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STANDARDIZING LIKERT-SCALE INTERPRETATION IN PHYSICAL EDUCATION RESEARCH: ENHANCING RELIABILITY AND PEDAGOGICAL DECISION-MAKING BY RANGE-GEM+ METHOD

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ABSTRACT
Physical education (PE) research often relies on Likert-type scales to measure complex constructs such as motivation, coaching effectiveness, and learner attitudes. However, inconsistencies in how researchers interpret Likert-scale data - particularly the widespread use of unstandardized total score intervals - introduce risks to both reliability and pedagogical decision-making. This study introduces the Range-Gem+ Method formula, a novel approach that standardizes Likert-scale interval interpretation using a micro-adjustment factor (Gem) to ensure equal-width and mid-point adjusted class intervals. Using the Positive Coaching Strategies Scale-30 (PCSS-30) as a pilot instrument, demonstrates how Range-Gem+ overcomes key limitations of total score interpretation, enhances comparability, and improves the rigor of data categorization. These findings support a shift away from total score dependence toward a unified mean score-based interpretation model.
Keywords
Likert-type scales, Range-Gem+ method, Positive Coaching Strategies Scale-30, Mean vs. Total scores, Unified Mean Score-based Interpretation Model

INTRODUCTION
The foundation of Likert-scale methodology stems from the work of Rensis Likert (1932). Likert-type scales are central to data collection in PE quantitative researches, often used to assess abstract but critical constructs such as student motivation, coaching quality, and self-efficacy. Despite their ubiquity, the interpretation of such scales remains inconsistent. Most researchers default to total score interpretation and derive class intervals arbitrarily - practices that lack methodological rigor and compromise the validity of findings. This study addresses that gap by introducing the Range-Gem+ Method and demonstrating its application in a PE context.
The Range Method was developed by prevalent use of Total Score Intervals (TSI) across various colleges - including PE - reflects an unexamined norm rather than a validated standard. Through Conventional Range Method with formula discrepancy, TSIs can lead into unequal or arbitrary class widths. Much more for multi-domain questionnaire, can lead to misinterpretation of attitudinal constructs. This becomes problematic when such flawed interpretations inform pedagogical decisions, program assessments, or student evaluations. There is a need for a standardized method that ensures interval consistency, scalability, and clarity.
The Range-Gem+ Method developed by Ebardo et al. (2025) addresses these issues. By adding a micro-adjustment factor (Gem = 10-n; n = decimal precision), this method develops an accurate formula that ensures equal-widths and midpoint-centered class intervals. It allows for consistent interpretation across domains, enhancing the validity and clarity of Likert-based evaluations.
This study critiques the conventional Range Method for its flawed class interval widths and formula inaccuracy and proposes the Range-Gem+ Method as a superior alternative. Additionally, this paper aims to demonstrate how the Range-Gem+ Method can standardize Likert-scale interpretation in PE research through mean score rather than total score interval. The method is empirically demonstrated using pilot test data from the Positive Coaching Strategies Scale-30 (PCSS-30), as a test instrument to show how this method enhances unified interpretive reliability and supports informed pedagogical decisions.
METHODOLOGY

This study employs a methodological-comparative design. The Positive Coaching Strategies Scale-30 (PCSS-30), a self-made Sports Psychology questionnaire, was randomly administered to 25 individual-event student-athletes during a pilot test at the 2024 ROTC Games in Zamboanga City, Philippines. The instrument comprises five domains:
• Communication and Feedback (7 items)
• Motivation and Team Building (8 items)
• Personal Development and Well-being (5 items)
• Self-Assessment and Improvement (10 items)
• Overall PCS (30 items)
Student-athletes rated each item on a 5-point Likert scale (1 = Very Low, 5 = Very High). Internal consistency was measured using Cronbach's alpha.
The critical and nuanced distinction between the conventional Range Method and the Range-Gem+ Method are mathematically investigated, compared, and synthesized - testing assumptions, refining clarity and demonstrating accuracy.
Two interpretation methods through Range-Gem+ were used for comparison:
A. Mean score with unified class intervals
B. Total score with factor-specific class intervals
RESULTS / DISCUSSION
Reliability Analysis:
• Full Scale Alpha: .988 (Very High)
• Subscale Alphas (Very High):
o Communication: .972
o Motivation: .973
o Well-being: .974
o Self-Assessment: .985
These values indicate remarkable scale coherence - suggesting that each set of items strongly measures a single construct. The internal consistency of the scale components justifies aggregation of item scores and supports the legitimacy of using mean scores for analysis and interpretation.
Demonstrating Accuracy: Range-Gem+ vs. Conventional Range Method 9
Range-Gem+ Method Conventional Range Method
1-3 Likert @ 1-decimal precision; n = 1

Gem = 10-n = 10-1 = 1/101 = 1/10 = 0.1

CW = [(HS - LS) + Gem] / k; k = 3
= [(3 - 1) + 0.1] / 3 = [2 + 0.1] / 3
CW = 0.7 (Exact)
Expect 3 intervals of 0.7 equal CWs 1-5 Likert @ 1-decimal precision
CW = (HS –LS) / k; @ k = 5
= (5 –1) / 5
= 4 / 5
CW = 0.8 (Exact)
Expect 5 intervals of 0.8 equal CWs

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Interval    Class Width
4.3–5.0 0.8
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Interval Class Width 3.5–4.2 0.8
2.4–3.0 0.7 2.7–3.4 0.8
2.7–2.3 0.7 1.9–2.6 0.8
1.0-1.6 0.7 ✓ 1.0–1.8 0.9 ✘
Introduced:
• Consistent class widths across all
• Formula accuracy. • Inconsistent class widths
• Formula inaccuracy
The comparison exposes a fundamental flaw of conventional Range Method: it does not maintain equal class widths, even when it's claimed to. These inconsistency and inaccuracy gaps strengthen the Range-Gem+ Method superiority - robust for analysis and interpretation.
Class Intervals through Range-Gem+ Method: Mean Score vs Total Score
A. Mean score class intervals
1-5 Likert @ n = 2 (2-decimal precision); Gem = 10-n = 10-2 = 1/102 = 1/100 = 0.01
CW = [(HS - LS) + Gem] / k; k = 5, Gem = 0.01
= [(5 - 1) + 0.01] / 5 = [4 + 0.01] / 5 = 4.01 / 5 = 0.802 ≈ 0.81

The Range-Gem+ Method offers 1-set of intervals accommodating all domains.
Domain Interval CW Interpretation
Overall PCS

Communication and Feedback
Motivation and Team Building
Personal Development and Wellbeing
Self-Assessment and Improvement 4.22–5.02 (≥4.22) .81 Very High
3.41–4.21 .81 High
2.60–3.40 .81 Moderate
1.79–2.59 .81 Low
0.98–1.78 (≤1.78) .81 Very Low
The strengths of this unified structure:
• Mathematically balanced (midpoint adjusted and equal interval width of 0.81).
• Interpretively elegant (all components interpreted using one set of intervals).
• Psychometrically justified (supported by very high reliability from pilot testing).
• Supports comparability across all domains.
B. Total score class intervals
1-5 Likert @ n = 0 (0-decimal precision), Gem = 10-n = 10-0 = 1 / 100 = 1 / 1 = 1
CW = [(HS - LS) + Gem] / k; k = 5, Gem = 1
Domain Item CW Interpretation
Very Low Low Moderate High Very High
Overall PCS 30 24.5 ≈ 25 28-52 53–77 78–102 103–127 128-152
⋯Feedback 7 4.8 ≈ 5 6-11 12–17 18–23 24–29 30-35
⋯Team Bldg. 8 6.4 ≈ 7 7-13 14–20 21–27 28–34 35-41
⋯Wellbeing 5 4.2 ≈ 5 3-7 8–12 13–17 18–22 23-27
⋯Improvement 10 8.2 ≈ 9 8-16 17–25 26–34 35–43 44-52
Total score methods produce interpretation bands that are specific to each component's number of items. However, this:
• Requires unique class intervals per domain, adding interpretation complexity.
• Allows unequal psychological weighting across dimensions leading to interpretation potential biases.
• May obscure cross-component comparisons.

The results affirm the advantages of mean score interpretation using the Range-Gem+ Method. The conventional use of total scores is mathematically sound but impractical for comparative or multi-component analysis. Total score intervals vary by item count, which complicates data presentation and weakens cross-factor comparability.
The Range-Gem+ Method standardizes mean score interpretations using equal-width, midpoint-aligned categories. By refining the boundary error in the conventional Range Method, the technique ensures interpretive accuracy and simplifies reporting. The method supports more intuitive communication of results to academic, educational, or policy audiences.
This study positions the Range-Gem+ Method as a standardized unifying interpretative framework for Likert-scale data, preserving the benefits of mean score usage while refining its common limitations.
CONCLUSIONS
This study encouraged the transition from total score dependence to a simplistic mean-based interpretations using the Range-Gem+ Method. By introducing a micro-adjustment factor "Gem"to refine conventional range-based discrepancies, the method provides equal-width, statistically sound, and replicable class intervals. Its application improves consistency, clarity, and cross-study comparability, particularly in instruments with multiple domains.
The Range-Gem+ Method represents a significant step forward in the methodological treatment of Likert-scale data, offering researchers a more transparent and standardized interpretation. Its adoption is a scholarly pedagogical decision-making and could mark methodological turning point for questionnaire-based research in Physical Education and beyond. Future studies should explore its generalizability across diverse instruments and fields.

REFERENCES
Ebardo, G. M., Fadare, S. A., Alcopra, A. R., Derramas, C. A., Kamlian, C. A., Aksan, J. A., & Ebardo, G. J. M. (2025). Unlocking Accurate Data Categorization: The Range Gem+ Approach to Meaningful Intervals for Global Development Perspectives. Salud, Ciencia y Tecnología –Serie de Conferencias, 4:1434. https://doi.org/10.56294/sctconf20251434

Likert, R. (1932). A Technique for the Measurement of Attitudes. Archives of Psychology, 140, 1–55.77

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