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The Correlation between SAT Scores and Selected Cognitive Abilities among International School Students in the Kingdom of Saudi Arabia

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Abstract

For a long time, the Scholastic Aptitude Test (SAT) has served as a standardized test for academically measuring all potential abilities when debate still ensues on its reliability as an indicator of cognitive ability. Some researchers assert that the SAT is a good predictor of academic performance. In contrast, others contend that it is mainly advantageous to people from privileged backgrounds yet does not encompass critical cognitive skills such as critical thinking, creativity, and adaptability. This study examines the correlation between SAT scores and a broader range of cognitive abilities by analyzing the performance of 40 Saudi Arabian high school students on the Number Series Test (NST) and the Stroop Task—two assessments measuring numerical reasoning and cognitive flexibility, respectively. The findings indicate a moderate positive correlation between SAT scores and NST performance ($r = 0.51$) and between SAT scores and Stroop correct responses ($r = 0.48$), suggesting that numerical reasoning and executive function contribute to SAT success. In addition, the cognitive control aspect of the SAT's assessed cognitive abilities is evidenced in the correlation ($r = -0.40$) between the SAT and incorrect Stroop test responses. This correlation would indicate that the SAT is a good measure of cognitive ability.

Keywords: Scholastic Aptitude Test (Sat), Number Series Test (Nst), Stroop Task Test, Cognitive Abilities, Inductive Reasoning, Pattern Recognition, Cognitive Flexibility, Standardized Testing, Executive Function, Saudi Arabia, Higher Education Admissions

Introduction

For many decades, the Scholastic Aptitude Test, popularly known as the SAT, has been a stepping stone for many high school students to demonstrate their academic prowess to higher learning institutions. Indeed, thousands of students take this vital examination yearly, considering it should eventually account for their academic skills (College Board, 2023; Smith & Johnson, 2020). Despite all that the SAT has accomplished, many researchers doubted its reliability as a trusted factor of a student's academic success and the development of their cognitive abilities (Wang & Wicker, 2020). Researchers such as Bachmann and Palmer (2022)

criticized the SAT for prioritizing logical thinking and quantitative ability while ignoring other cognitive skills required for academic achievement.

The significance of this study lies in its ability to bridge the gap between standardized testing and cognitive abilities. It is imperative to assess whether the SAT effectively measures higher-order cognitive skills such as critical thinking, adaptability, and creativity, which are essential for academic and professional success. This research is necessary because understanding the SAT's role in evaluating cognitive abilities can improve educational policies, admission criteria, and more effective academic support for students. Institutions of higher education and policymakers can utilize these findings to ensure that standardized tests serve as fair and comprehensive assessments of student potential.

Numerous studies have criticized the SAT for its reliability as an indicator of a student's intellectual potential. Some believe the SAT favors students with a certain socioeconomic status (Santelices & Wilson, 2010), while others state that it is a fairground for all students (Warne, 2021). These different conclusions could be due to various methodological approaches, with some studies utilizing long-term longitudinal ones (Sackett et al., 2012) and others relying on large data sets and statistical analyses (Westrick et al., 2015). Apart from the issues in study methodologies, the discrepancies in findings could have been attributed to a problem of variable concepts and definitions of "cognitive abilities." Other studies defined cognitive skills as no more than the skills measured in the SAT, such as mathematical calculation and analytical reasoning (Bridgeman et al., 2004).

On the other hand, several studies interpreted cognitive skills more expansively, encompassing aspects like critical thinking, creativity, and problem-solving (Sackett et al., 2008). Disagreement over the reliability of the SAT likely arises from differing interpretations of what cognitive skills entail. Psychological factors related to anxiety and test familiarity can seriously impact student performance in a test and conceal the actual capability of a student (Hannon & McNaughton-Cassill, 2011). Moreover, many external factors, such as one's socioeconomic status and geographical location, significantly affect the planner and the strategy of the test-taker. These factors, in turn, diminish the chance that the SAT accurately and validly represents the student's intellectual capacity (Gonzalez & Dunlop, 2023). Examining whether the SAT holistically assesses a student's cognitive potential or merely evaluates test-taking strategies is critical.

Understanding the relationship between SAT scores and cognitive abilities benefits students, educators, and policymakers. For students, this research provides insight into the skills necessary to excel in standardized testing and beyond. Educators can use these findings to tailor their instructional approaches to enhance cognitive abilities crucial for test performance and overall academic success. Policymakers can leverage this knowledge to reform admission processes, ensuring that standardized tests effectively measure true academic potential rather than just test-taking skills.

As these issues are interconnected, visible inconsistencies and fluctuating scores in SATs make the academic effort to reach an agreement on the test's accuracy more challenging. Because there is a debate on whether SAT scores reflect general cognitive capacities, this

paper examines how the SAT measures the whole gamut of different mental skills, including those the test does not explicitly aim at.

Specifically, this study hopes to determine if SAT scores are valid predictors of higher-order thinking abilities necessary for success in education, namely critical thinking, creativity, and adaptability.

- To what extent does the SAT indicate the development of the tested cognitive skills?
- What are the reasons for the disparity between SAT scores?

By addressing these critical questions, this research aims to contribute to the ongoing debate on the utility and effectiveness of standardized testing in assessing student potential beyond mere numerical proficiency. This study is particularly beneficial for students in non-Western educational systems, such as Saudi Arabia, where cultural and educational dynamics may influence SAT performance differently than in Western contexts. Examining the SAT's validity in this setting can help refine standardized testing practices and ensure a more equitable assessment framework for all students.

Literature Review

Although much research has been done on the reliability of the SAT as a predictor of cognitive skills, most of the work has been conducted within the United States. Because test performances are highly sensitive to environmental and cultural variables, geographic confinement restricts the generalizability of findings. In this regard, working on the same issue in a completely different cultural environment, which Saudi Arabia represents, offers a unique opportunity to understand the test applicability and relevance in non-Western environments. The present study attempts to investigate how the SAT measures cognitive abilities in divergent settings differently, taking into consideration the demographic, cultural, and educational characteristics of Saudi Arabia.

Traditionally, the reliability of the SAT has been studied in terms of the test's consistency as a predictor of performance. For instance, Bridgeman et al. (2004) discovered a solid association between the tallies of SAT and first-year college GPA, thus establishing the short-term predictive validity for American higher education.

On the other hand, Santelices and Wilson (2010) supported the view that the SES and reliability of resources readily influenced the outcome of the SAT (Alkhazim, 2003), thus creating an unequal opportunity for assessment regarding the cognitive ability of students from different backgrounds. Hannon and McNaughton-Cassill (2011) observed that the psychological factors that preferentially affect certain groups included test anxiety and familiarity. Although such research provides the beginnings of a theoretical framework for evaluating the SAT, it does not only consider how cultural and systemic differences outside of the United States might alter these dynamics.

Saudi Arabia is far removed from the United States in terms of educational and cultural settings. The Saudi Arabian education system relies heavily on memorization and standardized tests, likely affecting students' approaches toward the SAT (Oshan, M.S. 2007). Cultural beliefs about collective versus individual achievement can also influence how students approach and view a test in light of their public school education. Gonzalez and

Dunlop (2023) stressed that ecological factors, including geographical locations and test prep centers, significantly impact SAT scores. Preparation courses for SATs may not be accessible in Saudi Arabia as a nation, which would most likely cause unequal scores to test candidates. All of the previously mentioned factors can affect how the test is perceived by the testers, thus affecting the test's correlation to cognitive abilities.

Some specific challenges arise in evaluating the validity of the SAT, given the unique features of Saudi Arabia. For instance, sharp contrasts between educational infrastructures based on rural versus urban areas can affect preparation for and performance on tests. Moreover, gender segregation in the Saudi system of education may suggest a bias toward providing specific cognitive skills via the school curriculum. It would create disparity in the outcomes of male versus female test results on the SAT. Research papers such as that by Breland, 1977 and Linn, 1990 revealed that inequality in schooling can impact the validity of accountability and admission reasons. Applying such insights from such studies to the Saudi context will enable this study to investigate the demographic and systemic factors that affect differential aspects of SAT reliability compared to those accounted for through U.S.-based studies.

Although various studies of the reliability of SAT have identified key determinants, such as psychological factors and geographical inequities, they have yet to be limited within the domestic boundary of the United States. This lack of studies from non-Western countries like Saudi Arabia forms a severe lacuna in the literature. The study mentioned above will be replicated in a different demographic- in demographics- in this case, Saudi Arabia- it can further flesh out the understanding of this test's reliability as a measure of cognitive abilities. This is a critical perspective when assessing whether the SAT can serve as an international benchmark in terms of preparedness or whether it logically cannot be valid based on its origin within one cultural and educational paradigm.

The present paper will fill this lacuna by reviewing the reliability of SAT scores in Saudi Arabia. The comparison study investigates the results in Saudi Arabia compared to those obtained in the United States. This comparison helps develop a rich and deep understanding of the SAT as an index of mental aptitude.

Methodology

This study adopts a quantitative research design to evaluate the reliability of SAT scores as a predictor of cognitive abilities beyond analytical reasoning and quantitative skills. Using two different tests, the Number Series Test and the Stroop Task, to include a broader spectrum of mental skills, this study compared the results individually to create coefficients showing to what extent cognitive abilities and SAT scores are related. The Number Series Test measures inductive reasoning and pattern recognition, while the Stroop Task assesses cognitive flexibility and the ability to inhibit automatic responses. The dependent variable in this study is the performance of the cognitive tasks (Number Series Test and Stroop Task), while the independent variable is the SAT scores. Inclusion criteria required participants to have recently taken the SAT and had no prior significant exposure to test preparation courses less accessible in Saudi Arabia. The research is designed to provide insights into the applicability of the SAT in a non-Western educational and cultural context, namely Saudi Arabia. Participants were drawn from similar backgrounds to avoid adding extra factors not

accounted for in this research. The research was conducted with 40 male high school students in Saudi Arabia, where gender-segregated education is the norm due to the stricter form of the Islamic culture followed there (TutorChase, n.d.; EKB Journals, 2020). This limitation affects the generalizability of the findings for female students, highlighting an area for future research.

Findings & Discussion

Reasons For the Disparity Between Sat Scores

This section examines whether the SAT score can be validly used to indicate many cognitive abilities that can typically be improved with higher-order thinking skills, such as critical thinking, creativity, and adaptability. This study attempts to place these findings within the broader educational environment in Saudi Arabia, where the Western-style educational system and standardized testing create unique conditions.

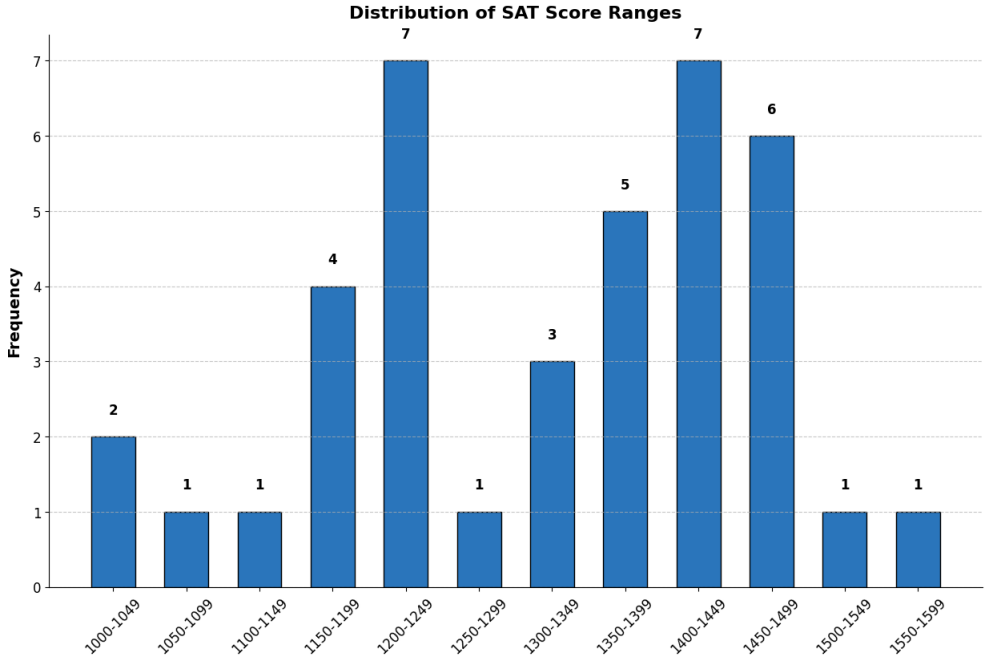

Figure 1

The SAT scores in the Figure 1 dataset range considerably from 770 to 1550. This variability can be attributed to multiple factors, including differences in students' academic backgrounds, preparation levels, and familiarity with standardized testing. Research suggests that standardized test performance is influenced by intrinsic factors, such as cognitive abilities and test-taking skills, and extrinsic factors, such as access to preparatory resources and socioeconomic background (Atkinson & Geiser, 2009). In an international school in Saudi Arabia, students likely come from diverse educational systems, each with its curriculum emphasis, which could impact SAT readiness. For instance, students educated in English-medium curricula, such as IB or AP programs, might be better prepared for SAT-style questions. In contrast, those transitioning from non-English curricula might find the reading and writing sections particularly challenging (Powers & Rock, 1999).

Figure 1 dataset's bar chart representation, which categorizes SAT scores into 50-point ranges, highlights a clustering effect around mid-to-high scores (1200-1500), with fewer students scoring at the extreme ends. Indeed, this distribution matches the research on global test takers. This indicates that students from resourceful international schools usually score higher than their counterparts who are less well-off in school (Buchmann & Hannum, 2001). Availability of SAT preparation courses, private tutoring, test familiarity, and so on have a significant bearing on the student's performance, with some studies indicating high scores among students who have been through extensive preparatory training compared to lower scores among those without it (Briggs, 2004). Also, proficiency in the language is fundamental. Non-English-speaking students often find the verbal sections of the SAT very difficult and, as a result, do not score as well as they might if they were able to demonstrate their true potential (Elder & Davies, 1998).

Cultural and educational priorities also influence SAT performance. While some international students may strive for Western universities in Saudi Arabia, others are interested in national higher education pathways where SAT scores are less relevant. This can thus lead to various levels of motivation and preparation among the students and take care of the score differences. The other big reason is socio-economic background, as children from wealthy families are more likely to afford private tutoring, SAT prep books, and extra academic support, which contributes to higher scores (Reardon, 2013).

In conclusion, the dataset in Figure 1 displays an array of SAT scores that reflect educational exposure, preparation, and language proficiency across international schools and access to resources. Even though most students score in the mid-to-high range, the above factors probably contribute to the observed variability. Future research could investigate these factors with a larger sample to confirm that they predict SAT performance.

Relationship Between SAT and Number Sequence Test (NST) Scores

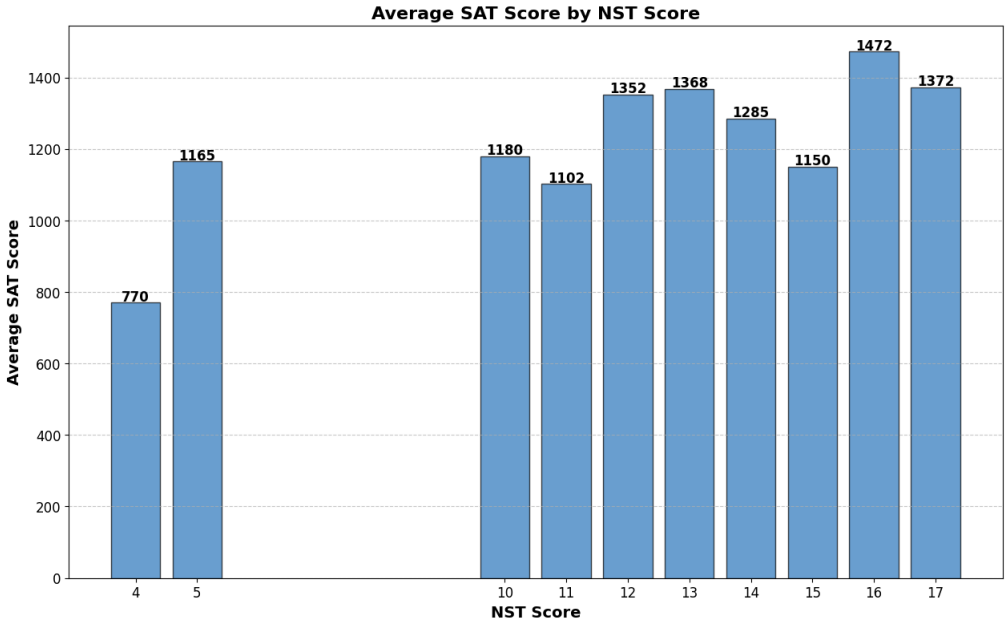

Figure 2

The relationship between SAT scores and Number Sequence Test (NST) scores in Figure 2 suggests a potential correlation between numerical reasoning ability and overall standardized test performance. Research indicates that numerical reasoning strongly predicts academic success, particularly in quantitative fields (Deary et al., 2007). Based on the data, higher NST scores correspond with higher SAT scores on average. This aligns with findings by Primi et al. (2010), who argue that cognitive abilities related to pattern recognition and logical reasoning contribute significantly to standardized test outcomes. Since the SAT includes mathematical reasoning components, individuals with strong numerical pattern recognition abilities (as measured by the NST) might also achieve higher SAT scores. Moreover, studies have established a relationship between efficiency in problem-solving and pattern recognition skills, which are critical to test-taking performances (Snow & Lohman, 1989).

However, this relationship is not necessarily causal, even though the trend suggests a connection. In this sample, the students come from similar educational backgrounds and had very similar test preparation. This minimizes the influence of external factors such as differences in schooling quality or access to resources. Ceci (1991) argues that external environmental factors can significantly impact cognitive development, but when such factors are controlled, individual cognitive abilities become a more reliable indicator of performance. Given that the NST measures numerical pattern recognition, a skill relevant to the SAT's math section, students who excel in one might perform well in the other. While other factors like test-taking strategies and personal motivation could still play a role, their influence is likely less significant within this controlled group.

The Association Between Stroop Performance and SAT Scores

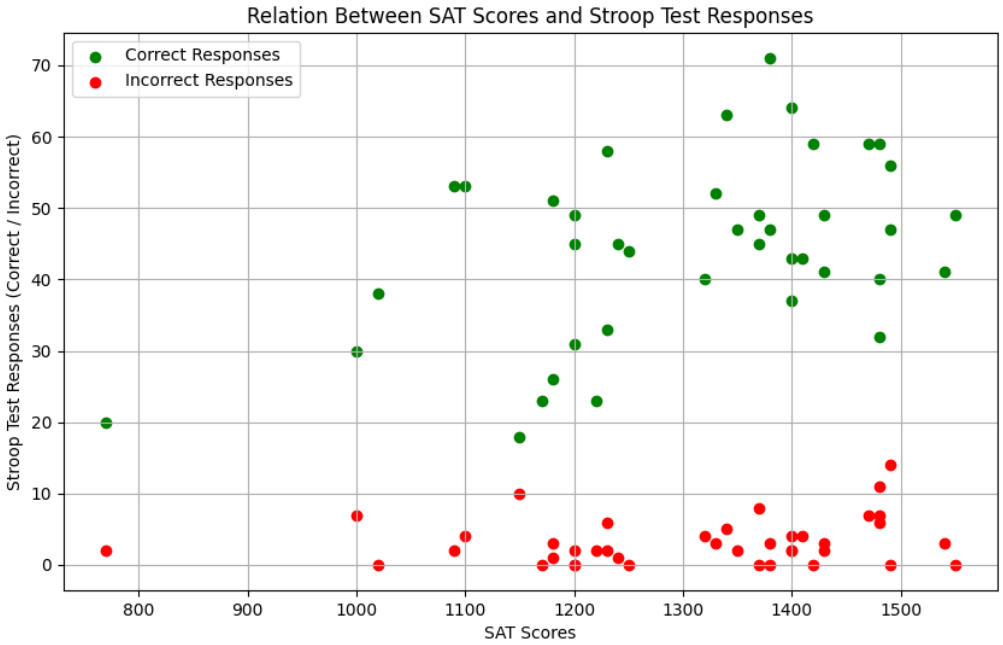

Figure 3

While the data in Figure 3 indicates a general association between Stroop performance and SAT scores, it does not imply causation. However, the more important thing is that since the sample of students is of similar background and test preparation, the score variation is likely due to differences in cognitive control and not external effects. The ability to manage

cognitive interference, as measured by the Stroop test, aligns with the attentional focus required for standardized tests like the SAT (Friedman & Miyake, 2004). Since external factors such as socio-economic status and test preparation are relatively controlled in this sample, the observed differences in performance may primarily stem from variations in executive function and working memory capacity (Diamond, 2013; Kane & Engle, 2003). This increases the importance of cognitive control with respect to academic achievement, arguing that intervening to strengthen executive function might eventually begin to impact performance on standardized tests and, in general, cognitive skills.

There is concrete evidence from this data that SAT scores are indeed related to measures of cognitive performance like those yielded by NST and Stroop test results. These correlations have been found in existing research on cognitive abilities with standardized test performance, supporting that better cognitive skills result in better academic performance. Scholars have long debated the extent to which standardized tests like the SAT reflect cognitive ability, with some arguing that they primarily measure learned knowledge and test-taking skills (Sackett et al., 2008), while others contend that they assess fundamental cognitive functions, including problem-solving and reasoning abilities (Deary et al., 2007).

Conclusion

Correlation Results Summary

Variable Pair	Correlation Coefficient	Interpretation
SAT Score and NST Score	0.51	Moderate positive correlation
SAT Score and Stroop Correct	0.48	Moderate positive correlation
SAT Score and Stroop Incorrect	-0.40	Moderate negative correlation

Figure 4

Numerical reasoning likely plays an important role in accounting for the moderate correlation between SAT and NST scores (0.51). The NST measures the essential, often taken-for-granted skill of recognizing patterns and using them to solve problems and make decisions. Like the SAT, which assesses this skill, Not all kinds of reasoning are equal when predicting academic success. Primi et al. (2010) found that the kind of reasoning that the SAT and NST measure—the kind that's essential for success in mathematics and the physical sciences—is not equally well correlated with success in all academic domains. Although it would be a mistake to suggest that arithmetic is synonymous with academic excellence, another mistake would be to fail to recognize the importance of basic numeracy.

Likewise, the correlations between SAT scores and Stroop Correct responses (0.48) characterize the relevance of cognitive control, attention, and information processing to success in an academic environment. The Stroop task measures an individual's ability to filter out distractions and accomplish focus-important tasks necessary for standardized testing. According to cognitive scientists like Friedman and Miyake (2004), the executive function,

which includes working memory, cognitive flexibility, and inhibitory control, is a powerful predictor for academic achievement. Moreover, research by Diamond (2013) indicates that students who have good executive function perform better in high-stakes testing environments because they can ignore distractions and keep their focus. This belief is congruent with the findings of this dataset, which indicates that students scoring high on the SAT would have better-developed cognitive control mechanisms, which would help them perform better during tests.

A different trend could be noticed in that SAT scores correlate negatively with Stroop Incorrect responses, namely a value of -0.40. This indicates that students who perform well on the SAT are likely better equipped to cope with cognitive interference and produce fewer errors. Certainly, Kane and Engle have cogent reasons for highlighting working memory's capacity as an essential cognitive office for controlling and regulating errors; both types of competence are necessary for performance on the SAT and Stroop tasks. Their results indicate that people with increased working memory capacity are better capable of carrying out more complex cognitive tasks and appear less vulnerable to errors. Furthermore, Ceci (1991) argues that while cognitive abilities are essential, environmental factors such as educational exposure and test preparation influence performance. Since the sample in this study consists of students with similar academic backgrounds and test preparation experiences, the observed correlation between Stroop's Incorrect responses and SAT scores likely reflects individual differences in cognitive control rather than external influences.

These investigations indicate that cognitive and executive functions and factors external to the person, such as preparation for testing and language, contribute to SAT performance. Specific moderate correlations in the data support the view that standardized tests often indicate general cognitive ability but do not fully define academic potential. Some scholars argue that standardized tests fail to capture creativity, adaptability, and real-world problem-solving skills, which are essential for success in higher education and beyond (Sternberg, 2006). Future research could explore longitudinal trends in SAT performance among international students to determine whether these relationships remain consistent over time and across different educational contexts.

Room for Future Research

Further research could investigate the role of cognitive abilities and standardized test performance across different educational backgrounds within Saudi Arabia. Comparing academic systems could come up with an advantage in finding out how different academic experiences affect SAT performance. Future studies may consider other tests of cognitive abilities apart from NST and Stroop tests. The tests should include other measures such as fluid intelligence tests, working memory assessments, and problem-solving tasks to create a more complex judgment of the relation between cognitive function and standardized test scores. Another area of research might study the performance of males and females on the SAT scores compared with their respective cognitive assessments since some previous studies appear to suggest that cognitive control, problem-solving strategies, and even test-taking behaviors tend to vary between the genders (Halpern, 2012). By doing this, research would widen the understanding of the relationship between standardized tests and cognitive performance by likely including various backgrounds, cognitive measures, and demographic factors.

Contributions

1. This study contributes to the ongoing debate on the validity of SAT scores as a measure of cognitive ability by examining students from Saudi Arabia, a non-Western educational and cultural environment. Previous research has primarily focused on U.S.-based students, making this study valuable for understanding SAT applicability beyond Western contexts.
2. The study finds that numerical reasoning (r = 0.51) and executive function (r = 0.48 for Stroop correct responses, r = -0.40 for Stroop incorrect responses) significantly contribute to SAT performance by indicating the correlation between SAT scores and cognitive tasks (NST and Stroop Task). This further supports the theory that SAT scores partly indicate cognitive abilities but do not fully extend into higher-level thinking skills.
3. Probably the most interesting finding of this investigation, besides the fact that this research accepts the Stroop Task as an objective measurement of cognitive flexibility and executive function within SAT research, is that students who perform better on the SAT also tend to make fewer Stroop errors in such a task. From this, one can gather the importance of cognitive flexibility regarding standardized test-taking and performance.
4. The research acknowledges the role played by externally proven variables like socioeconomic status, the amount and quality of preparatory resources, and speaking skills in determining students' SAT performance. Situating these findings within the Saudi educational landscape emphasizes the need for a more equitable assessment system that accounts for diverse student backgrounds.
5. Research indicates that SAT scores, while somewhat associated with cognitive benefits, are insufficient to measure skills such as creativity, flexibility, and critical-thinking abilities. This points out the necessity for universities, especially those in Saudi Arabia, to adopt a relatively more holistic admission process with other forms of cognitive evaluation and qualitative measures of the applicant's potential.
6. This research provides a foundation for further investigations into gender differences, curriculum influences, and longitudinal trends in SAT performance within the Saudi context. Future studies can expand on these findings by incorporating additional cognitive assessments and more prominent, diverse student samples.

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