Effects of Exam Question Formats on Neurodivergent Student Performance

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ABSTRACT

Neurodiversity encompasses natural variations in **cognitive functioning**, including attention-deficit hyperactivity disorder, autism spectrum disorder, and dyslexia. Traditional academic assessments often rely on **uniform** cognitive assumptions, which may **disadvantage** neurodivergent students by prioritizing test navigation skills over subject mastery. This study investigated how exam question format influences academic performance and cognitive strain among neurodivergent high school students compared to neurotypical peers.

A researcher-designed assessment containing five question formats was administered to 150 high school students in Alameda County. Formats included true false, single-answer multiple choice, multiple selection, short answer, and passage-based comprehension. Performance data and post-exam survey responses were collected to evaluate accuracy, perceived difficulty, and cognitive load across formats. Quantitative data were analyzed using statistical comparisons across groups, while qualitative feedback provided insight into student experiences.

Results demonstrated minimal performance differences for true false and short answer formats. In contrast, multiple selection and passage-based comprehension formats produced substantial performance gaps and higher reported cognitive strain among neurodivergent participants. These findings indicate that **exam format significantly affects performance independent of content knowledge**. The study suggests that assessment design plays a critical role in equitable evaluation and supports the development of testing practices that reduce unnecessary cognitive load while preserving academic rigor.

INTRODUCTION

Neurodiversity refers to **natural differences in how individuals process information**, regulate attention, and engage with learning tasks. Students with ADHD, autism spectrum disorder, or dyslexia often demonstrate strong subject understanding but may experience difficulty with assessments that emphasize sustained reading, multi-step reasoning, or rapid decision making. Prior research suggests that these formats can introduce **extraneous cognitive load**, interfering with a student's ability to demonstrate knowledge accurately.

In California, approximately 30 to 40 percent of students identify as neurodivergent, highlighting the importance of inclusive assessment practices within local school communities. When exams prioritize format navigation rather than content mastery, performance disparities may reflect test design rather than true academic ability. This study examines whether specific exam question formats contribute to these disparities and evaluates which formats more accurately represent student learning outcomes.

HYPOTHESIS

It was hypothesized that exam question formats associated with higher cognitive load, including multiple selection and passage-based comprehension questions, would result in lower performance among neurodivergent high school students compared to neurotypical peers. Simpler formats, such as true false and short answer questions, were expected to reduce extraneous cognitive demands and produce smaller performance gaps by enabling students to more accurately demonstrate subject knowledge.

METHODS

Target Population
- One hundred fifty students (N = 150) aged 14-18 from Alameda County
- Participants were evenly divided into three groups (n = 50 per group):
  - Neurotypical students
  - Diagnosed neurodivergent students
  - Self-identified neurodivergent students

Data Collection
- Participants completed a pre-exam survey assessing sleep duration, perceived stress, study habits, and demographic information
- A researcher-designed exam containing five question formats was administered:
  - True/false
  - Single-answer multiple choice
  - Multiple selection
  - Short answer
  - Passage-based comprehension
- No testing accommodations or assistive technologies were provided to isolate the effects of exam format
- Trained proctors, blinded to participants' neurocognitive classification, administered the exam under standardized instructions and a fixed time limit
- A post-exam survey assessed perceived difficulty, cognitive strain, and confidence for each question format

Data Analysis
- Exam performance was recorded as percent correct for each question format
- Statistical analyses included analysis of variance (ANOVA), independent t-tests, and effect size calculations using Cohen's d at an alpha level of 0.05
- Survey responses were analyzed to identify patterns related to cognitive strain, time pressure, and perceived fairness

Errors and Biases
- Potential self-identification bias among undiagnosed neurodivergent participants
- Test anxiety effects that may have influenced performance
- Absence of accommodations limits generalizability to real-world testing environments

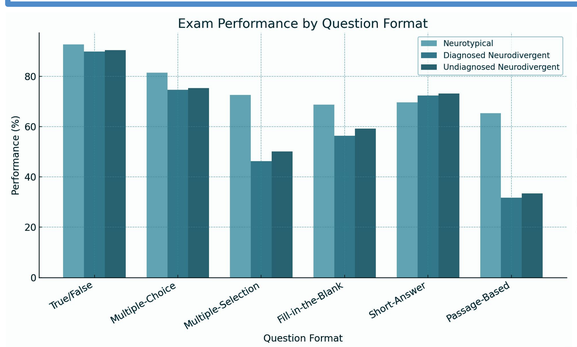

Figure 1. Bar graph of mean exam performance (%) by question format for neurotypical, diagnosed neurodivergent, and self-identified neurodivergent student groups.

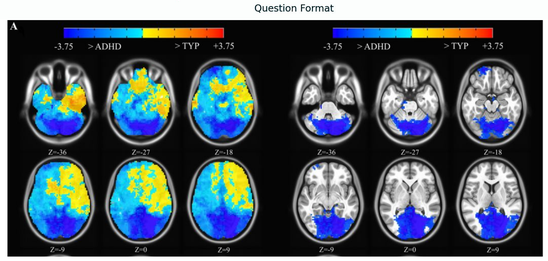

Figure 2. Representative neuroimaging visualizations illustrating localized neural activation associated with lower cognitive strain compared to diffuse activation associated with increased cognitive strain.

RESULTS

Neurotypical students achieved **higher average scores across all exam formats**, while diagnosed neurodivergent students scored lowest, with self-identified neurodivergent students falling between the two groups. Performance differences for true false and short answer questions remained under three percentage points and were not statistically significant. Multiple choice questions produced a moderate seven-point gap, often attributed to distractor complexity and second-guessing.

In contrast, multiple selection questions resulted in an eighteen-point performance gap, and passage-based comprehension questions produced the largest disparity. Seventy-eight percent of diagnosed neurodivergent participants rated passage-based questions as very difficult, compared to twenty-two percent of neurotypical students. Survey responses frequently cited time pressure, information overload, and difficulty filtering relevant details. These findings demonstrate that higher cognitive load formats disproportionately affect neurodivergent students and suggest that observed performance gaps reflect assessment design rather than content understanding.

CONCLUSIONS

This study demonstrates that exam question format significantly influences student performance independent of subject knowledge. High cognitive load formats, particularly those requiring sustained reading and multi-step reasoning, introduce barriers that disproportionately affect neurodivergent learners. In contrast, simpler formats yield more equitable outcomes and provide a more accurate measure of academic understanding.

These findings are directly relevant to **educators, school administrators, and policymakers** within the local community and beyond. Revising assessment design to reduce unnecessary cognitive demands can improve the validity and fairness of academic evaluations while maintaining rigor. More inclusive testing practices have the potential to benefit all students by emphasizing knowledge demonstration over format navigation. **Future research** should explore adaptive assessments, the role of accommodations, and long-term academic outcomes associated with inclusive testing strategies.

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