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SHAP-Assisted XGBoost Analysis of Psychological Flourishing in Deaf University Students: Contributions of Identity Integration, Self-Compassion, and Perceived Inclusion

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1. Round 1

1.1. Reviewer 1

Reviewer:

The section discussing identity integration includes the statement “Identity integration may therefore represent an essential foundation for flourishing because it promotes self-acceptance, psychological coherence, and a sense of belonging.” This claim is theoretically plausible but requires stronger empirical grounding. The authors should explain the specific theoretical framework underlying identity integration (e.g., bicultural identity integration, social identity theory, identity process theory) and clarify how it applies uniquely to deaf students.

In the self-compassion subsection, the authors state that “Self-compassion may be particularly relevant for deaf university students.” However, no evidence is provided regarding self-compassion levels or intervention outcomes specifically among deaf populations. The discussion would be substantially strengthened by citing disability-focused or deafness-related self-compassion studies to support this assertion.

The paragraph introducing perceived inclusion defines inclusion as "the subjective experience of being welcomed, respected, valued, and able to participate fully." While conceptually appropriate, the manuscript does not sufficiently distinguish perceived inclusion from belongingness, social support, accessibility, and institutional climate. The authors should provide a more rigorous conceptual differentiation to avoid construct overlap and potential redundancy in the predictive model.

In Table 1, the reported correlations among identity integration, self-compassion, perceived inclusion, and flourishing are relatively strong. The authors should conduct and report multicollinearity diagnostics (e.g., VIF, tolerance indices, condition indices) to demonstrate that predictor overlap did not distort the machine learning interpretation or feature importance estimates.

The Results section reports that "The model explained 87.2% of the variance in psychological flourishing in the training sample and maintained strong generalizability in the testing sample." While impressive, these values are unusually high for psychosocial data. The authors should provide additional evidence regarding model stability, including repeated train-test splits, bootstrapping procedures, or external validation analyses to address concerns regarding overfitting.

In Table 3, perceived inclusion is reported to account for "39.8% of total model importance." The authors should clarify whether these percentages were derived directly from SHAP values, normalized SHAP importance scores, or XGBoost gain metrics. A detailed explanation of the calculation procedure would improve transparency and interpretability.

Authors revised the manuscript and uploaded the document.

1.2. Reviewer 2

Reviewer:

The paragraph beginning "The growing complexity of these relationships presents methodological challenges that traditional statistical approaches may not fully capture" argues for machine learning methods but does not adequately justify why XGBoost was selected over alternative predictive algorithms. A stronger methodological rationale comparing the strengths and limitations of various machine learning approaches would enhance the study's contribution.

In the Methods section, the sentence "The study was conducted across several public universities in Canada" is too vague. The authors should identify the participating institutions, geographic regions, recruitment sites, and institutional characteristics. This information is necessary for evaluating sample representativeness and contextualizing the findings.

The participant description notes that "A total of 428 deaf university students participated in the research." However, the manuscript does not report the recruitment rate, response rate, number of individuals approached, or reasons for non-participation. These details are essential for assessing potential selection bias and the external validity of the findings.

The measurement subsection states that "Identity integration was measured using the Identity Integration Scale adapted for deaf and hard-of-hearing populations." The authors should provide detailed information regarding the scale adaptation process, including item modifications, translation procedures (if applicable), validation evidence, factor structure, and reliability coefficients obtained in the current sample.

The description of the Perceived Inclusion in Higher Education Scale indicates that it is a "16-item instrument designed to assess students' experiences." However, the authors do not provide information regarding the scale's origin, developer, validation studies, or psychometric properties. A more comprehensive description is necessary to evaluate the quality of the measurement instrument.

In the Data Analysis section, the statement "Missing values were examined and handled using multiple imputation procedures when necessary" requires further elaboration. The authors should specify the percentage of missing data per variable, the imputation model used, the number of imputations performed, and whether diagnostic analyses confirmed the appropriateness of the procedure.

The sentence "Hyperparameter tuning was performed using grid-search procedures" is insufficiently detailed. The manuscript should include the full hyperparameter search space, optimal parameter values selected, computational settings, and criteria used for determining the final model configuration. Such information is essential for reproducibility.

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2. Revised

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