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LightGBM-Based Prediction of Academic Burnout among High School Students from Perfectionism, Test Anxiety, Academic Self-Efficacy, and School Climate Indicators

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Ahmad Amani Associate Professor, Counseling Department, University of Kurdistan, Sanandaj, Iran a.amani@uok.ac.ir	**Reviewer 1:** Mehdi Rostami Department of Psychology and Counseling, KMAN Research Institute, Richmond Hill, Ontario, Canada. Email: dr.mrostami@kmanresce.ca **Reviewer 2:** Kamdin Parsakia Department of Psychology and Counseling, KMAN Research Institute, Richmond Hill, Ontario, Canada. Email: kamdinarsakia@kmanresce.ca

1. Round 1

1.1. Reviewer 1

Reviewer:

In the paragraph beginning with “Among the psychological characteristics associated with academic burnout, perfectionism has emerged as one of the most influential predictors,” the discussion treats perfectionism largely as a unitary construct. Because the Child and Adolescent Perfectionism Scale measures both self-oriented and socially prescribed perfectionism, the authors should provide a more nuanced conceptual distinction between these dimensions and explain whether differential predictive effects were expected theoretically.

The Measures section reports that “The MBI-SS has demonstrated strong psychometric properties across adolescent and educational populations.” However, the manuscript does not provide reliability estimates derived from the current sample. The authors should report Cronbach’s alpha, McDonald’s omega, composite reliability, or other relevant reliability indices for all instruments used in this study to demonstrate measurement quality within the analyzed dataset.

Regarding the measurement of perfectionism, the manuscript states that “The CAPS has been extensively validated among adolescent populations.” Nevertheless, there is no information concerning linguistic adaptation or cultural validation

procedures for Danish students. The authors should clarify whether validated Danish versions of the instruments were used and report any translation, back-translation, or cultural adaptation procedures undertaken.

Authors uploaded the revised manuscript.

1.2. Reviewer 2

Reviewer:

The paragraph reporting that "Another critical factor implicated in academic burnout is test anxiety" provides a comprehensive review of the construct; however, it does not sufficiently justify why test anxiety was hypothesized to outperform other predictors in the LightGBM model. The authors should develop stronger theoretical arguments explaining why anxiety-related variables may possess greater predictive value than perfectionism, self-efficacy, or school climate within machine learning frameworks.

The paragraph beginning with "In contrast to risk factors such as perfectionism and anxiety, academic self-efficacy has consistently been identified as a protective psychological resource" would benefit from a deeper discussion regarding possible mediation and moderation mechanisms. Specifically, the authors should explain whether self-efficacy was expected to buffer the effects of perfectionism and test anxiety on burnout and discuss why interaction effects were not explicitly examined despite the capability of machine learning algorithms to capture such relationships.

In the paragraph introducing school climate, the manuscript states that "School climate encompasses students' perceptions of safety, teacher support, peer relationships, fairness, connectedness, and overall educational atmosphere." Given the multidimensional nature of this construct, the authors should clarify whether school climate was analyzed as a total score or whether subdimensions were available. A more detailed justification is necessary because different dimensions of school climate may have distinct relationships with burnout risk.

The paragraph stating that "Machine learning methods provide powerful alternatives for identifying patterns within large datasets and generating accurate predictive models" does not sufficiently justify the selection of LightGBM over competing algorithms. The authors should provide a methodological rationale explaining why LightGBM was preferred instead of Random Forest, XGBoost, CatBoost, Support Vector Machines, or Neural Networks, particularly in relation to the characteristics of the present dataset.

In the final paragraph of the Introduction, the authors state that "the present study aimed to develop and evaluate a LightGBM-based predictive model." However, no explicit research questions or hypotheses are presented. Even within predictive modeling studies, clearly articulated hypotheses regarding variable importance rankings or expected predictive directions would improve the scientific rigor and transparency of the investigation.

Within the Study Design and Participants section, the manuscript indicates that "A total of 1,248 students were recruited from public and private secondary schools located in Copenhagen, Aarhus, Odense, and Aalborg through a multistage cluster sampling procedure." The sampling methodology requires additional detail. The authors should specify the number of schools approached, school participation rates, classroom selection procedures, and student response rates to allow readers to assess potential sampling bias and representativeness.

Authors uploaded the revised manuscript.

2. Revised

Editor's decision after revisions: Accepted.
Editor in Chief's decision: Accepted.

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