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Support Vector Machine Prediction of Adolescent Anxiety Based on Nomophobia, Fear of Missing Out (FoMO), Perfectionism, Cognitive Fusion, and Parent–Child Communication

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1. Round 1

1.1. Reviewer 1

Reviewer:

In the Introduction, the paragraph beginning with “One of the most significant emerging constructs associated with adolescent mental health is nomophobia” presents nomophobia as a multidimensional psychological phenomenon, but the conceptual overlap between nomophobia and FoMO remains insufficiently differentiated. Several cited studies imply that FoMO may operate as a mediating or overlapping construct within smartphone dependency processes. The authors should provide a clearer theoretical distinction between these constructs and explain why both were independently entered into the predictive model despite potentially high conceptual collinearity.

The paragraph beginning “Closely related to nomophobia is the construct of Fear of Missing Out (FoMO)” contains the statement “FoMO functions as a significant mediator between problematic smartphone use and psychological distress.” If FoMO is theoretically conceptualized as a mediator, the rationale for simultaneously treating it as a direct predictor within the SVM framework should be elaborated. The manuscript would benefit from a conceptual diagram illustrating the hypothesized relationships among nomophobia, FoMO, perfectionism, cognitive fusion, parent–child communication, and anxiety.

In the Introduction section, the sentence "Machine learning approaches offer significant advantages in this context because they allow researchers to identify hidden patterns, nonlinear relationships, and complex interactions among predictors" is overly generalized and lacks methodological specificity. The manuscript should discuss why Support Vector Machine algorithms were selected over alternative machine learning classifiers such as Random Forest, Logistic Regression, Gradient Boosting, or Neural Networks. Without comparative benchmarking, the justification for choosing SVM appears insufficiently grounded.

The paragraph beginning "Furthermore, cultural context represents an important consideration in adolescent mental health research" raises an important point regarding Tunisian adolescents, yet the manuscript does not sufficiently contextualize the sociocultural characteristics of Tunisia that may influence smartphone dependency, family communication, or anxiety. The authors should elaborate on relevant cultural dimensions such as collectivist family structures, educational pressure, digital access patterns, or gender norms to strengthen the contextual contribution of the study.

In the Methods section under "Study Design and Participants," the authors state that "742 adolescents participated in the study" and "718 questionnaires were retained for final statistical and machine learning analyses." However, the manuscript does not provide detailed information regarding missing data handling procedures, the percentage of removed cases, or whether exclusions systematically differed across demographic variables. The authors should include a more rigorous description of attrition analysis and missing-data management.

The statement "The Arabic and French versions used in the present study were subjected to translation and back-translation procedures" requires substantially more methodological detail. The manuscript should specify who conducted the translations, whether bilingual experts were involved, whether pilot testing was performed, and whether measurement invariance between Arabic and French versions was statistically evaluated. Given Tunisia's multilingual educational environment, linguistic equivalence is a critical methodological concern.

In the Measures section, the paragraph describing the Beck Anxiety Inventory notes that "Cronbach's alpha coefficient for the scale was calculated and indicated excellent internal reliability," yet no actual reliability coefficient is reported. This issue occurs repeatedly across the measures section, where psychometric properties are described qualitatively rather than quantitatively. The manuscript should explicitly report Cronbach's alpha values, composite reliability indices, or confirmatory factor analysis results for each instrument within the current sample.

The description of the Multidimensional Perfectionism Scale lacks sufficient specificity regarding whether the authors analyzed total perfectionism scores or individual subdimensions. Since self-oriented, socially prescribed, and other-oriented perfectionism demonstrate distinct psychological associations with anxiety, aggregating them into a total score may obscure theoretically meaningful patterns. The authors should justify this decision or provide subscale-level analyses.

In the Data Analysis section, the sentence "Continuous variables were standardized using z-score normalization prior to implementation of the machine learning algorithms" is appropriate, but the manuscript fails to clarify whether normalization parameters were calculated exclusively from the training set before application to the testing set. If standardization was performed prior to dataset splitting, this may introduce data leakage and artificially inflate classification accuracy. The authors should explicitly clarify the preprocessing pipeline.

The sentence "Hyperparameter optimization was conducted through grid search procedures involving adjustment of the regularization parameter and kernel gamma values" lacks sufficient reproducibility detail. The manuscript should report the exact parameter ranges explored, the final optimized values selected for C and gamma, and the evaluation metric used during optimization. Reproducibility is a fundamental expectation in machine learning-based psychological research.

The ROC analysis discussion includes the statement "This finding further confirms the suitability of machine learning approaches for psychological risk prediction." This conclusion appears overstated given the study's cross-sectional design and lack of external validation. The authors should exercise greater caution in translating statistical classification performance into claims regarding practical clinical utility.

The confusion matrix interpretation would benefit from inclusion of additional classification statistics such as specificity, sensitivity, negative predictive value, and balanced accuracy. Although the manuscript qualitatively states that "the algorithm demonstrated strong sensitivity," these metrics are not explicitly reported. Including them would improve methodological transparency and facilitate comparison with prior psychological prediction studies.

In the Discussion section, the authors repeatedly interpret associations in quasi-causal terms despite the cross-sectional design. For example, the sentence "smartphone dependency negatively influence cognitive and socioemotional development"

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implies directional causality that cannot be established in the current study. The discussion should consistently frame findings as associations rather than causal effects.

Authors uploaded the revised manuscript.

1.2. Reviewer 2

Reviewer:

The Findings section reports that "64.21% of participants reported daily smartphone usage exceeding five hours," but the manuscript does not clarify how smartphone use duration was measured. Was this self-reported estimation, objective screen-time monitoring, or categorical reporting? Since smartphone use is conceptually central to nomophobia and FoMO, the validity of this measurement should be clarified.

In Table 1, the strong correlation between nomophobia and FoMO (r = .66) raises potential concerns regarding shared variance and predictor redundancy. Although the authors state that "intercorrelations among predictor variables remained below critical multicollinearity thresholds," no actual VIF or tolerance values are presented. The manuscript should provide detailed multicollinearity diagnostics to support the inclusion of all predictors within the same model.

The paragraph interpreting Table 2 states that "the relatively small reduction in performance indicators between the training and testing datasets also suggests that the model maintained strong stability." However, no independent validation dataset was used beyond internal cross-validation and train-test splitting. The absence of external validation substantially limits claims regarding generalizability. The authors should explicitly acknowledge this limitation and moderate conclusions regarding robustness.

The presentation of "Feature Importance Scores" in Table 3 is methodologically problematic because traditional radial basis function SVM models do not inherently provide direct feature importance measures in the same manner as tree-based algorithms. The manuscript should clearly explain the method used to derive feature importance values (e.g., permutation importance, SHAP values, recursive feature elimination, or another post hoc interpretability technique). Without this clarification, the interpretability of Table 3 is questionable.

Authors uploaded the revised manuscript.

2. Revised

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

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