

## A modern, effective and user-friendly approach to medical learning: an overview of spaced repetition programs

**Anton Lambers**

Sixth Year Medicine (Graduate)  
University of Melbourne

*Anton is interested in medical education, sports medicine and orthopaedics. He is passionate about helping others to discover ways of improving their learning skills. He also enjoys long walks along the beach, ice-creams in summer, and hopes one day to live out a day in the life of a slug, by bathing himself in cooking oil and sliming about.*

Effective and efficient methods of learning are important for medical students to tackle the plethora of information available. A technique that is gaining increasing popularity is Spaced Repetition Learning.

Spaced Repetition Learning (SRL) enhances retention by addressing our poor ability to process and retain information presented en masse at a single point in time. [1] Information is presented at varying time intervals depending on the student's evaluation of their ability to recall facts. [2] The benefits of this technique have been shown in numerous studies. In mild Alzheimer's disease, SRL proved useful for improving retention, visual memory and source recognition. [3,4] Another study compared massed versus spaced delivery of information to gastroenterology residents, who on assessment with multiple-choice quizzes showed enhanced long-term retention of facts with SRL. [5] Kerfoot et al also conducted several studies that demonstrated the applicability, efficacy and long-term durability of SRL teaching for urological trainees. [6-8]

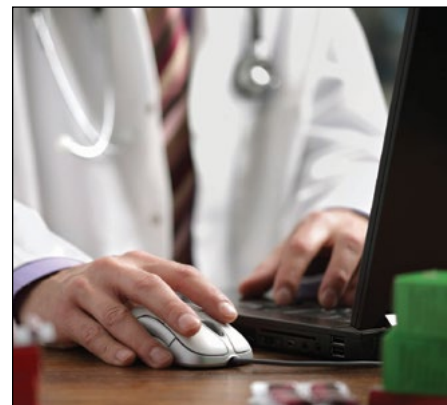
Unfortunately, there is relative paucity of randomized trials involving medical students. A handful of studies conducted by Kerfoot et al have shown SRL significantly increases the effectiveness of learning. [9-11] One notable study in particular found that medical students using SRL were able to achieve the same results with significantly reduced study time, thus increasing the efficiency of study. [10] On the contrary, a well-constructed study has disputed the long-term effects of SRL, presenting evidence that the effects are primarily short-term. [12]

Several computer programs readily available use SRL methods, two of which are Anki and Mnemosyne. [13-15] Both programs are free to use (exception: Anki on iOS) and both allow

an import and export of data in addition to supporting unicode, images, audio and LaTeX format. Anki also has the capacity to synchronise between devices, support video format and have multiple sides per card (Mnemosyne has a maximum of 3 sides per card). Both programs have cross-platform availability, and data from Mnemosyne is used to aid long-term memory research. [15]

To expand upon the use of Anki, with which the author has had more experience: it is a flashcard program that displays cards at varying intervals depending on how well one feels they have answered them in the past. Comprehensive and easy to understand instructions are available through the website, but in summary, the user writes a question and answer, and saves it to a 'deck' of cards. Each question can be labeled with one or more keywords (eg: 'cardiology'). Cards with a certain label can be reviewed exclusively or excluded from reviews as desired. Decks of cards can also be shared to Anki's online database or with other individuals. To begin learning without creating a new deck, downloading the "UK Finals Medicine" deck is a good starting point. There is also a varied range of other topics available including foreign languages, geography and musical instrument practice.

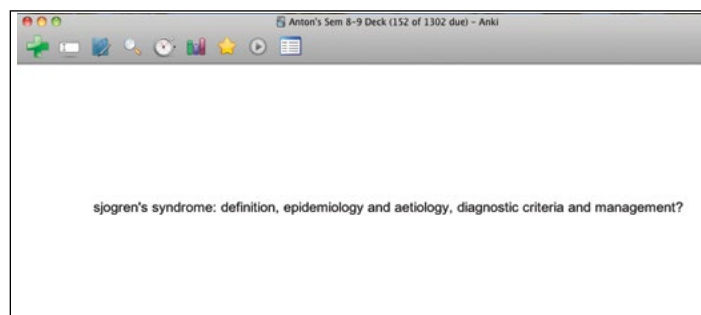
When reviewing a deck, the user is presented with a question (Figure 1), answers it (out loud, on paper, in their head) and clicks the mouse to view the answer. The user then grades their performance (Figure 2) and this is when spaced repetition theory is employed. By clicking "Again," the card will automatically become due at the end of that review session. Clicking "Easy" the first time a particular card is answered will make it due in about a week. Each successive time a card is answered correctly, the card's due date is pushed further into the future. Useful question examples for



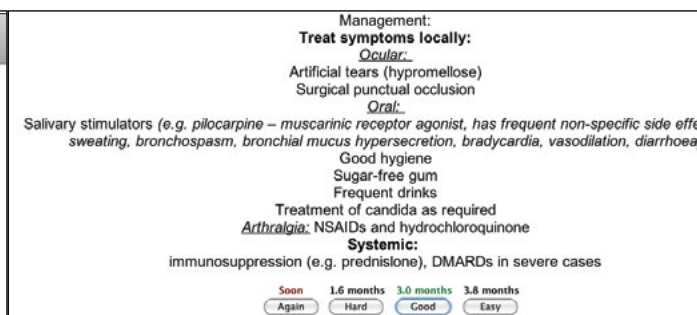
a complaint, such as chest pain, may include differential diagnoses, history questions, physical examination and investigations. For a disease, such as COPD, question prompts may include: definition, epidemiology, pathophysiology, aetiology, symptoms, signs, investigations, management, prognosis/staging and complications.

After using Anki for over a year, several benefits have become apparent. It ensures consistent new learning whilst refreshing the student of prior knowledge. Setting review deadlines and adhering to them means one can learn many facts effectively, which saves precious time. Answering questions out loud is perhaps the most effective way to clarify thoughts and consolidate your understanding of a topic. It is also particularly helpful for OSCE examination preparation. Another benefit is the accessibility of Anki, as it is available on most smart phones and can synchronise between devices and computers. The main shortfall of using SRL programs is that its efficacy depends on user commitment.

In summary, Spaced Repetition Learning has been shown to be an effective learning tool in research studies. There are a number of software programs currently available that



**Figure 1.** Screen capture of Anki showing an example question before the answer is seen.



**Figure 2.** Screen capture of part of the answer to Figure 1 and options for self-assessment.

are user friendly and free to use. From the author's personal experience and literature review, the success of SRL should certainly

be applicable to medical students and I look forward to seeing further objective research in the future to support its use.

### Conflict of interest

None declared.

### Correspondence

A Lambers: antonlambers@gmail.com

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