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Previous columns in the “How Do I Learn?” series explored the neurological basis of learning, memory, and attention. This month, we review the connections between memory and music and consider the possibility that music can facilitate uptake and retention of academic content. While formation of memories and their recall are complicated, several music-related factors are known to influence these processes, as discussed below.

## 1. Attention

A clear prerequisite for learning and remembering something is that one’s attention must be focused on whatever is to be remembered. The prefrontal cortex appears to have a “central executive” function that selects which components of working memories should be consolidated into longer-term memories (Müller & Knight, 2006). In contexts ranging from radio ads to movies, music may serve as an attentional hook that alters memory formation via the central executive. Music that triggers an emotional response may be especially powerful in focusing attention because emotion-related content is prioritized over nonemotional content in working memory (Levine & Edelman, 2009).

## 2. Rhythm & Rhyme

The meter and rhyme scheme of a song or poem greatly restrict the possible words that could fit into the song, which makes the lyrics easier to memorize and recall. In this way, many songs function as organizational mnemonic devices with respect to their lyrics, according to the classification system in Bellezza’s (1981) seminal paper.

## 3. Repetition

At the cellular level, repeated exposure to information or repeated practice of a task consolidates memories by strengthening networks of neurons associated with this information or practice. Transmissions through

the neural networks become more efficient thanks to pre- and postsynaptic changes underlying long-term potentiation – insertion of additional neurotransmitter receptors into the postsynaptic dendrites, for example (Morgado-Bernal, 2011). Aside from the attention/emotion issue, musical memories may be especially durable because music lends itself to frequent repetition via listening and/or rehearsal.

## 4. Modalities

Information can be received through one or more sensory modalities (e.g., auditory, visual, kinesthetic). There is some evidence that presenting information simultaneously through multiple modalities can enhance learning and recall (Delogu et al., 2009). It appears that more total information can be absorbed into working memory if multiple channels are accessed simultaneously. Since music can easily be experienced through several modalities (e.g., listening, reading the lyrics, and/or making associated gestures or dance moves), it might be learned and remembered more readily than unimodal material.

These ideas collectively convey music’s potential to enhance learning and recall in a variety of contexts. In theory, music could help Alzheimer’s patients access old memories and form new ones (Simmons-Stern et al., 2012). In addition, there is significant interest in using music to teach subjects like science, as indicated by the existence of hundreds of CDs of content-rich music targeting K–12 students catalogued in the SingAboutScience.org database (Crowther, 2012a). However, formal research on the educational utility of music has been limited in scope. Much of it has concerned the “Mozart effect,” in which listening to certain classical music pieces improves spatial reasoning. This effect is transient, not observable by all researchers, and of limited practical benefit (Waterhouse, 2006). Music

has been shown to facilitate memorization of preexisting song lyrics; however, we do not yet know the extent to which internalization of content-rich lyrics can improve academic performance (Crowther, 2012b). Likewise, there is potential value in having students create their own content-rich songs (Emdin, 2010), yet this strategy has yet to undergo rigorous evaluation.

Instructors who wish, despite the limited evidence of efficacy thus far, to teach with content-rich music can use factors 1–4 above to guide their implementation efforts. (1) Music is an attention-getting device. Use it sparingly, when covering material that is especially important. (2) Songs with highly regular rhythms and rhyme schemes, as well as easy-to-sing melodies, will be easiest to memorize (Crowther, 2006). (3) For maximum impact, songs should be heard or performed several times (McElhinney & Annett, 1996). (4) Memorability may be enhanced by coupling the auditory experience of music to visual displays of lyrics or relevant graphics and/or to kinesthetic activities such as the content-rich dance moves pioneered by Dr. Lodge McCammon (see lodgemccammon.com).

Having explored the influence of music on learning and memory, next month we will turn our attention to the impact of sleep on learning and memory.

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