Subconscious learning:

[The sleeping child outplays the adult's capacity to convert implicit into explicit knowledge](http://www.nature.com/neuro/journal/v16/n4/full/nn.3343.html) (Scholar). Researches showed that as a child, we learn things subconsciously even during sleep. <http://www.nature.com/neuro/journal/v16/n4/full/nn.3343.html>

[Study Shows How Sleep Improves Memory](https://www.sciencedaily.com/releases/2005/06/050629070337.htm) (Scholar) shows that A good night's sleep triggers changes in the brain that help to improve memory, according to a new study led by researchers at Beth Israel Deaconess Medical Center (BIDMC). <https://www.sciencedaily.com/releases/2005/06/050629070337.htm>

<http://www.bbc.com/future/story/20140721-how-to-learn-while-you-sleep> suggest that sleep helps us to generalize what we’ve learnt, giving us the flexibility to apply the skills to new situations. The research of a 19th Century French nobleman named the Marquis d’Hervey de Saint-Denys found that he could bring back certain memories with the relevant smells, tastes or sounds.

<http://www.forbes.com/sites/daviddisalvo/2014/07/28/how-to-really-learn-a-foreign-language-while-you-sleep/#7a78e95126c2> (Additional Info): only play audio of foreign words you’ve already heard, and set the audio to run for the first two to three hours of sleep. When you wake, give yourself a quiz to test your recall.

Sleep tracking:

There are several methods for sleep tracking:

* Accelerometer/Muscles movement: Cost efficiency, low accuracy
* EEG: most accuracy to date
* Heart beat: Good accuracy
* Breath/Snore sound: Low accuracy

Vocabulary learning design:

[Attention and Awareness in Foreign Language Learning](https://books.google.com.vn/books?hl=en&lr=&id=P2gGD0HnjcYC&oi=fnd&pg=PA1&dq=subconscious+learning+long+term+memory&ots=C24vtgTfDL&sig=HSlyrvUG5YqFag4Gf95C__mWzI4&redir_esc=y#v=onepage&q=subconscious%20learning%20long%20term%20memory&f=false) (Scholar) states that language learning (or “acquisition” is unconscious or subconscious and in natural settings takes place through interaction and the processing of input. <https://books.google.com.vn/books?hl=en&lr=&id=P2gGD0HnjcYC&oi=fnd&pg=PA1&dq=subconscious+learning+long+term+memory&ots=C24vtgTfDL&sig=HSlyrvUG5YqFag4Gf95C__mWzI4&redir_esc=y#v=onepage&q=subconscious%20learning%20long%20term%20memory&f=false>

[Understanding Your Subconscious Mind](http://www.briantracy.com/blog/general/understanding-your-subconscious-mind/) (Additional Info) The researchers added a techie dimension by conducting electroencephalographic (EEG) recordings of the sleeping participants’ brains to track neural electrical activity during the learning period. They found that learning the foreign words overlapped with the appearance of theta brain waves, an intriguing result since theta is the brain wave state often associated with heightened learning while awake

Music therapy:

* Higher than 40 Hz, Gamma waves, Higher mental activity, including perception, problem solving, fear, and consciousness
* 13–39 Hz, Beta waves, Active, busy or anxious thinking and active concentration, arousal, cognition, and or paranoia
* 7–13 Hz, Alpha waves, Relaxation (while awake), pre-sleep and pre-wake drowsiness, REM sleep, Dreams
* 8–12 Hz, Mu waves Mu rhythm, Sensorimotor rhythm
* 4–7 Hz, Theta waves, Deep meditation/relaxation, NREM sleep
* Lower than 4 Hz, Delta waves, Deep dreamless sleep, loss of body awareness

App Design: