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Research Article

The Role Of Executive Functioning And Intellectual Capacity In Criminal Behaviour : A Comparative Analysis Of Violent And Non-Violent Juvenile Offenders

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ABSTRACT

Juvenile offending has been consistently linked to executive dysfunction and an inability to inhibit responses in demanding situations. Over the past several years, research has explored the relationship between crime, intellectual capacity, and brain dysfunctions. Brain studies indicate that the prefrontal cortex plays a critical role in executive functioning, with its development influencing behavioral regulation, including antisocial behavior changes. Dysfunction in the brain part namely prefrontal cortex can lead to executive dysfunction, which may, in turn, serve as a pathway to violence. Executive control activities such as understanding the purpose of actions, planning, setting specific goals, and executing them effectively. Similarly, intellectual capacity enables individuals to think, act, and regulate behavior in an appropriate manner, including the ability to delay or inhibit responses based on the evaluation of multiple factors.

The purpose of this study is to address gaps in the research by examining differences in intellectual capacity and executive functioning between violent offenders (VO) and non-violent offenders (NVO). While previous studies have investigated executive dysfunction in offenders, limited research has explicitly compared cognitive flexibility and response inhibition across violent and non-violent groups. This study used Raven's Progressive Matrices to assess intellectual capacity, the Stroop Test to measure response inhibition and the Wisconsin Card Sorting Test (WCST) to evaluate executive functioning.

Findings reveal a significant difference in intellectual capacity, with violent offenders scoring significantly higher than non-violent offenders ($t = 2.513$, $p = .029$). However, no significant differences were observed in executive functioning measures, including cognitive inhibition (Stroop Test) and cognitive flexibility (WCST), suggesting that deficits in these domains are not exclusive to violent offenders. These results challenge the assumption that executive dysfunction alone differentiates violent from non-violent offenders. The study also elucidates the relationship between intelligence and delinquent behaviour.

Keywords: Intellectual Capacity, Executive Functioning, Response Inhibition, Stroop Test, Wisconsin Card Sorting Test, Criminal Behavior

INTRODUCTION:

India, a nation with a dynamic and burgeoning population. Currently its population estimated over 1.4 billion, which comprising 14% of its total as children. As the population continues to surge, so does the rate of crimes committed by children also increases, which compels researchers and social scientists to formulate theories to understand the phenomenon and causes of crime committed by juvenile delinquents. Juvenile offending gained prominence globally in the late 1960s and became a highlighted issue in India during the late 1980s. Juveniles, due to their lower levels of physical and mental maturity, differ significantly from adults in their capacity for decision-making and impulse control (Richards, 2011).

Observation homes have recorded an increase in admissions of children who are in conflict with the law in recent years (NCRB, 2022). Risky behaviours such as alcohol consumption, drug abuse, and involvement in

fights during early life often increase the likelihood of juveniles developing into hardened criminals in adulthood (Mason et al., 2010). several factors contribute to juvenile delinquency, including ineffective parenting style, lack of affection, family disturbances, and dysfunctional parental characteristics (Mwangangi, 2019). In addition to these social and environmental factors, juvenile delinquency requires consideration of various factors related to the cognitive and psychological mechanisms that can lead to delinquent behaviour is crucial.

While extensive research has provided empirical evidence on juvenile delinquency, a key limitation is the ongoing debate regarding the age boundary between juveniles and adults. This demarcation varies across countries, generally falling between 16 and 20 years of age. In India, the Juvenile Justice (JJ) Act of 2015 defines the upper age limit for juvenile delinquents as 18 years. A juvenile delinquent is broadly defined as one who breaks the law, persists in disobedient behaviour, or endangers their own moral life and that of others. The impact of juvenile crime extends beyond the offender, affecting parents, families, educators, and society at large, while also increasing the risk of negative outcomes for the juvenile themselves.

Not all children exposed to similar environmental conditions engage in delinquent activities. While one child may commit a crime due to poor or single parenting, another may do so due to negative peer influence, conduct disorders, or low socio-economic status. Despite these varied backgrounds, all such children often receive the same rehabilitative treatment in observation homes (Ajisuksmo, 2023). This concern highlights a critical question: What are the primary and significant factors contributing to delinquent behaviour? This study intends to examine the role of intellectual capacity, response inhibition, and executive functioning in distinguishing violent and non-violent juvenile offenders.

Theoretically, crime can be broadly divided into two types, i.e., Violent and Non-Violent Crimes. Offenders, on the basis of crime commitment, are also designated as violent offenders or non-violent offenders. Operationally speaking, violent offenders comprise people who are imprisoned because of any lawbreaker allegation for a fierce offense against another individual, including assault, assault inflicting damage, injuring, attempted crime, manslaughter, seizing, effective restriction, armed robbery, and all 'involved' sexual offenses. On the other hand, non-violent offenders engage in crimes related to property, drug trafficking, burglary, larceny, and public order offenses. Basically these acts do not involve a threat of harm or an actual attack upon a victim (Coleman, 2016). Looking into these intricate ideas, the current study explored the role of executive function, intelligence, and response inhibition constructs among violent and non-violent offenders.

The current study is an attempt to utilize intelligence tests and neuropsychological approaches to understand the factors responsible for violence among juveniles beyond biological, social, and situational contributory factors. Research in the past has established the relationship between various biological, sociological, physiological, and neuropsychological approaches contributing to the study of criminal behavior. All such approaches help in understanding the factors responsible for committing a crime. Essentially the biological approach focuses on the genetic basis and neurological underpinnings of criminal behavior. whereas the sociological approach emphasizes social influences including family dynamics, peer associations, and socioeconomic conditions that detemine criminal intent. another important factor is the neuropsychological factros which examines the structure and function of the brain and identifies specific regions associated with behavioral and psychological processes.

This study specifically focuses on intellectual capacity, executive functioning, and response inhibition ability in juvenile offenders through intelligence and neuropsychological assessments.

Intelligence and Juvenile Delinquency

Prior studies have extensively explored the relationship between intelligence and juvenile delinquency. these researches consistently revealing an inverse correlation. A lower level of intelligence has been linked with higher rates of delinquency, indicating cognitive deficits as a potential factor contributing to criminal behavior. Nickel (2017) conducted a logistic regression analysis using secondary data from the Children of the National Survey of Youth. The findings shows that lower intelligence is associated with higher rates of delinquency. It suggests that cognitive deficits may play a role in contributing to criminal behavior. Similarly Ellis & Walsh (2003) further validated this association by illustrating that linguistic intelligence demonstrates a more pronounced correlation with offending behavior compared to spatial reasoning. This suggests that verbal cognitive abilities significantly impact delinquent behavior by influencing problem-solving and decision-making skills.

Early research by Steinbach (1934) investigated juvenile delinquents using intelligence tests and analyzed environmental and familial factors influencing behavior. this research findings revealed that most delinquents are not mentally deficient. In addition they found that the higher intelligence is associated with fewer delinquency charges. This study is an example of the complex nature of delinquency, where cognitive abilities interact with environmental influences to shape behavior. Gluek (2010) employed a psychological approach to assess juvenile offenders by integrating intelligence tests with semi-structured home interviews, as well as psychiatric and physical evaluations. Another study conducted by Pandey & Kumari (2018) found that juvenile delinquents scored significantly lower on intelligence tests compared to non-delinquents, indicating differences in intellectual abilities between these groups.

Executive Functioning and Juvenile Delinquency

Research indicates that deficits in executive functions—cognitive processes such as planning, working memory, and impulse control—are associated with antisocial behavior and juvenile delinquency. These deficits are often linked to dysfunctions in the part of brain which is prefrontal cortex and responsible for executive functioning (Girotti et al., 2018).Executive functioning refers to a set of cognitive skills that regulate an individual's thoughts, emotions, and behaviors. These skills, drived by the prefrontal cortex. all these skills are essential for daily functioning, decision-making, and self-control (Funahashi, 2017). The key components of executive functioning includes working memory which has ability to hold and manipulate information over short periods. Cognitive llexibility is the capacity to switch attention between tasks and adapt to changing rules. another component is inhibitory Control which is the ability to suppress impulsive or inappropriate responses.

Planning and Organization is one important component to set goals, develop strategies, and prioritize actions. Task initiation is the skill to begin tasks without unnecessary procrastination and emotional regulation is the ability to manage emotions effectively.

Research has demonstrated a strong relationship between antisocial behavior and neuropsychological deficits, particularly executive dysfunction. Moffitt's (1993) theory suggests an association between executive dysfunction and antisocial behavior, with executive impairments increasing the likelihood of delinquent acts.

Neuropsychological assessments indicate that executive dysfunction is not necessarily linked to gross prefrontal cortex damage but can be subtle yet impactful. Miyake et al. (2000) examined the separability of three executive functions—mental set shifting, information updating, and response inhibition—to determine whether executive functioning should be considered a unitary or diverse construct. They found that while these functions are moderately correlated, they remain distinct constructs contributing differently to complex cognitive tasks. These findings indicate that executive functioning is multidimensional and requires a nuanced approach when analysing its role in delinquency.

Neuroimaging studies further support these findings. Raine et al. (2001) revealed reduced activation in the right temporal cortex in violent offenders with a history of abuse compared to control subjects during a working memory task. Similarly, Raine et al. (2006) found there is activation deficits found in the brain regions namely left frontal gyrus and anterior cingulate cortex in violent individuals. compared. These findings align with longitudinal studies demonstrating that children with both low neuropsychological performance and family adversity had significantly higher aggression scores than those with only one of these risk factors (Moffitt, 1993).

Response Inhibition and Criminal Behavior

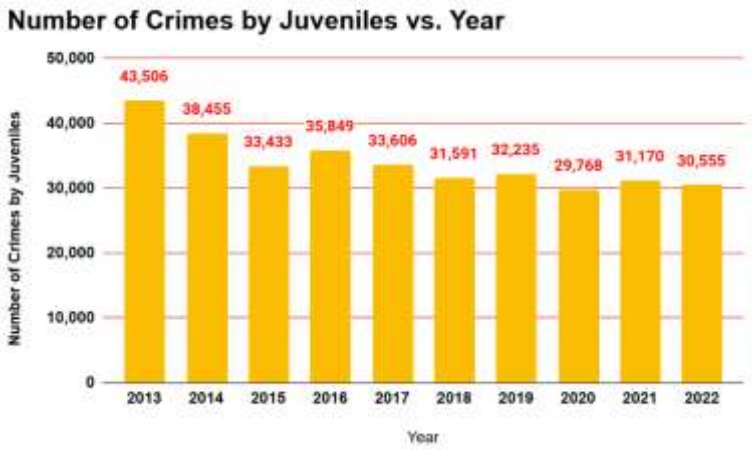
Response inhibition plays a crucial role in organizing cognitive performance across perception, attention, memory, and motor processes. The Stroop Test is one of the most reliable tools for assessing response inhibition. Behavioral studies indicate that inhibitory control (Leon-Carrion et al., 2004; Luna et al., 2004a), processing speed (Luna et al., 2004a), working memory, and decision-making (Luciana et al., 2005; Hooper et al., 2004) continue to develop throughout adolescence.

Neuropsychological studies have shown that impaired response inhibition is a common characteristic among individuals displaying criminal behavior. Lapierre et al. (1995) found that psychopaths were significantly impaired on all orbitofrontal ventromedial tasks, including Go/No-Go and maze tasks, but performed similarly to non-psychopaths on dorsolateral frontal cortex-related tasks. Poor neuropsychological status has also been identified as a predictor of early-onset male offending before age 13 and persistent criminality into adolescence and adulthood (Moffit & Silva, 1994).

Collectively, these findings indicate that intelligence, executive functioning, and response inhibition are interrelated factors contributing to delinquency. The current study aims to integrate these cognitive constructs to develop a deeper understanding of juvenile delinquency, potentially informing intervention and rehabilitation strategies.

Data on Juvenile Delinquency in India

Juveniles Apprehended Under Indian Penal code (IPC) & Special and Local Law (SLL) Crimes by Sex from 2013-2022



Graph: 1 Adapted from NCRB Report: 2022

Since 2013, the number of crimes committed by Juveniles has generally exhibited a downward trend, with occasional exceptions in 2016, 2019, and 2021. During these years, there was a marginal increase in reported crimes compared to the preceding years. Specifically, the number of crimes rose from 33,433 to 35,849 in 2016, from 31,591 to 32,235 in 2019, and from 29,768 to 31,170 in 2021.

The NCRB classifies Juvenile crime data into two categories: those committed in violation of the Indian Penal Code (IPC) and those in violation of Special and Local Laws (SLL). Analysis of this data reveals a reduction in both categories over the period from 2013 to 2022. Specifically, the number of IPC-related crimes decreased from 38,765 to 26,571, while SLL-related crimes decreased from 4,741 to 3,984 during this period.

Methodology

Aims of the Study

1. The aim of the current study is to evaluate and compare the executive functioning in Violent Offenders (VO) and Non-Violent Offenders (NVO).
2. Another aim of the study is to evaluate and compare the ability to inhibit response in Violent Offenders (VO) and Non-Violent Offenders (NVO).

Hypotheses

1. There will be a significant difference in Intellectual Capacity among Violent (VO) and Non-Violent (NVO).
2. There will be a significant difference in executive functioning among Violent (VO) and Non-Violent (NVO).
3. Response inhibition level would be less in Violent (VO) and Non-Violent (NVO).

Study Design

The present study follows a cross-sectional between-group design to assess and compare Intellectual Functioning, Executive Functioning, and Response Inhibition among Violent (VO) and Non-Violent (NVO) juvenile offenders.

Sample and Recruitment

The representative sample was collected from the Observation Home for Boys II, Kingsway Camp, Delhi. The control group sample was gathered from nearby localities within the same society.

A total of 48 juveniles initially participated; however, 6 offenders failed to complete all the test instruments due to release on bail, and 2 withdrew participation after completing one test. The final sample consisted of 40 participants (20 violent and 20 non-violent offenders).

All participants were male juveniles and randomly selected based on availability and willingness to participate.

Demographic Factors:

- Approximately 50% of participants came from households with an annual income of Rs 60,000.
- Around 90% were immigrants, originally from other states but residing in Delhi, while only 10% belonged to Delhi.
- Educational background varied with some having minimal formal education, potentially influencing cognitive performance.

Inclusion Criteria

1. Male juveniles
2. Age range: 16 to 18 years
3. Ability to read, write, and speak Hindi or English

Exclusion Criteria

1. Age below 16 years
2. Inability to read, write, or speak Hindi or English
3. Substance addiction (drug or alcohol dependency)
4. Presence of significant physical, neurobiological, or psychiatric conditions (e.g., mental retardation, personality disorders, schizophrenia)

Tools and Materials

The following psychological test-tools were used to assess cognitive functioning:

1. **Raven's Progressive Matrices Test (Raven, 1936)** – Used to measure non-verbal intellectual functioning. This test was chosen over others due to its reliability in assessing general intelligence independent of language and formal schooling.
2. **Wisconsin Card Sorting Test (WCST) (Heaton et al., 1993)** – Evaluates executive functioning, including cognitive flexibility, problem-solving, and rule-based learning. WCST was selected because it is widely recognized for assessing frontal lobe functioning, which is often impaired in offenders.
3. **Stroop Test (Stroop, 1935)** – Measures response inhibition and cognitive control. This test was preferred due to its strong evidence in differentiating between impulsive and non-impulsive individuals.

Procedure

All assessments were conducted after obtaining permission from the Women and Child Development (WCD) Office, New Delhi, which authorized interaction with juveniles in conflict with the law.

Before participation, each juvenile was provided with a written and verbal explanation of the study, ensuring they understood its academic purpose and confidentiality measures. Ethical considerations were strictly followed, and sensitive questions related to criminal history were avoided to maintain neutrality and avoid distress.

Statistical Analysis

The collected data was analyzed using non-parametric statistical methods due to:

1. Small sample size
2. Violation of normality assumptions
3. Nature of measurements (e.g., RSPM, WCST, and Stroop Test scores)

Using non-parametric techniques enhanced robustness and statistical power, reducing the likelihood of Type I & Type II errors. Data analysis was conducted using SPSS-18 software (IBM Corp., 2011).

- t-tests were used to compare means between groups.
- Pearson's correlation was performed to examine relationships between variables.
- The alpha (α) level was set at 0.05, aligning with common standards in psychology and education, balancing statistical rigor with a low risk of committing a Type I error.

Results

The current research endeavor intended to strengthen, expand, and improve our existing knowledge of youth and violent offender's decision making and risk-taking behaviors.

The Independent-Samples t-test procedure was utilized to compare the means for two separate groups viz. Violent Offenders (VO) & Non-Violent Offenders (NVO) for looking into the significant differences, if any existed or not on Intellectual Capacity , executive functioning and Response inhibition level.

S No.	Dimension	Mean	SD	t value	df	p value
1.	**Intellectual Capacity**	**VO= 29.90 NVO= 20.20**	**VO= 11.59 NVO= 3.82**	**2.513**	**10.737**	**.029**
2.	Stroop I	VO= 17.30 NVO=22.40	VO= 5.27 NVO=12.07	-1.224	18	.237
3.	Stroop II	VO= 21.70 NVO=28.50	VO= 5.376 NVO=12.10	-1.624	18	.122
4.	Total Errors in Stroop II	VO= 1.10 NVO=1.60	VO= 1..28 NVO=1.26	-.876	18	.392
5.	Total Correct	VO= 80.90 NVO=76.80	VO= 9.94 NVO=13.19	.784	18	.443
6.	PeseverativeResponse Errors in WCST	VO= 26.70 NVO=28.40	VO= 6.36 NVO=7.32	-.554	18	.586
7.	Conceptual level Response in WCST	VO= 63.10 NVO=58.00	VO= 11.81 NVO=18.11	.746	18	.465
8.	Categories completed in WCST	VO= 3.40 NVO=3.00	VO= 1.43 NVO=1.63	.583	18	.567

Table 1: "t" analysis between Violent (VO) and Non-violent offender on Raven's Progressive Matrices, Stroop and Wisconsin Card Sorting Test.

The analysis revealed a **significant difference** in **intellectual capacity** between violent offenders (VO) and non-violent offenders (NVO), with **violent offenders scoring higher (M = 29.90, SD = 11.59) compared to non-violent offenders (M = 20.20, SD = 3.82; t = 2.513, p = .029)**. This suggests that violent offenders, on average, demonstrated **higher cognitive ability** as measured by Raven's Progressive Matrices (See Table 2).

However, no significant differences were found between the two groups in measures of **executive functioning**, including **cognitive inhibition (Stroop Test)** and **cognitive flexibility (Wisconsin Card Sorting Test - WCST)**. In **Stroop I and Stroop II**, non-violent offenders scored slightly higher than violent offenders, but the differences were not statistically significant (p = .237 and p = .122, respectively). Similarly, **total errors in Stroop II (p = .392), total correct responses (p = .443), perseverative errors (p = .586), conceptual level responses (p = .465), and categories completed in WCST (p = .567)** showed no significant differences.

These findings indicate that while **intellectual capacity differs significantly between violent and non-violent offenders, executive functioning impairments are common across both groups**, suggesting that cognitive deficits in inhibition, problem-solving, and flexibility may not be unique to violent criminal behavior.

Discussion:

Crimes like homicide, robbery, assault, and drinking are generally carried out by the adolescents. It is obvious from the above results that the guilty parties who committed such offenses generally lie under the age class of 15-18 years. Every one of the respondents had a place with the poor financial foundation with low parental training and pay. However most of the families were not the casualties of liquor addiction and criminal record, still these youngsters carried out the offenses like homicide, assault, robbery, drinking, smoking, and so forth. The vast majority of the adolescents had to work and the concentrate likewise expresses that fairly going to class they functioned as a day to day wage work. Because of absence of legitimate socialization and direction, these adolescents could have done without going to class, more often than not they favored investing their energy alongside their companions.

The findings of this study reveal that intellectual capacity, as measured by Raven's Progressive Matrices, was significantly higher in violent offenders (VO) compared to non-violent offenders (NVO). However, other cognitive measures, including Stroop Test (assessing cognitive control and inhibition) and Wisconsin Card Sorting Test (WCST) (assessing executive functioning, cognitive flexibility, and problem-solving), did not show a significant difference between the two groups. These results provide insights into the cognitive characteristics of offenders and suggest that intelligence, rather than executive dysfunction, may play a more prominent role in distinguishing violent and non-violent offenders.

The significant difference in intellectual capacity between violent and non-violent offenders is consistent with previous research indicating that some violent offenders, particularly those engaged in premeditated crimes, tend to possess higher cognitive abilities (Mokros et al., 2011). Higher intelligence levels may enable violent offenders to strategize and execute crimes with greater planning and control, distinguishing them from non-violent offenders who may act impulsively without careful foresight (DeLisi et al., 2010).

Research also suggests that individuals with higher intelligence may exhibit superior problem-solving skills, which can contribute to engaging in complex criminal behaviors rather than impulsive crimes (Gao & Raine, 2010). Additionally, studies indicate that violent offenders with high intelligence tend to be more manipulative and socially adept, which aids in criminal planning (Salekin et al., 2004).

Despite prior studies highlighting executive dysfunction as a factor in criminal behavior (Morgan & Lilienfeld, 2000), this study did not find significant differences between violent and non-violent offenders on the Stroop Test and WCST. One possible explanation is that both groups of offenders share similar deficits in executive functioning, such as impulse control, cognitive flexibility, and problem-solving ability (Raine, 2013). Given that both violent and non-violent offenders have histories of criminal behavior, they may both exhibit impaired executive functioning, leading to no clear distinction between the two groups (Brower & Price, 2001).

Another possible explanation is that executive dysfunction is more closely related to reactive or impulsive violence rather than premeditated violence (Dolan & Anderson, 2002). While some violent offenders engage in impulsive crimes due to poor executive functioning, others with higher intelligence may compensate for executive dysfunction, allowing them to engage in more controlled, strategic criminal behavior (Woodworth & Porter, 2002).

Additionally, the small sample size may have limited the statistical power to detect significant differences. A larger sample may provide more conclusive evidence on the relationship between executive functioning and violent behavior.

Limitations of the Study

The constraints of the examinations need to be taken into account when deciphering the outcomes.

Little Population
The discoveries of this study won't be quickly summed up to different settings or everyone, as the quantity of members engaged with this study was little and confined.

Control Group
Enlisting a fitting benchmark group will keep on being really difficult for research around here. The high inconstancy noted across the two imprisoned gatherings, which can't be changed by the scientist, likewise makes it hard to make suspicions about a detained populace overall, and makes finding a very much paired control bunch risky.

Gender
Current review was limited to an examination of liquid insight and chief working and its relationship to savagery executed by male guilty parties just. Future investigations could and ought to include female members as well.

CONCLUSION

Conclusion and Implications
The findings suggest that higher intelligence may facilitate violent criminal behavior, especially in cases where crimes are planned rather than impulsive. However, executive dysfunction appears to be common in both violent and non-violent offenders, possibly due to underlying neurodevelopmental or environmental risk factors shared across criminal populations. Future research should investigate different subtypes of violent offenders (e.g., impulsive vs. premeditated) to further explore how intelligence and executive functioning interact in criminal behavior.

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