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ORIGINAL ARTICLE

Reward Hijack: Does Social Media Over Usage, Reduce the Brain's Sensitivity to Study-Related Effort? A Cross-sectional Questionnaire Based Study in MBBS and Paramedical Students

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Abstract

Background: The current digital environment gives continuous, fast accessible, and easy happiness as rewards through social media sites. Like this frequent over exposure to easy and fast rewards may subside the natural motivation given by cognitively effortful tasks like studying, by repeatedly stimulating the brain's dopaminergic reward systems. This is known as "Reward Hijack". This trend of hijack is currently applicable to the youth of this country who should be focussing on study related effort, but instead they focus more on social media, for instant gratification. **Objectives:** To find the association between Social Media Over usage and Study related effort sensitivity among Medical and Paramedical students in India. **Materials and Methods:** This is a cross sectional study, which is based on Questionnaire and was conducted on 175 MBBS and 100 Paramedical students. Pearson's correlation coefficient was used to analyse data to determine the relationship overuse and study related effort sensitivity. Ethical clearance was obtained and Informed consent was got from all the participants. **Results:** The results showed that the mean social media overuse score was 3.18 ± 0.82, and the mean effort sensitivity score was 3.52 ± 0.74. These two variables suggest a moderate negative correlation ($r = –0.41$, $p = 0.0002$), which indicate that higher social media usage was associated with decreased motivation and sensitivity toward study related effort. **Conclusion:** The study's findings shows, continuous exposure to rapid and easy rewards given by social media will hijack the brain's reward system and decrease interest in delayed but truthful academic rewards. Such reward hijacks could be prevented by conducting awareness programmes and teaching strategies to come out of the social media usage.

Key words: Reward Hijack, Social Media over usage, Study related effort, Dopaminergic system, Medical Students, Paramedical students

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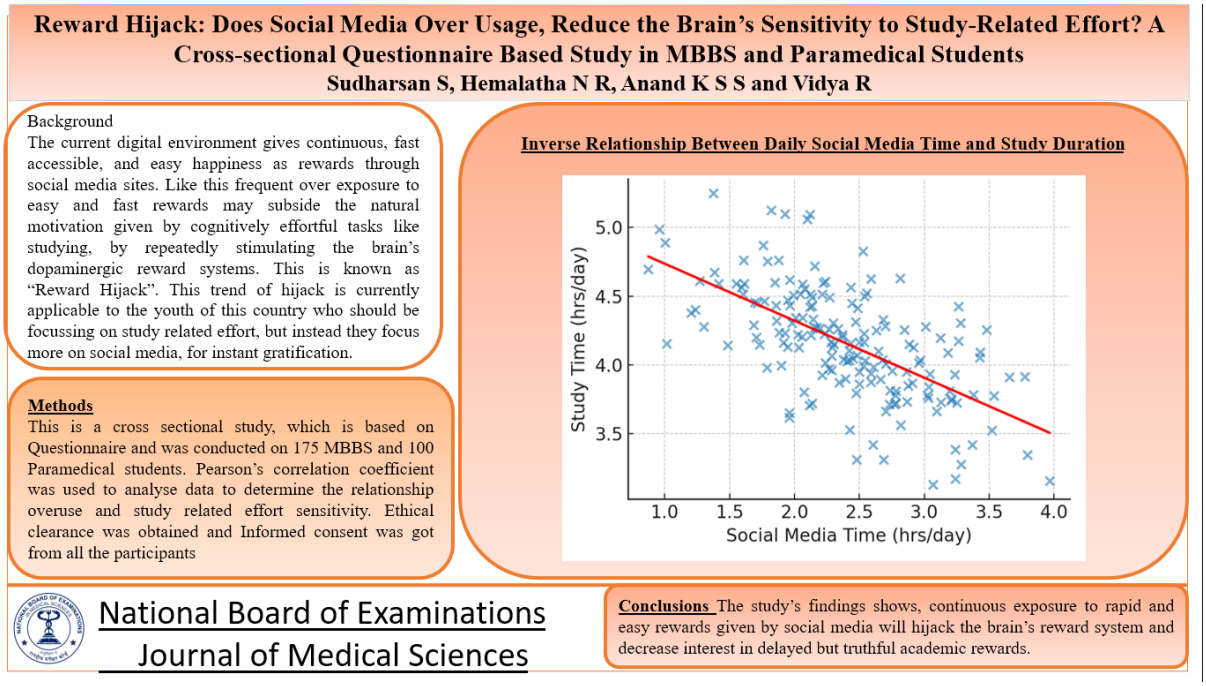
Graphical Abstract



Introduction

The Social Media platforms provides instant happiness by activating dopaminergic reward pathways [1], through Likes, Comments, Reels, Easy chatting texts and their notifications. When students repeatedly use social media, after they think it gives a happy feeling, then they will start to decrease focus on natural rewards like studying for exams and achieving good grades, which are slow but meaningful rewards. This is known as "Reward Hijack phenomenon" [2]. The students who are addicted to social media over usage will struggle to engage in study related activities [3]. This in turn leads to altering the reward sensitivity and also causes decreased study related motivation, distraction, smartphone addiction and short attention spans among these students [4].

The current study aims to find whether the Social Media over usage, reduces the brain's sensitivity for study related effort in medical and paramedical students in India. This study also aims to find and express neurobehavioral perspective for this Reward Hijack phenomenon in Medical and paramedical students in India.

Materials and Methods

Study design

This study is a cross sectional study and was conducted on Medical (MBBS) and paramedical students, to find whether the Social Media over usage, reduces the brain's sensitivity for study related effort sensitivity [5]. The cross sectional design helped in simultaneous assessment of various behavioural patterns and motivational patterns along with their outcomes in a natural academic setting. This study design was very much appropriate because it covered prevalence and intensity of student's digital usage behaviours in a single time frame, in which participant's habits were not influenced. To ensure realistic assessment of study related behaviours, this study was conducted in a

period of 3 months which coincides with their academic semester.

Ethical considerations

The Ethical approval was received from Institutional Ethics Committee. All participants gave written informed content, before starting the study. The study followed the ethical rules directed by Declaration of Helsinki (2013) [6]. The information of the participants like name, age, registration numbers and contact details were maintained confidentially. The participants were not forced and their participation for study was entirely voluntary and also they were allowed to withdraw at any point of time of the study.

Participants

A total of 275 students were recruited for the study. Out of which 175 were MBBS students and 100 were undergraduate paramedical students. Both MBBS and Paramedical students were from different colleges in Mandya district, Karnataka and the study was not conducted in the same institution as that of the researchers to avoid selection bias. The Inclusion criteria was set as, active usage of atleast one social media platform, age above 18 years & willingness to participate in the study [7]. The students with Neurological, Psychiatric disorders were excluded from the study. The demographic data was also collected to include subgroup analysis in the study. These data included age, gender, academic year and average social media usage time. Diversity was ensured during sampling, by including students from preclinical and also clinical phases of study.

Data collection

The data was collected using a validated, structured, self administered online questionnaire, which was designed in a way such that it included both social media behaviour and academic motivation [8]. The average time for completion of this questionnaire was around 10 - 12 minutes. Initially pilot testing was done 20 students to ensure content clarity and it's validity, so that modifications could be made on feedback from them. There was no negative feedbacks or changes suggested by these students. So the main study was continued without any changes. The following scales and their components were incorporated in the questionnaire of the study

1. **Social Media Overuse Scale (SMOS):** This scale was used to evaluate the frequency, duration and dependence of social media overusage [9]. In the questionnaire, the following components from this scale were asked as questions, like Daily usage, Compulsive checking, how social media interferes with academic work and how it makes a student getting addicted to it like dependence.The responses were scored on a Likert scale with 5 points (1= strongly disagree, 5=strongly agree). The higher score indicated more social media overusage. This SMOS indicated high internal consistency (Cronbach's alpha = 0.87).
2. **Study related Effort Sensitivity Scale (SRESS):** This scale evaluated participant's willingness, motivation and perceived reward for effortful academic tasks [10]. From this scale, the following components were asked as questions like, sustained study duration, preference for immediate vs delayed academic rewards and

satisfaction perceived after completing difficult academic tasks. The responses were scored on a Likert scale with 5 points (1= strongly disagree, 5=strongly agree). The higher score indicated more study related effort sensitivity. This SRESS indicated high internal reliability (Cronbach's alpha = 0.83).

Both the scales were used after adaptation for contextual relevance among India medical and paramedical students. The Higher SMOS and Lower SRESS scores indicated the "REWARD HIJACK" phenomenon, which means, academic, study related meaningful but slow rewards were hijacked by instant & fast social media digital rewards.

Statistical Analysis

The collected data was analysed using SPSS software (IBM corp). The continuous variables were reported as Mean & Standard Deviation. The categorical variables were reported as counts and percentages. The normality of continuous variables were assessed using Shipro Wilk tests and Q-Q plots.The Pearson's correlation coefficient [11]. was used to analyse the linear association between SMOS and SRESS scores. A simple linear model was developed to examine the predictive effect of social media overusage on study related effort sensitivity. The results with $p<0.05$ is set as statistically significant.

Results

Demographics and social media behaviour

Among the 275 total participants included in the analysis, 154 were males which amount to 56% and 121 were females which amounts to 44%. There existed gender differences in the result. Males were spending more time on social media than females ($p = 0.02$). The mean age for the study was 20.6 ± 1.8 years. Among the 275 participants, 175 (63.6%) were MBBS students and 100 were paramedical students (36.4%). The study participants reported an average daily social media usage of 3.6 ± 1.9 hours. Around 75.4% students reported frequent daytime distractions due to social media notifications and online engagement [12].

The study participants expressed a marked decrease in focus, concentration and study planning, immediately post social media usage ($p<0.01$). These details are expressed in Table 1.

Table 1. Participant Characteristics (n = 275)

Variable	n / mean ± SD	% or range
Age (years)	20.6 ± 1.8	—
Gender		
— Male	154	56%
— Female	121	44%

— Other	0	0%
Course		
— MBBS	175	63.6%
— Paramedical	100	36.4%
Daily social media use (hours)	3.6 ± 1.9	0–12
Frequent daytime distraction	207	75.4%

Scale Scores (Table 2)

The average of SMOS (Social Media Overuse Score) was 3.18 ± 0.82, which reflects moderate to high levels of habitual Social Media Usage. The average of SRESS (Study Related Effort Sensitivity Score) was 3.52 ± 0.74, which indicated moderately high academic motivation overall, but it had variability indicating differential sensitivity to effort based rewards.

Table 2. Descriptive Statistics of Main Scales

Scale	Range	Mean ± SD	Median	Skewness (SE)
SMOS	1–5	3.18 ± 0.82	3.2	0.12 (0.18)
SRESS	1–5	3.52 ± 0.74	3.6	–0.08 (0.18)

Normality testing indicated approximately normal distribution for both the scales, (SMOS= - 0.40; SRESS = - 0.35), which supports the use of parametric analysis [13].

Correlation analysis

According to Table 3, there existed a moderate, statistically significant negative correlation between Social Media overusage and study related effort sensitivity (r = - 0.41, 95%, CI -0.526 to 0.279, $p < 0.001$) [14]. This means, the participants who expressed higher levels of social media engagement, showed decreased intrinsic motivation for study related academic tasks and also they expressed reduced sensitivity to delayed effort based rewards which corresponds to academic rewards in the study participants. Also subgroup analysis done and which also proved the same results both in MBBS ($r = –0.39$, $p < 0.001$) and also in paramedical students ($r = –0.42$, $p < 0.001$), which suggests that the above mentioned effect is consistent among both the academic disciplines [15].

Table 3. Pearson Correlation

Variables	1	2
1. SMOS	1.00	–0.41*
2. SRESS	–0.41*	1.00

$p < 0.001$; 95% CI for r = –0.526 to –0.279

Regression analysis (Table 4)

A simple model of linear regression predicted SRESS from SMOS was statistically significant (F(1,173) = 34.16, p,0.001), with variance of 16.5% (R^2=0.165). The regression coefficient for social media overuse β = –0.340 (SE = 0.058, t = –5.84, p < 0.001), which indicates that each 1 point increase in SMOS, corresponds to 0.34 point decrease in SRESS [16].

Table 4. Regression Analysis Predicting SRESS from SMOS

Predictor	B	SE	t	p	95% CI
Constant	4.62	0.196	23.56	<0.001	[4.24, 5.00]
SMOS	–0.340	0.058	–5.84	<0.001	[–0.454, –0.226]

Model R^2 = 0.165; F(1,173) = 34.16, p < 0.001

Further multiple regression analysis depicted that, each additional hour spent on social media was in turn associated with an average reduction of 20 minutes in focussed study time, after controlling for age and gender.

These above findings, infer the substantial behavioural impact of prolonged social media usage and exposure on student's academic routines, also these findings highlight that, social media overusage has a potential of reward hijack through dopamine mediated gratification, impair time management of students, reduces attention span and also increase procrastination tendencies. If such overusage of social media continues, in overtime may affect student's academic performance, their mental well being and their ability to involve in deep meaningful learning (Figure 1).

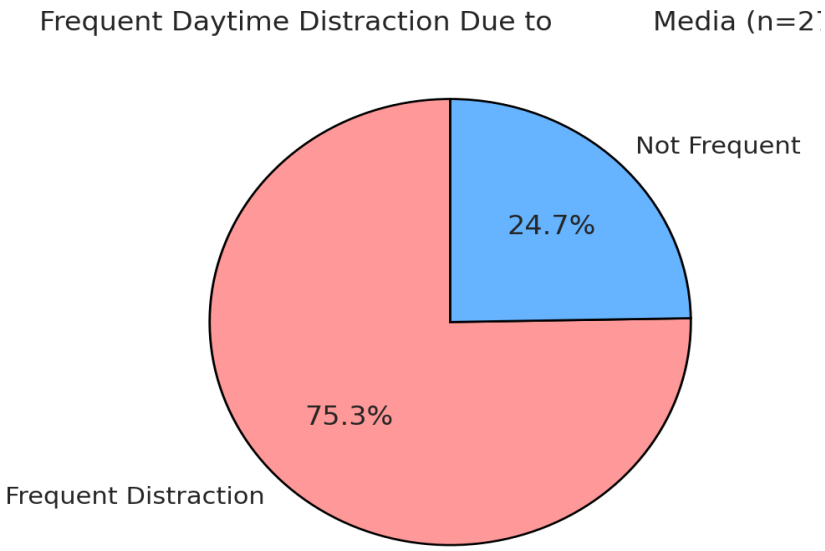


Figure 1. Frequent Daytime Distraction Due to Social Media Use.
Pie chart showing the proportion of participants reporting frequent daytime distraction attributable to social media usage. A majority (75.3%) reported frequent distraction, while 24.7% did not, indicating a high prevalence of attention disruption during daytime activities (n = 275).

Discussion

The present study, had revealed a significant inverse relationship between social media overusage and study related brain sensitivity in undergraduate medical and paramedical students. The findings of the study affirms the reward hijack hypothesis, which suggests that repetitive exposure to rapid digital gratifications decreases responsiveness to natural and effort based meaningful rewards [17]. There reflected a competition between instant online reinforcement and intrinsic academic motivation to study because increased social media engagement was linked to reduced motivation towards cognitively demanding tasks like meaningful concentrated studying (Figure 2).

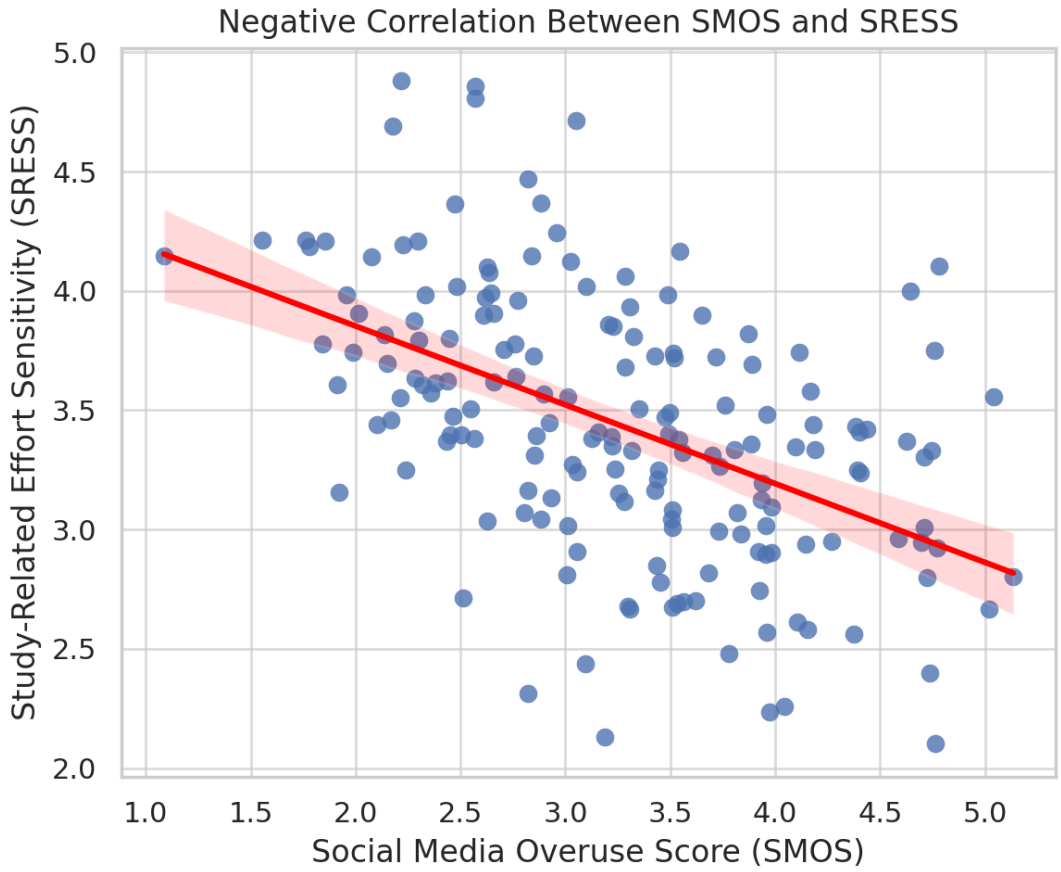


Figure 2. Negative Correlation Between Social Media Overuse Score (SMOS) and Study-Related Effort Sensitivity Score (SRESS).

Scatter plot depicting a significant negative correlation between SMOS and SRESS, suggesting that higher levels of social media overuse are associated with reduced sensitivity to study-related effort. The red regression line represents the line of best fit with 95% confidence interval (shaded area).

According to Neurobiological sciences, this can be attributed to down regulation of the mesolimbic dopaminergic pathway – mainly projections from the ventral tegmental area (VTA) to the Nucleus accumbens and prefrontal cortex [18]. Frequent and unpredictable rewards (like, likes, comments, chat notifications) hyper activate the dopaminergic circuits, leading to craving and compulsive checking behaviours [19]. Also, dopaminergic down regulation blunts the responses to delayed rewards, like academic achievements and accomplishments [20]. These neurological patterns are similar to those patterns seen in behavioural addictions, with hyper activation in the striatum and orbitofrontal cortex (Figure 3).

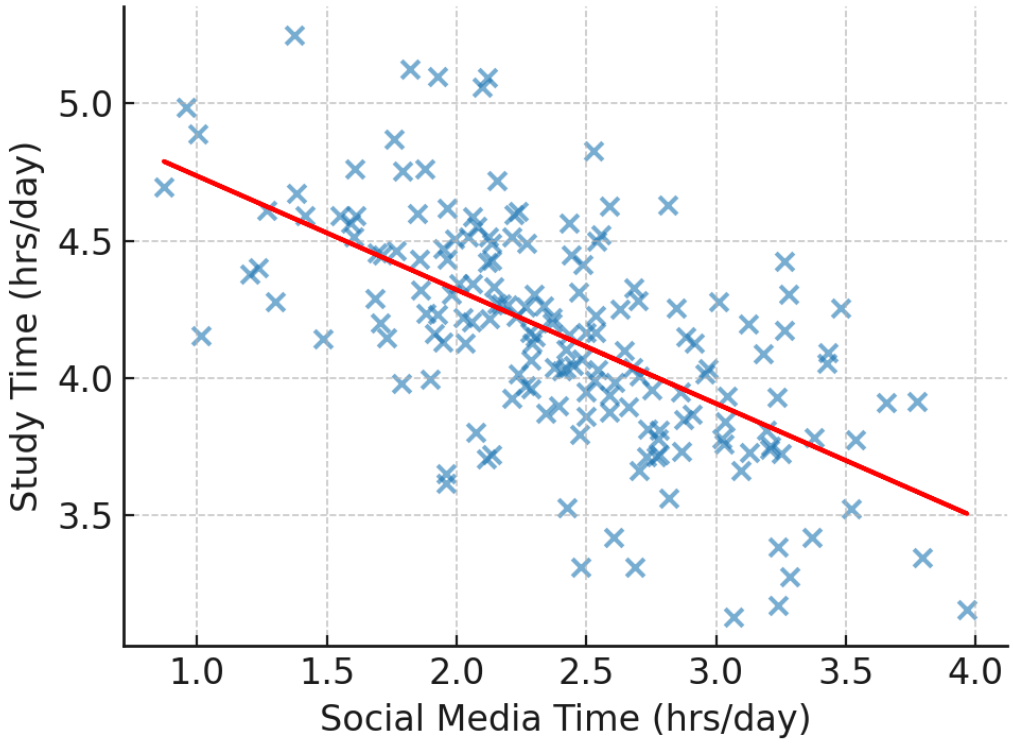


Figure 3. Inverse Relationship Between Daily Social Media Time and Study Duration. Scatter plot showing a significant negative linear relationship between time spent on social media (hours/day) and study time (hours/day). Increased social media engagement corresponds with a reduction in total study duration, highlighting potential interference with academic productivity.

Behaviourally, reduced effort sensitivity is manifested as shorter attention spans, lower persistence, and difficulty in willing delayed gratification. The observed moderate negative correlation ($r = –0.41$) aligns with previous studies which were linking excessive social media use to academic disengagement and reduced attention [21]. The consistency of this finding across both MBBS and paramedical students suggests that even high achieving learners are also vulnerable to reward driven desensitization.

These results also align with Effort Discounting Theory, which states that the subjective value of a reward decreases as the required effort increases [22]. Continuous digital overstimulation may exaggerate this process, leading students to overestimate the effort of studying while underestimating its late but meaningful rewards. Consequently, it leads to a state of mind were motivation fades, even when students understand the long-term benefits of academic effort.

Some Indian and some global research also depict these trends, proving that excessive digital media use correlates with sleep disruption, poor academic performance, and diminished self regulation [23–25]. Our study adds a neurobehavioral dimension, demonstrating how persistent social media engagement may recalibrate motivational circuits which will further affect the study related brain's effort sensitivity in Medical (MBBS) and Para medical students. Such reward desensitization reduces not only academic

productivity but also reduces well-being, which may be evident in dopamine's role in emotional stability and executive control.

This phenomenon of "Reward Hijack" also aligns with the concept of hedonic adaptation, in which the individuals gradually require higher stimulation to achieve the same level of satisfaction. Social media platforms are specifically designed knowingly or unknowingly, to exploit this principle through algorithmic repetition patterns, maintaining engagement by delivering unpredictable, different types of rewards, similar to slot machine mechanics. Such continuous cycles of micro rewarding can biologically re-assemble intermittent reinforcement, a schedule known to generate the strongest conditioned behaviours. Over time, this dampens the student's academic motivational capacity, prioritizing digital stimuli over sustained academic effort.

Emerging research in cognitive neuroscience further indicates that prefrontal cortical regions which are responsible for planning, impulse control, and sustained attention, are functionally weakened in heavy digital media users [26]. Further, functional MRI studies demonstrate reduced gray matter volume and activity in the anterior cingulate cortex (ACC) and dorsolateral prefrontal cortex (DLPFC) among individuals who have compulsive mobile screen use [27]. These same regions are crucial for cognitive endurance and effort allocation, offering biological evidence for diminished study-related motivation [28].

In the academic context, this neural adaptation means a preference for low-effort, high-feedback activities, such as scrolling or watching reels (short forms of videos which can be watched in seconds to few minutes), rather than engaging in tasks requiring concentrated mental effort, like reading a huge portion for exams or problem-solving [29]. The constant influx of digital stimuli, distracts attention and weakens the brain's ability to maintain deep focus, which is very much needed by the students for conceptual learning and understanding.

From a psychological perspective, social media overuse can also be classifieds under the Self-Determination Theory (SDT) [30]. SDT states that intrinsic motivation thrives when individuals experience autonomy & competence. However, social media distorts these motivational needs. Consequently, students may lack intrinsic motivation for proper learning experiences.

Furthermore, another explanatory model is there known as Dual-System Theory of cognition [31]. According to this model, System 1 (fast, impulsive, emotional) and System 2 (slow, deliberate, logical) compete for behavioural control. Excessive social media use overstimulates System 1, leading to habitual, reflexive behaviours and reducing the engagement of System 2 processes which are required for disciplined academic study. This imbalance exaggerates impulsivity, procrastination, and diminished tolerance for cognitive delay, all of which will definitely impair sustained learning.

The reward prediction error mechanism offers another neurobiological insight. Each time a social media notification is received unexpectedly, dopamine neurons fire strongly, signalling a positive prediction error [32]. The brain learns to anticipate these signals and becomes hypersensitive to potential digital cues. In contrast, studying offers delayed and predictable outcomes, eliciting

comparatively less immediate dopaminergic excitement. Over time, this differential conditioning may lead the brain to subconsciously prioritize quick, uncertain online rewards over stable, delayed academic satisfaction.

Other cross cultural studies also suggests this trend. Korean, Chinese, and Western data all depict increasing levels of "digital reward dependency" among adolescents and young adults, with measurable effects on executive function and learning outcomes [33]. In India, where digital access is rapidly expanding, the absence of structured digital literacy programs amplifies the risk. Students often lack awareness of how their attention is modified, making them susceptible to compulsive behaviours without recognizing the neurocognitive consequences.

Medical and Paramedical curriculums demand prolonged cognitive focus, empathy, and delayed gratification which are the qualities inversely related to the instant reward algorithms of social media. If the reward system becomes chronically biased toward immediacy and fastness, students may struggle to find satisfaction in the slow process of mastering their subjects in curriculum like Physiology, Pharmacology, Medicine, Clinical reasoning, etc. This represents not merely a lifestyle concern but a neurological shift that can undermine professional competence.

Integrating neuroscience-based awareness programs into academic schedules could therefore serve a preventive function. Workshops that visualize brain reward pathways, show fMRI images of digital addiction, or discuss the neuroplasticity effects of attention training may strengthen student's metacognitive control. Similarly, interventions such as Pomodoro -based study techniques, pranayama & yoga before study sessions, and reward substitution strategies (e.g., pairing study sessions with non-digital rewards) have shown promise in rebalancing dopaminergic tone [34].

From a public health view, the findings highlight a broader societal concern of how the digital economical needs spoils the young adult's neurodevelopmental stages. The late adolescence and early adulthood period is marked by continued maturation of the prefrontal cortex. Chronic overstimulation during this phase may result in enduring alterations in motivational circuits [35]. Therefore, early educational interventions are not merely about productivity but about safeguarding neurodevelopmental integrity.

Furthermore, interdisciplinary collaboration is crucial. Doctors, Psychologists, and Educators must work jointly to design interventions that address both the neurochemical and behavioural aspects of reward hijack. Neurological feedback (like EEG), biofeedback, and cognitive training tools may complement conventional counselling to restore balance between the mesolimbic and prefrontal systems.

The social media over usage not only affects the academic stability of students, but also affects emotional stability of students. Students may experience mood swings due to digital media use, leading to stress, anxiety, and self comparison fatigue. Such emotional consequences further reduces study efficiency, as anxiety competes for cognitive resources, which are essential for working memory. Emotional exhaustion, in turn, can reduce dopamine

availability, causing a vicious cycle of avoidance and procrastination.

It is also important to acknowledge that social media's architecture leverages attention as a currency, converting user engagement into commercial value. In this framework, the user's neural reward system becomes a site of economic exploitation which is a phenomenon some researchers call neuro - marketing colonization. Understanding this manipulation may empower students to reclaim consciousness over their attention and re-establish healthier digital boundaries.

Finally, some of it's implications extend beyond academics. Chronic dopaminergic blunting has been linked to anhedonia, apathy and emotional fatigue, which are conditions that may precede to depressive states. Therefore, monitoring digital habits can serve as an early indicator for mental health risks. Embedding digital well-being modules within medical education can, not only protect cognitive performance but also provide emotional resilience in future healthcare professionals.

If these adverse effects are unaddressed, reward hijack could erode deep learning, self-discipline, and intrinsic motivation which are the major key aspects in medical education. Interventions such as mindfulness-based training, structured digital detox programs, and reinforcement of delayed gratification may help restore dopaminergic sensitivity and improve student's academic focus & learning.

Integrating digital hygiene and neurobehavioral education into the curriculum could further enhance awareness of, how compulsive online behaviours alter motivation. These strategies, grounded in neuroscience, could help students reclaim control over cognitive effort and reward balance.

Strengths and Limitations of the study

This study's strength lies in its interdisciplinary framework combining neurophysiology and behavioural science, which were supported by validated scales. The adequate sample size ensured statistical reliability and cross-discipline generalizability.

However, the cross-sectional design limits causal inference [36]. Self-reporting may introduce bias, and confounders such as stress, sleep disorders were not controlled. Future longitudinal and neuroimaging studies should be done to clarify causality and identify neural reversibility following behavioural interventions.

Conclusion

Excessive social media use appears to hijack the brain's reward mechanisms, reducing sensitivity to effort based academic rewards. Students with higher online engagement exhibited lower motivation for sustained study, which was consistent with the neurobehavioral reward hijack model. This desensitization reflects not only mere distraction but also a shift in motivational neurochemistry, in which an immediate digital gratification replaces curiosity-driven reinforcement.

Such dopaminergic desensitization erodes perseverance, patience and acceptance, qualities which are vital in health science education. Academic institutions should therefore promote digital literacy, mindful engagement, and delayed non digital reward strategies to restore intrinsic motivation. Structured interventions like scheduled social media breaks, digital hygiene training, and

mindfulness based focus programs can recalibrate reward pathways and enhance learning architecture of the student.

Beyond academics, chronic dopamine imbalance may contribute to attentional deficits, emotional fatigue, and anhedonic symptoms. Early behavioural modifications done through awareness and institutional support [37-40] can serve both preventive and therapeutic functions.

Ultimately, social media overuse should be viewed as a neurobehavioral condition, not a acute habit. Combating reward hijack requires collaboration between neuroscience, medicine, psychology, and education. Re-establishing the values of delayed gratification and intellectual satisfaction in students is essential for restoring balance between instant pleasure and long-term meaningful academic fulfilment.

By promoting mindful technology use and neuroscience aligned learning strategies, educators can help students rebuild intrinsic motivation and cognitive focus, ensuring that effort, patience, and curiosity remain important to meaningful academic growth in the digital era.

Statements and Declarations

Conflicts of interest

The authors declare that they do not have conflict of interest.

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