Physical Assessment: Practical Chest Auscultation* CDROM, reinforced by Kerr (1997), is that learning clinical skills occurs best in an environment where learners feel a strong sense of purpose, high authenticity and low stress. The *Physical Assessment: Practical Chest Auscultation* innovation was developed in response to the literature indicating the need for more effective learning and teaching strategies in the area of physical assessment. An

Australian study by Lont (1992) indicated the lack of chest auscultation attended by nurses. Results clearly backed up that physical assessment skills were largely learnt on the job, but more importantly a high number of nurses revealed they were never taught. Furthermore the frequency with which nurses perform chest auscultation was poor (over 50% never or less than once a week), these nurses (89%), however, believed they carried out physical assessments daily. An American study to evaluate the auscultatory proficiency of medical students and physicians-in-training also demonstrated a low emphasis on teaching cardiac auscultation. The authors, Mangione, Nieman, Gracely and Kaye (1993) revealed that program directors attributed great importance to cardiac auscultation and thought that more time should be devoted to teaching it. However, only 27% of internal medicine and 37% of cardiology programs offered any structured teaching of auscultation. The trainees' accuracy ranged from 0% to 56.2% for cardiology fellows and from 2% to 36.8% for medical residents. Several authors (Adolph 1998; Marcus 1999; Woywodtand and Hofer 1999.) agreed with a later study by Mangione and Duffy (2003) that while there have been significant gains, auscultation skills are still becoming eroded. The poorly skilled are teaching the next generation in turn. One could deduce that pre-service students don't have enough opportunity to practise and develop auscultation skills. Another possible reason being a lack of authentic learning resources. One consequence of ineffective auscultatory teaching will be an ever-increasing reliance on more costly laboratory diagnostic technology. Clearly better ways are needed to revitalize time honoured bedside assessment skills.

Project Description

Physical Assessment: Practical Chest Auscultation CD-ROM (2001) provides twenty-one patients/clients for physical examination. These cover different ages and body types from both sexes. Their heart and lung sounds are authentic. Some extraneous noise, for example stethoscope handling has been intentionally left. Each client's position can be changed to reflect actual chest auscultation requirements. The bell and the diaphragm of the stethoscope can be used interchangeably for some listening sites. There is an array of normal and some more common abnormal chest sounds included. Learners auscultate by using the mouse to locate and activate listening sites. Bud- type headphones (not included with the CD-ROM package) are recommended or, alternatively a stethoscope may be held near an amplified speaker system. The learner can assess different clients and document their findings on an auscultagram. Learning is reinforced through use of a tutorial, client history, and the opportunity to compare findings with those of a consultant. The tutorial uses multimedia comprising animations, videos and text to stimulate learning. The computer screen design enhances realism by allowing learners to use a clipboard to enter the tutorial, patient history, auscultagram and consult while simultaneously maintaining eye contact with their patient. Pre-service health professionals licensed to perform physical assessment are the prime target group for this learning resource. It is used in the third year of the Bachelor of Nursing program at Charles Sturt University, Wagga Wagga.

The teaching innovations developed through this project have potential to be implemented in a variety of ways:

- Besides its primary value for self-paced instruction, the *Physical Assessment: Practical Chest Auscultation* CD-ROM can also be used for group learning. Either a computer laboratory or the Internet can be used.
- Given that auscultation has no cultural boundaries, this CD-ROM has international value as a learning resource. The program requires a learner to have neither an extensive understanding of English language nor computers to get value from it.
- *Physical Assessment: Practical Chest Auscultation* learning resource can easily be adapted for those students without access to computers or electricity. The extensive library of chest sounds and tutorial can be transferred from CD-ROM to audiotape.



Evaluation of Project Outcomes

Several formative evaluation strategies were employed during the development of the auscultation CD-ROM to ensure these objectives were attained:

- A reference group comprising health professionals with a medical and/or multimedia background was established to monitor the project's milestones until its completion. This group proved particularly helpful in evaluating the photographic patient images and rating the authenticity of a sample of heart and lung sounds recorded for the CD-ROM.
- The Greater Murray Area Health Services Ethics Committee reviewed the project proposal prior to its commencement to ensure protection for all participants.
- An Internet site (*auscweb*) <http://csu.edu.au/learning/ausc/> was established on commencement and periodically updated to invite feedback from the wider community. Messages of support and interest in acquiring the finished version of the auscultation CD-ROM was received from academics at Christchurch Polytechnic, University of Western Sydney, Central Michigan University and Southland Polytechnic.
- Early prototypes were trialled using participant observation techniques during 1999 and 2000 with some local medical practitioners, physiotherapists from Wagga Wagga Base Hospital and academics from the School of Clinical Sciences, Charles Sturt University. Feedback confirmed the project content was useful to learn chest auscultation and that the program used a logical conceptual framework for easy navigation.
- Summative Evaluation: Eleven (n=11) final year Bachelor of Nursing students volunteered to anonymously evaluate the final version of the CD-ROM during September 2003. Each student was given a copy of the auscultation CD-ROM to use at their convenience and were asked to complete a 14 item evaluation questionnaire when feeling ready to do so. The evaluation contained items relating to the CD-ROM's features using a Likert rating scale for responses. Further open questions elicited the most significant things learned, students' overall evaluations and recommendations.

Table 1. The summarised results of part of an anonymous questionnaire

Feature	Mean score 1 extremely negative, 5 extremely positive
Instructions	4.7
Navigation	4.5
Tutorial	4.6
Authenticity	4.5
Relevance to skill acquisition	4.6
Range of clients available	4.4
Recording of observations	4.5
Expert consultations	4.6
Screen layout / design	4.7

In addition, 100% of respondents:

- would recommend this as an efficient method for developing auscultation skills when patients are not accessible and would use similar educational materials in the future if available; and
- felt that they achieved the objective of learning how to carry out chest auscultation by using the CD-ROM.

Findings

The initial question asked nursing students which device was used to listen to chest sounds. The majority (64%) of students used either headphones or stethoscope against computer speaker as instructed. However, computer hard disk noise is recognised as a potential problem. The use of bud earphones as recommended, reduces this and maintains a little of the tactile experience of using the stethoscope. However, as some students observed, the presence of ambient noise made it difficult to use standard computer speakers.

On the whole, the extremely positive responses with means ranging from 4.4 to 4.7 (max 5.0) indicated that the system was an effective resource in learning chest auscultation. Aspects such as the screen layout that scored very highly, reflect an interface that was simple to use and which presented data in a manner that was easy to understand. It was most encouraging to find that the realism of the sounds led to comments in the evaluation by almost all respondents. Indeed, 90% described recognising and locating the different sounds as the most significant thing they learnt.

It was also clear from other questions in the survey that the program was highly usable and was able to achieve its objectives. Evaluation to date is best summed up by respondents as,

An excellent tool to provide safe, effective learning. Review, consult and tutorial features were very good at providing background information and feedback. By being interactive it encourages use and concentration.

One aspect that was identified as a deficiency, relates more to the range of data than the actual system. There is a need to include more clients to extend the useful range of the system. As one student noted:

There was no real bad asthma wheezes or bad pulmonary oedema creps (sic) so we could not learn what real respiratory distress sounds like.

Limitations of *Physical Assessment: Practical Chest Auscultation* CD-ROM

Innovation of itself does not guarantee successful learning; to the contrary it can beget incompetence, initially at least. Learners and teachers adapt to innovation by either reverting to past practices or developing new skills. Educators often embark on innovation with unrealistic expectations. The author acknowledges that evaluation of the CD-ROM to date while limited is ongoing. A larger sample and a controlled study comparing simulation with traditional auscultation learning methods is planned. Feedback to date has been mostly positive especially with regard to the need for such a resource, its ease of use, authenticity of sounds and patients presence during the physical examination. It remains inconclusive, however, as to what degree auscultatory accuracy of clinicians improved after using *Physical Assessment: Practical Chest Auscultation* CD-ROM. It can claim to improve learners' willingness in undertaking chest auscultation and their ability to differentiate between normal and abnormal chest sounds. Earlier physical assessments lead to earlier referrals and better health outcomes for clients.

References

- Adolph, R.J. (1998) In defence of the stethoscope. *Chest*, November. **114**(5), 1235–1236.
- Kerr, R. (1997) Professional actors really do enhance nursing skills development: A comparative study of three clinical teaching strategies. *Australian Electronic Journal of Nursing Education*, **3**(1). [Online] Available: <http://www.scu.edu.au/schools/nhcp/aejne/archive/vol3-1/no1.htm>.
- Kerr, R. (2001) *Physical Assessment: Practical Chest Auscultation*, CD-ROM Charles Sturt University: Wagga Wagga. [Online] Available: <http://www.scu.edu.au/faculty/health/clinical/auscweb/>.
- Lont, K.L. (1992) Physical assessment by nurses: a study of nurses' use of chest auscultation as an indicator of their assessment practices. *Contemporary Nurse*, September **1**(2), 93–97.



- Mangione, S., Nieman, L.Z., Gracely, E. and Kaye, D. (1993) The teaching and practice of cardiac auscultation during internal medicine and cardiology training. A nationwide survey. *Annals of Internal Medicine*, July. **119**(1), 47–54.
- Mangione, S. and Duffy, F.D. (2003) The teaching of chest auscultation during primary care training. has anything changed in the 1990s? *Chest*. October **124**(4), 1430–1436.
- Marcus, F.I. (1999) The lost art of auscultation. *Archives of Internal Medicine*, November **159**(20), 2396.
- Woywodt, A. and Hofer, M. (1999) Cardiopulmonary auscultation: Duo for strings- Opus 99. *Archives of Internal Medicine*. November **159**(20), 2477–2479.

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