The Use of Anki Software to Facilitate Oral and Maxillofacial Pathology Learning

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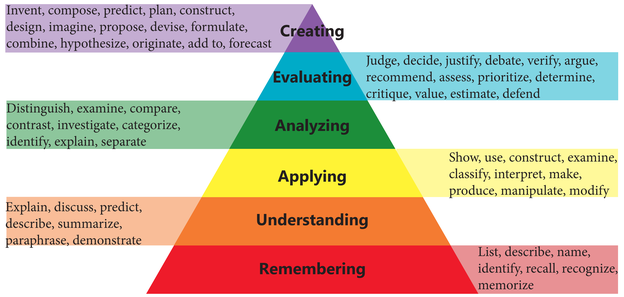
Background

Over the course of a dental student's education, there is a substantial quantity of information that must be learned. Depending on the curricular structure of an institution (especially those with a traditional lecture didactic component assessed with multiple-choice questions), this may result in suboptimal study strategies on the part of the student, particularly in terms of "cramming" for examinations. While these strategies may not result in an immediately assessable disadvantage for the student, long-term memory may be impacted.

The two basic strategies to improve recall include:

- "Massed" study: reviewing a large quantity of information in one sitting.
- "Spaced" study: variable break between study sessions (days to weeks).

Most studies have found that, counterintuitively, increased spacing generally improves information recall,[1–3] though the mechanism by which this acts is still debated.



Bloom's Taxonomy (with keywords)

Oral and maxillofacial pathology requires the ability to recognize and diagnose oral disease processes, which requires both lower-level thinking and higher-level thinking. According to Bloom's taxonomy:

- Lower-level thinking: "remembering" factual knowledge, which is a foundation for:
- Higher-level thinking: being able to formulate differential diagnoses based on factual knowledge of disease entities.

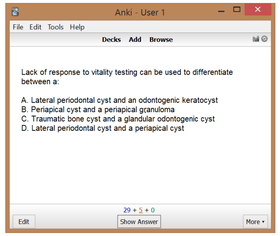
The amount of information that students must know can be a challenge for students, particularly if they are employing study methods that focus on short-term memory acquisition for examinations. To combat this tendency, we created a study tool that utilizes spaced repetition techniques to assist students in learning oral and maxillofacial pathology in a manner other than the traditional massed study concept that many students employ. To our knowledge, there are no reports of spaced repetition software being used in a dental education setting.

Our hypothesis is that we can use spaced repetition software to encourage short study periods of studying, which, distributed over the weeks before the exam, will improve memory in examinations for oral pathology courses, board examinations, and into post-graduation practice. We also theorize that this software can act as a self-reflective formative assessment for students, helping to direct their study into areas that they consistently have problems with. The aim of this pilot project was to assess students' perceptions and use of a spaced repetition program, Anki.

Why Anki?

The program that we chose for this intervention, Anki, is an open-source spaced repetition software, meaning that its use is permitted non-commercially. The features we thought were important were:

- It is provided, maintained, and improved by an online community.
- It is freely available on Mac, PC, and Android phones, and for a minor fee, iOS phones.
- A free account allows the learner to synchronize their progress across all platforms.
- The ease of adding questions that can be distributed to students over time.
- User customizability.
- Extensive feedback provided by Anki (see Supplemental Figures for a graph from Anki).



Sample Anki Card

Methods

The instructor of a second-year dental school oral and maxillofacial pathology course (Danciu) separated the course material into modules that could be progressively released over the duration of the course along with case-based homework assignments. The default settings were:

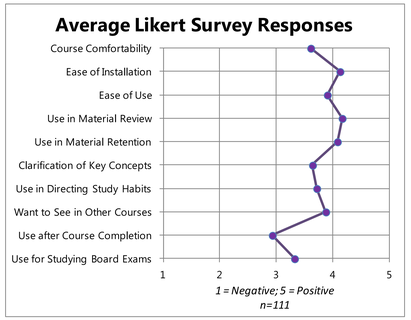
- 24-84 questions per module.
- Five new cards daily (in addition to cards that needed review).
- Most questions were formatted as multiple-choice questions.

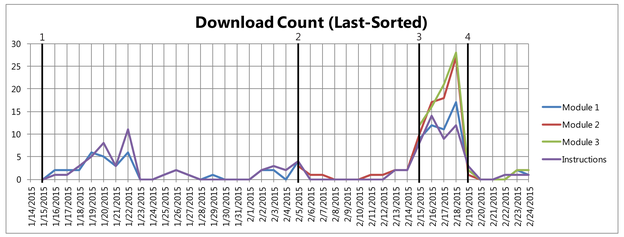
The first module was released along with an instruction document describing the rationale of Anki use, how spaced repetition is superior to "cramming," and basic Anki functionality (see Supplemental Figures). At the time of this presentation, three modules have been released, all covering material assessed on the midterm examination. None of the questions in the Anki decks were used in the examination, though the material in the decks addressed similar topics.

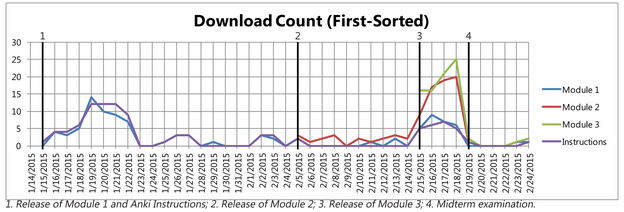
Before the midterm examination, we gave an anonymous survey to the students asking some questions about their impressions of Anki, as well as asked for an image file with their Anki usage (sample in Supplemental Figures).

Results

The results for the Likert-style questions and the download counts for the modules appear in the graphs in the column to the right. Since many students downloaded the modules, two graphs were fabricated: one counting the first time they downloaded it, and one for the last time (the latter is probably most accurate, since re-downloading the module likely means it was not being used the first time). Both the qualitative comments and these graphs show that almost every student used Anki not as a spaced repetition software, but rather as a collection of practice exam questions. This shows a basic lack of understanding about how spaced repetition software is supposed to work despite our suggestions to the contrary. As a result, we could not identify associations between performance, comfortability with course material, Anki usage, and the other categories because of the homogeneity of the respondents.





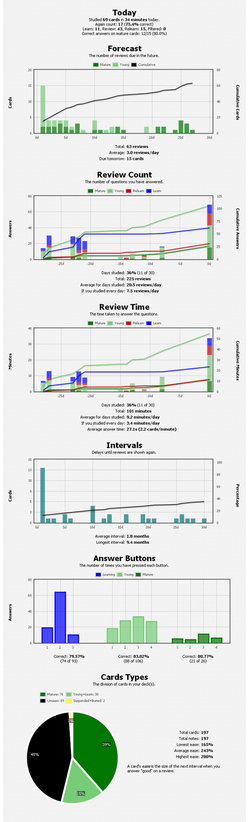


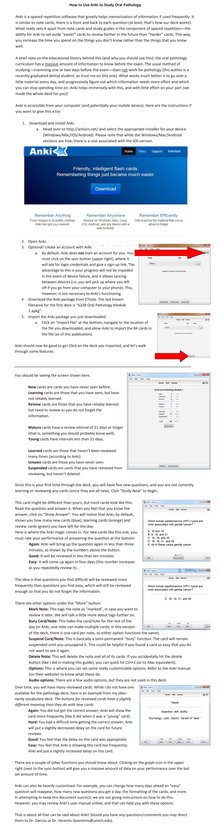
1. Release of Module 1 and Anki Instructions; 2. Release of Module 2; 3. Release of Module 3; 4. Midterm examination.

Future Steps

Because of the relatively positive response to Anki, we intend to continue the use Anki through the rest of the school year. Future decks will feature fewer multiple-choice questions and more open-ended responses. We also intend to search for a correlation between Anki usage and improved examination performance once the majority of students have taken the NBDE part I, ideally with varying question types (MCQ, open-ended, fill-in-the-blank, etc.) in both Anki and the examinations. In future courses, we are considering the use of alternative spaced repetition software that will allow for a more engaged experience at the expense of user customizability.

Supplemental Figures





References

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2. Xue G, Mei L, Chen C, Lu Z, Poldrack R, Dong Q. Spaced learning enhances subsequent recognition memory by reducing neural repetition suppression. J Cogn Neurosci. 2011 Jul;23(7):1624–33.
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