Review Article

Study the impact of Cramming in medical students

ABSTRACT

Aim: to reveal pre- exam cramming among pre-clinical medical students, what drives this practice, failure due to cramming and the problems and difficulties related to the act of cramming.
Discussion: Cramming is common practice among struggling medical students. The prevalence of cramming is like an iceberg phenomenon. The act of stacking too many information just the night before an exam probably authorize the perpetrator to remember some information in the short term period and enable them to take in enough information for the exam. Along with this practice also comes sleep deprivation, mental and emotional disturbances and even substance abuse in order to achieve good marks and passing the exam. Unfortunately for some experts, cramming is not considered as learning. Procrastination and some other reason are believed to be the reason the culprit commits cramming.
Conclusion: Cramming not only changes the behavior of the perpetrator, but also has an impact on his family, classmates, environment and future.

Keywords: Procrastination, medical students, attitude, memory, learning styles, dopamine loop, exam

1. INTRODUCTION

Students in medical school often feel overwhelmed by the excessive amount of factual knowledge they are obliged to learn. Although a large body of research on effective learning methods is published, scientifically based learning strategies are not a standard part of the curriculum in medical school. Students are largely unaware of how to learn successfully and improve memory [1]. For those who are pressed for a deadline, cramming is often the best choice. Some experts considered cramming is not learning at all [2].

The simplest definition of Cramming is to try to learn a lot very quickly before an exam. Other definition mentioned about “to study for an examination by memorizing facts at the last minute” [3]. The exact number of prevalence on the act of Cramming is foggy, especially in Medical school; but one source from the Hawkeye s mentioned data from polling on Indiana University of Pennsylvania’s (IUP) students about their study habits. This simple study was using the Qualtrics survey tool available to campus users. Electronic Questionnaires were sent to 1,500 randomly selected IUP undergraduates. Among respondents who responded to the survey, 99% stated they conducted cramming for exam or assignments. Furthermore, around 25% said they crammed for every exam, test and even assignment. What’s more surprising is that 48 % already planned to cram for their next exam or test or assignment [4].

This short article aim to reveal pre- exam cramming among pre-clinical medical students, what drives this practice, failure due to cramming and the problems and difficulties related to the act of cramming.

2. MEDICAL EDUCATION: INSIDE OUT

The regular faculty of medicine concentrates on a combination of traditional lectures and integrated problem-based learning modules [5,6]. Clasically, in a big class, lectures given didactically by a lecturer, and students taking notes on important matters and then after all lectures given, tests or exam was held. This is the standard way in which medical school builds and tests were conducted in order to measure the student's level of knowledge. Medical education combined basic medical sciences and clinical knowledge with mixture and correlation between them [5].

The first three and a half years of our medical school named the pre-clinical phase. Basically, it is a mixture of classroom and lab time along with clinical skills. Students take classes in basic medical sciences, such as Biology, Histology, Anatomy, Biochemistry, Parasitology, Microbiology, Pathology and Pharmacology. They also learn the basics of interviewing and examining a patient. Traditionally, students take four or five courses in various disciplines at the same time. However, some schools focus on a single subject for a shorter block of time—six weeks per block in our medical faculty—then move on to another.7 Other schools held an interdisciplinary approach to pre-clinical coursework, in which each class focuses on a single organ, examining all the anatomy, pharmacology, pathology and behavior relevant to that system [9].

The next phase is four to five semesters of senior medical students that conducted rotations at hospitals and clinics affiliated with their school, culminating with taking (and passing) national Competency Test named Uji Kompetensi Mahasiswa Program Profesi Dokter (UKMPPD). Students doing rotations to assist doctor in a particular specialty such as ophthalmology, obstetrics, surgery, community medicine, pediatrics, psychiatry, internal medicine or forensics. This clinical phase made students interact with patients and perform basic medical procedures along with any tasks regarding the patient's sake [9].

There are plenty antecedents of a good academic achievement in medical school including good and appropriate facilitation, prior academic triumph, personality characteristics, and individual distinction in cognitive strategies engaged during learning [10]. Cognitive learning strategies are specific strategies that enhance an individualized learner's capacity to produce initial information into a more long-term knowledge, transfer and apply information to critical new situations, and result in enhanced and better-retained learning [11].

Academic performance is mainly a function of students' study habits referring to the student's way of study whether systematic, efficient, or inefficient. A great deal of learning actually occurs outside of the classroom, yet aside from anecdotal evidence, not much is known about how students study on their own [12,13]. The first step in this process is determining how students are currently studying and what influences their studying decisions [14].

As the saying goes and then it becomes a kind of legend among the students that certain students perfectly blossom on vigorous academic milleu and perhaps also social events for young people who are boisterous and time-consuming. Physically and emotionally, the prevalence of burnout amongst medical students increased sharply, especially in the Covid-19 pandemic era [15,16]. Generally, in order to cover everything all at once, the students modify their study habits [17]. A vast majority of the students features as effortless

procrastination [18]. But unfortunately, the underlying reason is this putting off of work until the last minute is complicated and routine methodical practice among perpetrators [19]. The reason this method of working procrastination and cramming- is so completely ordinary and acceptable among students and yet perhaps official global denial can be found in the act of cramming. This the condition demarcating the profiles of this 'unique' students.

The way medical school structures and organize time in order to operate their curriculum, to my opinion, is more than just a casual phenomenon that affects only students but rather, it can have profound effect/impact on the mental organization regarding time and their future work habits throughout the rest of the perpetrator later lives.

3. WHAT DRIVES THIS PRACTICE?

The reasons why do pre-clinical students cram when it comes to important exams are very diverse and complex. The cause can come from within or from outside the perpetrator. The following are some of the reasons that cause students to cramp**:**

1. The clandestinely reason why students continue to cram is because of their or others previous success in preceding exam while cramming [2-4]. It is often that it seems to work[21]. The key difference in these two perspectives (whether cramming works or does not work) revolves around the central issue of how long learning retention over the perpetrator; is it only for short term period or otherwise long term. According to Chai and Guest [27], there are positive relationship between patterns in student access of Online Lecture Recordings (OLRs) and engagement in 'cramming' behaviour, – eventhough this practice of delaying study until just before exams and then studying very intensively in preparation caused the perpetrator high stakes assessment tasks. OLRs give students greater flexibility about when they can access learning materials and what form their study tasks can take. They find evidence that intensive access of OLRs is positively correlated with the degree to which students engage in cramming. However, occasional OLR access is not positively correlated with this type of behaviour. They also find evidence of positive correlation between procrastination and academic performance more generally.

2. Waiting until the night before an exam to study can fill a student's brain with a huge amount short-term memory to master it actually forces the brain to make wise decisions for survival. When a student gets a good grade through cramming, they often feel that rush of relief associated with getting away with something. That feeling of private victory in combination with the positive feedback of a good grade creates a chemical dopamine reward loop that links cramming with feelings of positive emotion. Dopamine is involved in reward and pleasure and perpetrator of cramming actually get limited dopamine from doing difficult and time-consuming tasks such as last minute cramming. Based on study regarding brain activity, increased in dopamine content effectively obliterates any record of past motivational conflict [22], phobia [23,24], anxiety [25], or even nervousness [26]. Instead, it initiates a vicious cycle of behavior in which cramming will almost certainly be leaned on again. Dopamine may reinforce a pattern of repetitive procrastination in a gender-dependent manner[28].

3. Actually like gambling, repetitive cramming cause activation of the short-term, dopamine-driven feedback loops [29]. Slowly, little by little it have created the perpetrator into bona fide addicts and destroying the image and the pride of having hard-works based intellectual attitude [29,30]. The impact extends to the future of the perpetrator, his/her family members and even to society as a whole. Future

research is needed to understand whether any treatments or behavioural coaching work in cramming and for whom specific treatments might work best.

4. Poor time management. These days, it is harder than ever before for students to manage their time [32,33]. Many interesting extracurricular activities and other social events for the youth available, even during active learning period in the current semester. All of these actually very intense and time consuming for students who should focus on studying. the price to pay is lack of sleep, irregular eating which leads to potential health and mental problems that can lead to burnout [32,34]. So, unnumbered exhausted students are being directed to the poisoned vicious circle of cram-studying. The contradictive explanation is as follows: crammed studying may have slightly better performance on extremely short time scales, e.g., for only a day or two [2,21]. As a result, cramming can allow the perpetrator to occasionally squeeze through classes they'd normally fail. One scientific evidence regarding this comes from a study conducted by Mackey et al [35], closely examined the diffusion tensor imaging (DTI) brain scans of 45 college students. The participants of the study were broken into two groups. One group included 23 participants enrolled in an intense LSAT prep course, while the second group had 22 members of comparable age and IQ who were also planning to take the LSAT, yet not enrolled in any prep courses. Researchers took DTI scans prior to and after the intense 100-hour preparation period. The scans revealed that the cramming sessions helped alter the brain structure of the 23 prep course participants, as they clearly illustrated a stronger connection between the brains' frontal lobes, as well as between the parietal and frontal lobes. This indicates that while reasoning skills are generally considered to be an activity performed by the left side of the brain, with proper time and training, the brain's right side will be forced into action and reasoning skills will improve as the brain structure changes. As a result, students who put off studying until the last minute now have scientific evidence to suggest that it's never too late to develop the reasoning skills necessary to succeed, as long as they set aside adequate quality time for intense cramming sessions. From this point of view, we can say that college time just became a little more enjoyable.

5. In the beginning, cramming always feels easy and good because it is very simple and requires very little planning. Most of the time, the perpetrator faced with several different courses, all competing for his/her precious study time and with their own exam schedules. With the rapid march of each upcoming exam, it is easier to just focus on what is next, and this becomes a dilemma as well as a distraction from the real potential dangers of procrastination and cramming

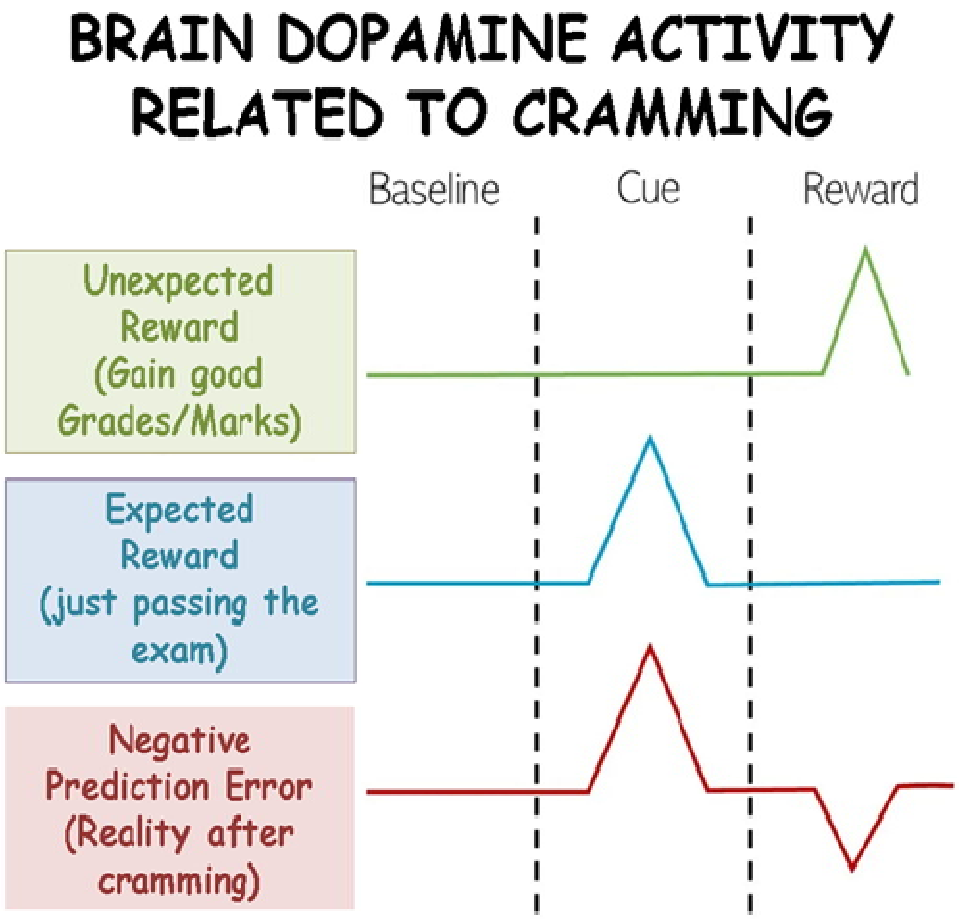

Fig. 1. Reward prediction and subsequent dopamine activity, the dopamine reward loop in modification. Unexpected rewards increase the activity of dopamine neurons, acting as positive feedback signals for the brain regions associated with the preceding behavior. As in the case of cramming takes place, the timing of activity will shift until it occurs upon the cue alone, with the expected reward having no additional effect. And should the expected reward not be received, dopamine activity drops, sending a negative feedback signal to the relevant parts of the brain, weakening the positive association. Adapted and modified from Haynes [31, with modification].

3.1 The vicious circle of cramming: all sorts of randomness

There is several scientific evidence regarding cramming that essentially forbid the establishment of good long-term memory of the material [2,3,21]. Using brain activity sensor, different parts of the brain support different kinds of memory [36]. Recognition is strongly affected by the ease with which information collected through the sensory areas of the brain, such as the visual cortex, e.g., by looking at lecture notes [37,38]. On contrary, Recall is supported by a network of different areas of the brain, including the frontal cortex and the temporal lobe, which coordinate to recreate a memory from any clues available [39]. The neurons in recall area thus shows a high level of activity only during the time required to keep the correct spot "in mind" until the moment arrives to respond actively. So, if cramming

only conducted for exam purpose, then it is very possible that what has been seen/learned during cramming will not be deeply embedded in the recall area.

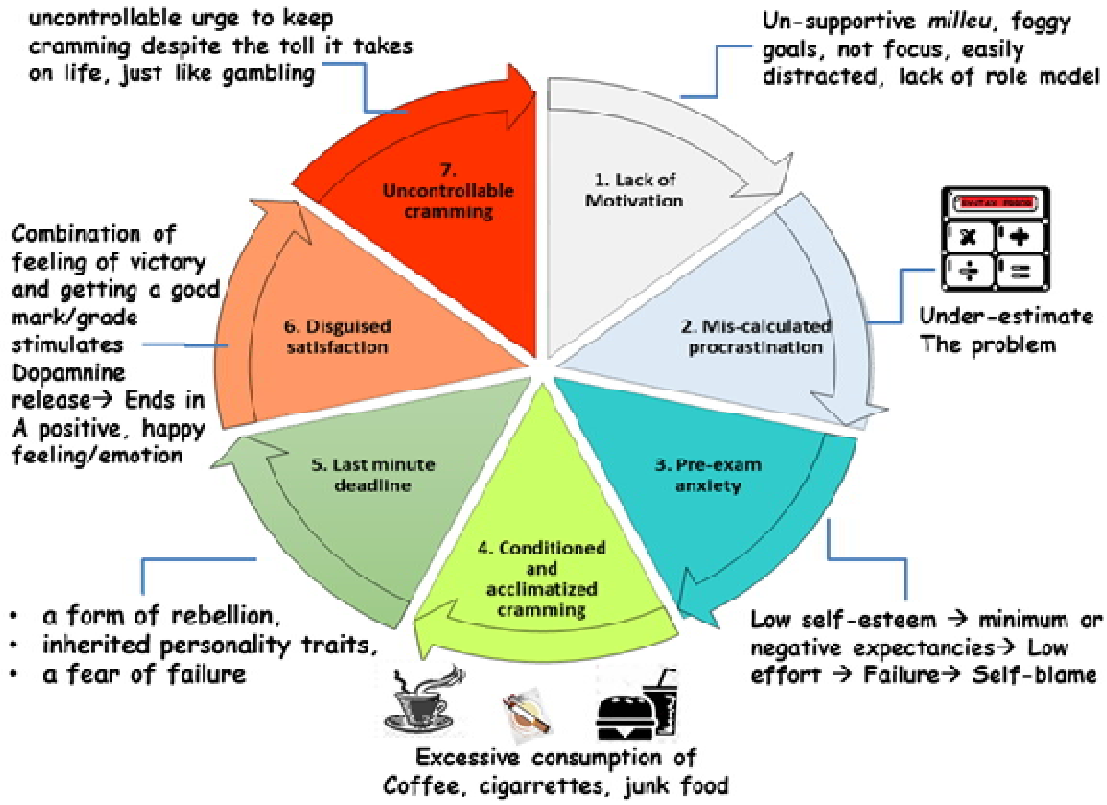

Fig.2. Vicious circle of cramming, with modification from Dr. WG Sommer [40].

Series of event that promotes cramming are as follows:

1. Lack of Motivation and focus due to burnout: The most significant career choice factor was altruistic motivation, followed by extrinsic motivations: gaining a degree, finding a job, accessing career opportunities. Lack of altruism was found to be a major risk factor, in addition to the traditional risk factors, for cynicism and reduced academic efficacy. grouped into external (university workload and environment) and internal (personality) factors; their mutual interactions were also assumed to be important in the formation of burnout. The external causes found to be most significant are the quantity of material to be learned, pressure of time, examination stress and financial uncertainty. Being confronted with death and suffering and other emotional burdens is also involved in student burnout [41]

2. Mis-calculated procrastination: the perpetrator of procrastination actually is trying to manage the negative emotions they feel about a particular task that needs doing [42,43]. The pressure students feel to perform well from prior tests or exam outstrips

their ability to confront the task at hand [43,44]. Rather than seeing the assignment before them, the perpetrator see all that it might symbolically represent the potency for cascading failures. Procrastination offers quick though short-lived relief by distracting a student's thoughts from this shapeless cloud of anxieties [42-44]. Potential perpetrator purposely appraise sufficient space in their schedules because based on his personal judgment, it is possible to be able to carry off a good grade with a high-intensity night of cramming [19,20]. There is also the link between addiction due to cellphone, gaming or excessive shopping online with cramming for exam [45].

3. Pre-exam anxiety: As the exam period approaching, anxiety due to the potency of getting bad or low grade on the assignment wins over the tendency to further put it off. This is quite literally a panic reflex. Relying on the surge of adrenaline and cortisol that stress triggers in a panicked brain, potential perpetrators subject their minds and bodies to a barrage of potentially dangerous hormone responses in the name of quick study. Glucocorticoids (GCs), the main class of stress hormones, are strongly linked to memory performance whereby elevated GC levels are associated with memory performance decline in both normal and pathological cognitive aging. Accordingly, it is believed that GCs may increase the brain's vulnerability to the effects of internal and external insults, and thus may play a role in the development of age-related cognitive disorders such as Alzheimer's disease (AD) [46].This kind of panicked adrenaline rush is analogous to the fight or flight response we feel under sudden, existential threat, and can be severely damaging over repeated exposure [47].

4. Conditioned and acclimatized cramming: This is the period of time the perpetrator of cramming actually spends studying. Caffeine [48], energy drinks [49], a startling lack of sleep [50], nicotine [51], junk food and even drugs with the possibility of a mixture of these various substances in their consumption [2,3]. The adrenaline released by extreme stress might predispose this substance abuse. Medical students who use psychostimulant drugs for non-medical reasons actually using these drugs in order to enhance performance and,subsequently, grades on examinations [52]. But unfortunately it turn out to give negative effect in the perpetrator's exam performance [52,53]. It may alter both their own performance on exams and as a further consequence, like snowball effect, also affected the grading for all students taking standardized exams. For example, since the US Medical Licensing Examination is graded in a relative scale, if a large numberof students use these drugs to attain higher grades, then the entire grading system will be altered, which could negatively affect students who did not abuse them. Findings indicate that students with low self-control were at bigger likelihood for announcing over drinking, marijuana use, and prescription drug misapply [51].

5. Last minute deadline: The stress and pressure of "last minute" reading and studyin diminish cognitive performance: The executive purpose skills (and most other academic skills sets, for that matter), function optimally at the time the students are relax, stress-free, have adequate time to function at their own speed, and with personal belief due to repetitive practice and consistency [1,10]. All of those factors, which aid student performance, are removed in a "night before" study scenario. According to Dr. Megan Zhang, of the NYU Neuroscience and Education Lab, explains that "Some individuals may have highly impaired executive functions (cognitive abilities such as memory, attention, and planning) when placed in stress-arousing environments." The attempt to study a year's worth of content in only less than 24 haours, e.g start in the evening, will put the perpetrator most certainly in

under stress condition. Specifically, very low and very high levels of arousal or stress can both impair executive functions, while a moderate level of arousal can actually improve them. When studies conducted over time, the condition of tolerable stress, e.g., meeting small study goals, or anticipating the exam day ahead, can be considered helpful. On contrary, the extreme stress put on the mind and body to learn vast quantities of material with limited time allocation and with very low support can be deleterious [18,19]. There is simply not enough time to cover all the content effectively [2-4,18].

6. Disguise satisfaction. One of the hallmarks of cramming is its uncertainty – whether it's the potential grades ahieve or the probability of passing the exam, at all. And reward uncertainty, in this context passing the exam and achieving good grade, plays a crucial role in cramming's attraction and satisfaction.

7. Uncontrolable cramming. Dopamine, the neurotransmitter of the brain releases during enjoyable activities such as eating, sex and drugs, is also released during situations where the reward is uncertain like cramming. In fact dopamine release increases particularly during the critical moments leading up to a potential reward. This anticipation effect might explain why dopamine release parallels an individual's levels of cramming "high" and the severity of the perpetrator addiction. It likely also plays a role in reinforcing the risk-taking behavior seen in cramming. As a matter of fact, similar to drugs, repeated exposure to cramming and uncertainty produces lasting changes in the human brain. These reward pathways, similar to those seen in individuals suffering from drug addiction, become hypersensitive. Animal studies suggest that these brain changes due to uncertainty can even enhance the perpetrators' cravings and desire for addictive drugs. Repeated exposure to cramming and uncertainty can even alter the respond to failing. Counterintuitively, in individuals with a cramming problem, failing the exam might trigger the rewarding release of dopamine almost to the same degree that winning does. As a result, in problem cramming, losing sets off the tendency to continue playing, rather than the disappointment that might prompt you to walk away, a phenomenon known as chasing losses. When a student gets a good grade through cramming, they often feel that rush of relief associated with getting away with something. That feeling of private victory in combination with the positive feedback of a good grade creates a chemical dopamine reward loop that links cramming with feelings of positive emotion. It effectively wipes any record of strife, anxiety, or panic. Instead, it initiates a vicious cycle of behavior in which cramming will almost certainly be leaned on again.

3.2. Why Cramming failed

Cramming student simply will not have the time to understand and furthermore to memorize all of that information at the last minute. Plus, if he/she only focus on cramming 'old/worn out' material, he/she won't have time to learn the new material from the previous few classes. Cramming actor/actress may be wondering how to avoid cramming in med school when their schedule is filled to the brim. All it takes to learn how to study ahead is finding a method (no, not cramming) that allows you to add in new material regularly.

Cramming, though it may offer short-term triage to one's GPA, almost always fails long-term. It's just not sustainable. In the majority of classes, in which learning is cumulative and incremental, the work of cramming becomes harder and its success more dubious the farther along you are in the course. In other words, you might be able to pull off a superficial

win on a unit test in Calculus. However, cramming for the final exam is much more likely to land you with a very low grade.

Cramming essentially prohibits the formation of long-term memory of the material. Different parts of the brain support different kinds of memory. Recognition is strongly affected by the ease with which information passes through the sensory areas of our brain, such as the visual cortex if you are looking at notes. Recall is supported by a network of different areas of the brain, including the frontal cortex and the temporal lobe, which coordinate to recreate a memory from the clues or information given. Just because the visual cortex is fluently processing the notes after five-six-seven or even more consecutive hours of cramming when the perpetrator looking at them, it does not mean the rest of the brain is going to be able to reconstruct the memory, just in the time it is really needed. Further studied deserve to be conducted in the area of how brain react best to recalling or reconstructing information needed.

4. CONCLUSION

Theoretically, pre examination Cramming just the night before an exam probably authorize the perpetrator to remember some information in the short term period and enable them to take in enough information for the exam. However, this may will most likely mean that you'll have no lasting connections to the knowledge, and you won't develop any deep understanding of the information. Mis-calculated procrastination offers quick through short-lived relief by distracting a student's hopeless thoughts of anxieties into unexpected rewards of gaining good grades/marks. The perpetrator not aware that repetitive cramming cause activation of the short-term, dopamine-driven feedback loops and slowly, little by little it have changed them into bona fide addicts and destroying hard-works based intellectual attitude.

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