Engagement and habit formation in the classroom

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How can teachers increase the effectiveness of their classroom practice, so that not only are ideas transferred (Perkins & Salomon, 1988), but so that students become people who shape their future and make the world a better place? This is an important question that refocuses the purpose of education and takes attention away from curriculum and outcomes to issues that have been seen as peripheral to education, such as 'learning readiness' (Schindler, 1948). The ludicrousness of the unspoken assumption that many students will simply 'suck up lessons' like a vacuum cleaner as they are presented, is thrown into stark relief.

Consequently, this paper looks at two associated topics that rarely seem to gain prominence in discussion of pedagogy: a) How to gain and maintain attention and b) How to make and break habits. It goes without saying that a lack of student attention results in poor learning. Furthermore, as many skills and thought processes are automated and habituated, rather than conscious, it is highly important for teachers to understand how to make and break habits. Recent advances in neuroscience are impacting many industries, and education is no exception. How can advances in neuroscience advance our understanding of attention, and habits?

This paper is divided into two sections. In the first the author looks at the psychology and neurophysiology of attention, and discusses some implications for practice. In the second section the author examines the psychology and neurophysiology of habituation along with some implications.

Attention

A study of attention is important for teachers because, as Bunce, Flenz and Neiles (2010) say, "A common experience among teachers is that students do not pay attention" (p. 1438). It is implied, of course, that attention is a necessary ingredient for learning. But *how* does a teacher gain and maintain attention? Sun Tzu, when asked by the Emperor of Wu to demonstrate his military skill by converting the general's harem into an army, was faced with giggles and inattention. His solution was to publicly execute two of the king's concubines as a lesson. Subsequently, he gained the attention of the concubine army and they followed his every command (retold in Pham, 2018). On the other end of the spectrum, Pavlov discovered, through classical conditioning, how a dog could be taught to salivate at the sound of a bell and Skinner discovered, through operant conditioning, how to teach a rat to press a lever in the anticipation of a reward (Floyd, 2018). Sadly, the level of complexity required from school students is much higher than simply salivating or pressing a lever, and generally speaking, public execution is a route closed to teachers so a more sophisticated understanding of attention, and how to gain attention is required.

> *How can advances in neuroscience advance our understanding of attention, and habits?*

'Attention' is a growing edge in the field of neurophysiology. One of the most recent trends is to use breakthrough medical imaging techniques in conjunction with elegantly designed experiments to identify the exact areas in which attention is taking place. Baldauf and Desimone (2014), for example, can identify the difference in brain signals for 'object based' and 'location based' attention. However, these latest insights into brain function are descriptive, and do not offer a model that can be applied to classroom practice.

We will turn our attention then, to the emerging field of 'neuroeconomics', which has roots in psychology and neurophysiology and examine the models of Klaff (2014), a professional 'pitcher' who offers deals to potential investors, who are often bored, hostile and have heard it all before. His findings are distilled in his popular book Pitch *Anything* which, although 'popular' in style, rather than academic, offers practical advice for secondary teachers, who are, in effect, having to 'pitch' ideas to fifteen year olds who are equally bored, hostile and have heard it all before.

Klaff's model is as profound as it is simple and

claims to rely on simple neurophysiological findings. Rather than trying to talk to the 'neo-cortex', through facts and data, Klaff aims his pitch at the 'croc brain' (equivalent to MacLean's, 1990; 'reptilian brain'), comprised roughly of the pons, medulla and hypothalamus. According to Klaff, if a pitcher can keep the investor's 'croc brain' attentive for twenty minutes, regardless of facts and data, the investor will be persuaded by the pitch. Klaff proposes three filters for the croc brain. If a pitcher can get through these three filters, attention has been gained. The filters are: 1. *Novelty*: Have I seen this before? 2. *Safety*: Is this a threat? 3. *Simplicity*: Is it too complicated? If the answer is 'yes' to any of these three filter questions, the 'croc brain' slides off into the water and disappears, and all attention is lost. Klaff's model, which he says is based in neurophysiology, can be confirmed through current academic consensus understandings of brain function. *Encyclopedia Britannica*, in its article on 'Attention—The Neurophysiology of Attention' (2018), for example, describes how in a state of attention, human physiology responds to 'novel stimuli' (i.e. '1. Have I seen this before?') and how the autonomic nervous system (ANS) prepares the body to respond to a 'potentially threatening situations' (i.e. "2. Is this a threat?"), and there is discussion about how complex tasks are 'filtered' (i.e. "3. Is it too complicated?").

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Once attention has been gained, it must be kept. Klaff's neurophysiological definition of attention is simple and workable: Attention is simply a flooded balance of two neurotransmitters in the brain: norepinephrine and dopamine. Hunt (2006), offers corroboration, identifying dopamine as the 'reward' neurotransmitter (p. 4). Dopamine release is triggered when a person 'gets' a joke or a mathematics problem, or when they are given a box of chocolates. Norepinephrine (NE), on the other hand, is literally 'adrenaline in the brain' and is associated with alertness, alarm and stress.

> The functional role of NE might be illustrated by imagining the experience of walking alone in the woods... you suddenly hear an abrupt crack, the sound of a stick being broken by an unseen object moving several yards away. Immediately your senses burst alive -- your head turns in the direction of the sound, your heart begins to race..." (p. 2).

In this way, attention is kept when a person 'feels good' (dopamine) while simultaneously experiencing a measure of alarm. As complex as keeping this chemical balance may seem, Klaff explains it is not too difficult. Klaff proposes a set of techniques. One technique is 'Stacking frames for hot cognition.' Hot cognition is when people *think* they are being logical and rational, but they're being driven by emotion. In other words, the pitcher *frames* information in a series of different ways: a) intrigue frame - the deal is part of a bigger story b) prize frame - the deal is highly valuable c) time frame - the 'clock is ticking' on the deal, and d) moral frame - taking the deal is the right thing to do. A second technique Klaff suggests is the *telling of engaging narrative* which, by design (and perhaps definition) balances satisfaction (dopamine) with suspense (norepinephrine). He advocates ending the story on a 'cliff-hanger' without resolution, for maximum attention. A third technique Klaff proposes is to *draw attention to movement* - to show, for example, how accepting the deal will make a change to finances, not just referring to the finances themselves.

Finally, of note is Klaff's claim that due to brain chemistry, a flood of norepinephrine and dopamine can only be maintained for about twenty minutes, which means that the brain can only sustain attention for a maximum of about twenty minutes. This is corroborated by Souza (cited in Bunce et al., 2010)

> Sousa suggests that students' processing of information during a lecture is dependent upon their motivation. The more motivated students pay attention longer than the less motivated. He suggests that unmotivated students pay attention for an average of 10-20 min. (p. 1438)

Bunce et al. discovered, through clicker training, that student attention "alternates between being engaged and nonengaged in ever-shortening cycles throughout a lecture segment." (Bunce et al., p. 1442).

Implications for the classroom

A teacher can apply these concepts about attention in the classroom in the following ways:

a. ***Observe the physiology of students*** to see which ones are at attention, which ones are 'sliding away into the water' like crocodiles, to avoid the lesson, and which ones are over-anxious. For example Young, Wu and Menon, (2012), identified 'math anxiety' as the dampening effects of stress on the prefrontal cortex.
b. When possible, ***apply Klaff's three filters*** by using novelty that is non-threatening and simple, to gain attention - not just at the beginning of lessons, but throughout. (Frustratingly, the author has discovered through professional practice that many students who complain of boredom are so habituated to 'normal' classroom routine that any change is threatening and is thus the trigger for more complaints.)

c. ***Use stories*** to balance dopamine and norepinephrine, and thus keep attention. Stories from the teacher's own life work well, as do short videos from the internet, excerpts from novels etc. As a corollary to this, frame information using 'hot cognition.' For example, tell students that learning long division will help them one day escape from a prison camp. It's not true, of course, and no student would believe it, but the intrigue frame creates attention.
d. Don't be afraid to ***'play' with students*** with various games that balance reward and stress. The author recently told a sleepy Year 9 male, "What would it be like if the assessment notification was like a court summons? If it doesn't touch you, then you don't have to do it!" The author then approached the sleepy male, who suddenly jumped up from the desk and ran around the room, happily eluding contact for the next three minutes. It's the most energetic thing he's done in a year!
e. ***Plan lessons to the 20 minute window***, being aware that students will, just like adults, 'vague in' and 'vague out', and create a contingency plan for them. Bunce et al, with regard to maintaining attention, recommends the use of "student centred pedagogies" (p. 1442).

Habit formation

Before exploring the neural basis for habit formation, it is worthwhile laying a foundation of the psychological understanding of habits. According to the American Psychological Association, a habit is "a well-learned behavior or automatic sequence of behaviors that is relatively situation specific and over time ... is performed with little or no conscious intent" (https://dictionary.apa.org/habit). The common understanding of habits, based on the work of surgeon Maxwell Maltz (cited in Clear, 2018), says that it takes "21 days to lay down a habit" (para. 6). This, however, is a misquote. Maxwell Maltz' actual observations on surgical patients were that it took at least 21 days for patients to get used to their new body, such as becoming used to seeing their new face, or coming to grips with a phantom limb (para. 3). More recently, Philippa Lally (para. 15) saw that it actually took, on average, 66 days to form a habit.

Before we tackle the neurophysiology of habits, it is worth mentioning John Boyd's short yet seminal military paper on 'Destruction and Creation' (1976), as it will become relevant in the light of the neurophysiology. Boyd's model is that all thinking is either creative (inductive) or destructive (deductive), and the fighter pilot who can more quickly adapt to a change in situation through destroying old ideas and creating new ones is more likely to survive.

Brain science has demonstrated that habit formation is associated with creation of physical structures in the brain - 'neural pathways'. A neural pathway is formed when neurons connect to enable an electric signal to be sent from one region of the nervous system to another. Leaf (2013), in explanation of her 'detoxing the brain' process, explains how 'active reach', or consciously dwelling on a new idea results in observable physical changes in the brain. As a person dwells on a thought over a period of around 21 days, there are 'bumps' that form on neurons (around 7 days), that grow into 'lollipops' (around 14 days) and then mushrooms (21 days) (p. 153). In other words, as a habit forms—as automisation takes place, the *mind* is actually determining the physical structure of the *brain*.

Voges, Muller, Bogerts, Munte and Heinze (2013) interrupted brain patterns of alcoholics by implanting small electrical devices and broke alcohol dependency. Researcher and journalist Charles Duhigg (2012) in his book, *The Power of Habit*, claims that when the device was activated the participant lost their craving for alcohol. However, four of the five subjects in the experiment relapsed because the drinking was associated with other cues, such as stress or loneliness. Yet through therapy that taught them new routines for coping, all subjects experienced dramatic success (Duhigg, 2012). What is interesting to note here is that serious habitual problems like alcohol dependency, while they have their own addiction chemistry, are reinforced through secondary cycles of cue/response/reward that can be addressed.

Duhigg (2012) explores a three part model of habit; a cycle of 'cue', 'response' and 'reward'. He shows that it takes an enormous amount of willpower to build habit cycles from scratch, yet it is relatively easy to intentionally modify a habit by identifying the cues, *changing the response*, and receiving a similar reward. His description of the case of 'Mandy', a chronic nail biter who received treatment at the Mississippi State University counselling centre is highly useful in seeing, in practical terms, how habits can be reshaped. The first stage of her habit reversal training was to identify triggers immediately prior to biting her nails. For her it was a sense of tension, or a little pain. Duhigg claims, that it is usually hard to 'see' what triggers habits, as triggers have become so much part of what seems 'normal'. She also identified the reward, a brief sense of completeness. In the next step, Mandy carried around an index card and made a mark every time she felt the trigger. In a week, it was 27 times. In the third step,

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Mandy learned a 'competing response'—to grip a pencil or put her hands under her legs. To give an equal reward—a sense of completeness, she put a checkmark on a card every time she was successful in using this competing response. After a month, her nail biting habit was broken.

Implications for the classroom

Maddox, Forte, Boozer (2000), identify three dimensions of learning readiness: emotive-attitudinal, cognitive, and behavioural. The variables, such as 'willing to function in partnership' are skill-based rather than knowledge based, and are habitual in nature, cued and rewarded. It becomes clear from reviewing the literature on habit formation that habituation plays a significant foundational role in education. Firstly, the repetitive, timetabled nature of schools lends itself to automatic, and often misplaced, habituation. Think, for example, of the students who are habituated into filing into class and 'switching their brain off' when they hear 'the bell' of instruction from a teacher. The author posits that many students who are seen as 'difficult' do not learn the content of a lesson, but the *personality* of the teacher. In other words, the cue may well be the teacher's mood for the day, the response may be to 'look busy' or to 'play up', and the reward may be either to be spotlighted by the teacher, or to be ignored. If this is the case, then it follows that there may well be times when a teacher is trying to put a stop to poor student behaviour but in fact the *teacher is inadvertently reinforcing* the behaviour by supplying a cue. It also follows that many *teachers are habituated into poor habits* by students. Consider, for example, the teacher who is too afraid of an emotional outburst from a certain student, so will respond to a cue, such as 'head down, disengaged' by going to the other side of the classroom. The teacher's reward is a peaceful lesson.

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Consequently, the author posits that the reason why there is a perceived disconnect between mandated content and student interest has a lot to do with habits. Thus, teachers who want to make significant, lasting change in the lives of their students must address students at the habit level. The 'Golden Rule of Habit Formation,' as described by Duhigg is a touchstone for professional teachers: To change a habit, retain the cue and the reward, and change the response. This means the teacher needs to:

a. Identify existing rewards
b. Identify the response they want changed, both in them and the student, and to invite students into the dialogue
c. Take time and expend effort to utilise habit change techniques in the classroom.

Leaf's "21-Day Brain Detox Plan" is another practical resource that can be readily adapted to the classroom to teach students how to gain control of their habits. The process parallels the Habit Reversal Training (see above) and involves breaking down toxic thoughts and creating healthy thoughts in their place. However, putting it into practice necessitates carving out time from content to let students work through the process.

Conclusion

Through laying a foundation of psychological understanding of attention and habit formation, and then exploring recent neurophysiological advances in these areas, a number of practical suggestions have been shared to inform teachers as to how they can enhance their practice enabling improved student learning. Rather than just delivering curriculum, educators can engender real and lasting change in their students' intensity of attention, positive habitual responses and ultimately successful achievement.

TEACH

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One current project is developing a practical business course for entrepreneurial teens, 'This Is Awkward'. I'm working on a few other agricultural startups as well and I presently enjoy landscaping with my backhoe.