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Jazz improvisation: Achieving a high aesthetic level during vocal education

Improvisação jazzística: Alcançar um elevado nível estético durante a educação vocal

Kechao Wang
Sichuan Normal University, Chengdu, Sichuan, China
kechao_wang692@gmx.com

Abstract: Jazz vocal improvisation remains insufficiently studied in pedagogical contexts, despite its central role in the aesthetic outcomes of performance. This study investigated parametric correlations between improvisational components and aesthetic achievements within cross-cultural contexts of vocal education. Employing mixed-method triangulation (n=197 conservatory students; 57.8% Chinese, 42.2% Western origin), the study implemented structured pedagogical interventions over twelve months. Quantitative assessment utilized validated rating scales (AJVA, α=.91) and hierarchical statistical procedures, while qualitative measurements captured phenomenographic categorizations of experiential descriptions. Hierarchical evaluation demonstrated the primacy of "artistic idea" (weight 2.27; 95% CI: 2.14–2.40), followed by "intonational variability" (weight 2.19; 95% CI: 2.05–2.33). Factor analysis confirmed a technical-expressive duality (cumulative variance=88.2%). Longitudinal tracking revealed logarithmic skill progression: harmonic sophistication increased by 169.4%; timbral diversification expanded register distribution from mid-range dominance (83.7%) to balanced chest, head, and mixed register usage; phonetic modifications enlarged syllabic inventory from 7.3 to 24.7 discrete units. Metacognitive verification showed systematic perceptual convergence (Cohen's d decreased from 1.076 to 0.104; inter-rater reliability improved from ICC=0.68 to 0.87). The findings advocate pedagogical restructuring. First,

instructional interventions should be sequenced according to documented developmental trajectories. Second, it is necessary to implement weighted assessment protocols reflecting parametric prioritization. Additionally, pedagogical strategies should incorporate self-evaluative convergence strategies. Furthermore, vocal training frameworks must expand beyond traditional technical-expressive dichotomies by embracing cross-cultural aesthetic principles. Together, these adjustments would contribute to the development of empirically grounded methodologies in jazz vocal education.

Keywords: cross-cultural performance; hierarchical parameters; metacognitive verification; performance parameters; phonetic modification; technical-expressive dualism; timbral differentiation

Resumo: A improvisação vocal no jazz continua a ser insuficientemente estudada em contextos pedagógicos, apesar do seu papel central nos resultados estéticos da performance. Este estudo investigou correlações paramétricas entre componentes de improvisação e realizações estéticas em contextos transculturais de educação vocal. Empregando a triangulação de métodos mistos (n=197 alunos do conservatório; 57,8% chineses, 42,2% de origem ocidental), o estudo implementou intervenções pedagógicas estruturadas ao longo de doze meses. A avaliação quantitativa utilizou escalas de classificação validadas (AJVA, α=. 91) e procedimentos estatísticos hierárquicos, enquanto as medições qualitativas captaram categorizações fenomenográficas de descrições experienciais. A avaliação hierárquica demonstrou a primazia da "ideia artística" (peso 2,27; IC 95%: 2,14–2,40), seguida da "variabilidade entoacional" (peso 2,19; IC 95%: 2,05–2,33). A análise fatorial confirmou uma dualidade técnico-expressiva (variância cumulativa=88,2%). O rastreio longitudinal revelou uma progressão logarítmica das competências: a sofisticação harmónica aumentou 169,4%; a diversificação tímbrica alargou a distribuição dos registos do domínio de médio alcance (83,7%) para a utilização equilibrada de registos de peito, cabeça e mistos;

modificações fonéticas alargaram o inventário silábico de 7,3 para 24,7 unidades discretas. A verificação metacognitiva mostrou uma convergência percetiva sistemática (o d de Cohen diminuiu de 1,076 para 0,104; a fiabilidade entre avaliadores melhorou de ICC=0,68 para 0,87). Os resultados defendem uma reestruturação pedagógica. Em primeiro lugar, as intervenções instrucionais devem ser sequenciadas de acordo com as trajetórias de desenvolvimento documentadas. Em segundo lugar, é necessário implementar protocolos de avaliação ponderada que reflitam a priorização paramétrica. Além disso, as estratégias pedagógicas devem incorporar estratégias de convergência autoavaliativas. Além disso, as estruturas de treino vocal devem expandir-se para além das dicotomias técnico-expressivas tradicionais, adoptando princípios estéticos interculturais. Em conjunto, estes ajustes contribuiriam para o desenvolvimento de metodologias empiricamente fundamentadas na educação vocal do jazz.

Palavras-chave: performance intercultural; parâmetros hierárquicos; verificação metacognitiva; parâmetros de desempenho; modificação fonética; dualismo técnico-expressivo; diferenciação tímbrica

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1. Introduction

Jazz vocal improvisation confronts performers with dialectical contradictions: technical mastery opposes intuitive self-expression, while tradition restrains innovation. Timbral aesthetics—reflected in the nuances of vocal production, vibrato variability, subtonal inflections, affective exclamations, and register transitions—serve as vehicles for individual expression. These sonic manifestations function as specific markers (statistical properties emphasize individuality) while participating in collective aesthetic traditions (Daikoku, 2020). Cultural specificity further influences timbral choices: performers position themselves within a "nexus of cultural heritage as students, exemplars, custodians, and transmitters," while vocal aesthetics solidify distinct artistic lineages (Mohammed, 2022).

Improvisation is a creative and individual process that forms the style of vocal performance and promotes the achievement of a more emotional performance (Spence, 2021). The learning process should be based on an individual approach to students' creative abilities, the presence of a preliminary musical base, and the level of musical thinking (Lee et al., 2018). Jazz improvisation is a phenomenon situated at the intersection of formalized structures and spontaneous invention. It presents musicians with considerable epistemological challenges. These include reconciling intuitive expression with harmonic and rhythmic organization, navigating the tension between tradition and innovation, and establishing pedagogical foundations for processes that are inherently ephemeral (Roe and Lysaker, 2023). Tonal organization emerges through stratified harmonic systems (blues sequences, II-V-I progressions, modal structures), which constitute a "structural grammar." Improvisers craft individual statements through the contextual manipulation of established patterns. These harmonic architectures serve as probabilistic rather than deterministic frameworks, enabling collective consonance while preserving expressive autonomy (Setzler and Goldstone, 2020).

Rhythmic foundations incorporate swing articulation (asymmetrical eighth-note subdivisions), syncopated accentuation (metric displacement), polyrhythmic layering (simultaneous contrasting patterns), and relative temporal organization (elastic relationship with the underlying pulse). These elements generate temporal fields in which improvisers establish, subvert, and restore rhythmic expectations. These temporal manipulations trigger neurological phenomena akin to "flow states," wherein performers transcend analytical cognition (Diaz Abrahan et al., 2022). Contemporary percussion instruments have further shaped this rhythmic dynamic by fostering dialogic patterns among soloists (Scott, 2022).

The acquisition of jazz improvisation skills by students should be based on the development of melodic hearing, rhythmic approaches to writing their musical compositions, and a combination of musical notes (Zhu et al., 2022). The importance of jazz in developing vocal skills is manifested in the use of various musical systems characteristic not only of Chinese music but also of European music (Jimenez and Kuusi, 2020). The aesthetics of performance reflect the vocalist's training, encompassing principles of vocal singing, musical texture nuances, and the ability to utilize aesthetic components (Riley, 2024). The aesthetics of jazz performance depend on distinctive musical qualities employed, variations in tonality, and textual phrasing (Solli et al., 2022).

1.1 Literature Review

The analysis of the works of contemporary jazz composer Maria Schneider allowed the authors to identify indicators to pay attention to during jazz improvisation. Her music emphasizes the traditional arrangement, which affects the spatial separation of compositions. Flexibility and expressiveness characterize her compositions, which affect the harmony and consistency of musical elements (Geyer, 2019). Jazz improvisation should be based on background and transitional music, which affects the artistry of perception. Regardless of the level of musical skills,

vocal improvisation promotes free performance. Improvisation promotes performing compositions harmoniously and influences the development of musical skills through the search for new approaches to performance (Siljamäki, 2022). Jazz improvisation should rest on the smoothness of sound and freedom of expression, affecting the performance quality. Jazz improvisation stems from a spontaneous presentation of melodic lines formed from various consecutive chords in one key. For a harmonious sound, the tonality can deviate slightly, for example, from C major to G major. During solo singing, singers can use invented syllables as improvisation, affecting performance virtuosity (Forbes and Cantrell, 2021).

Individual motor and auditory schematization—not purely cognitive processes—underlie stylistic distinctiveness in jazz vocal evolution. Throughout the developmental history of jazz vocals, physical embodiment has governed expressive capabilities—from primal blues inflections to contemporary instrumentalism. Phonetic transformations followed systematic progressions. Thus, blues vocalism (emphasizing microtonal bends and emotional intensity) yielded to the syllabic articulation of the swing era. The instrumental mimesis of bebop supplanted melodic ornamentation, and post-bop harmonic sophistication surpassed rhythmic displacement (Norgaard et al., 2022). This technical transmutation necessitated cognitive oscillations between "conscious intent and unconscious impulse," with expertise manifesting in states of both awareness and unawareness (Bjerstedt, 2024).

Comparative analysis of virtuosic performers reveals distinct improvisational strategies: melodic variation (exemplified by Ella Fitzgerald's motivic development) manipulates thematic material through intervallic expansion/contraction. Rhythmic displacement (as in Sarah Vaughan's metric modulation) recontextualizes phraseological units via temporal reorganization. Harmonic reinterpretation (Betty Carter's signature approach) superimposes alternative chordal structures onto established progressions. The "stronger time and speed correlations" observed in recurring patterns compared to control samples confirm that

improvisational originality stems from individualized "audio-motor schemata" rather than theoretical constructs (Norgaard et al., 2022; Reimann, 2024).

Distinct stylistic idioms have given rise to varied improvisational approaches. Swing-era vocals prioritized melodic accuracy, often enhanced through ornamental embellishments. Bebop innovation emphasized extended harmonies, particularly through chromaticism that replaced diatonic stability. Cool jazz aesthetics focused on timbral experimentation through phonetic modifications. Free jazz completely abandoned referential frameworks (Scott, 2022). Contemporary practice increasingly incorporates elements from other musical traditions and experimental techniques (Dias, 2024). These hybridized expressions establish "idiosyncratic" libraries of melodic patterns that are unique to individual performers rather than existing in universal vocabularies (Norgaard et al., 2022).

Musical ear has become jazz's primary transmission mechanism, while notation has receded to a peripheral role. Auditory pattern encoding strategies—where melodic and harmonic sequences become imprinted on neural substrates—create vocabularies. Simultaneously, rhythmic exercises develop temporal flexibility (Hagberg, 2020). These methods stimulate brain activity in professional jazz pianists, specifically activating "the anterior cingulate and medial prefrontal cortex" during creative performance (Rahman et al., 2021).

Educational institutions have canonized different methodologies. Aebersold's play-along paradigm emphasizes harmonic navigation through standard progressions, democratizing access while homogenizing expression. Berklee's systematic approach breaks down improvisational elements into discrete competencies, facilitating measurable outcomes but potentially fragmenting holistic understanding. The traditionalist orientation of the Manhattan School prioritizes lineage-based transmission, preserving idiomatic authenticity while limiting innovation (Merlino, 2021). The underlying philosophical

foundations—though rarely explicitly stated—fundamentally shape outcomes: improvisation requires phenomenological practices through which musicians negotiate sonic environments (Matarrese, 2023).

Technological interventions are reshaping traditional methodologies. Algorithmic analysis tools extract statistical patterns from recorded improvisations, quantifying intuitive elements. Interactive software applications like AutoScale, which implements scale mapping on standardized fretboard layouts, reduce technical barriers (Jaccard et al., 2020). Neural network models that emulate improvisational decision-making provide real-time feedback (Vigran, 2020). According to Alves Da Mota et al. (2020), restricted improvisation activates "default mode, executive control, and language networks," while free improvisation decreases activity in brain regions associated with "goal-directed cognition" (Alves Da Mota et al., 2020). The analyzed literature sources allowed the authors to determine that the development of vocals with the help of jazz improvisation should stem from free performance and the consistency of musical elements.

1.2 Problem Statement

This study examined the aesthetic dimensions of jazz vocals through parametric analysis of improvisational components. The research was motivated by an identified pedagogical gap between technical mastery and creative expression. The study pursued four key objectives: (1) to quantitatively assess correlations between improvisational parameters (artistic conceptualization, intonational flexibility, and timbral differentiation) and aesthetic impact; (2) to examine developmental trajectories through longitudinal intervention cycles; (3) to identify hierarchical aspects of evaluation criteria; and (4) to establish metacognitive models of convergence between performer self-perception and expert assessment protocols.

The pedagogical motivation stems from observed disparities between current technical training paradigms and expressive outcomes. Quantitative documentation of improvisational skill acquisition offers a systematic framework for curriculum restructuring. This approach addresses integration challenges between disparate cultural traditions—specifically, Chinese pentatonic structures and Western chromatic systems.

2. Methods and Materials

2.1 Methodological Framework

This study employed a mixed-methods paradigm. The research design integrated triangulated quantitative and qualitative assessment protocols that combined phenomenological interpretivism with the post-positivist measurement system. Pedagogical interventions underwent systematic evaluation through a convergent parallel design (following Creswell's taxonomy). Phenomenographic analysis served as the interpretive substrate, capturing empirical variations in improvisation perception.

2.2 Research Design

The study comprised four sequential phases:

1) The baseline assessment included spectral analysis of vocal performances, measurement of intonational deviations, self-evaluation protocols, and expert assessment procedures.

2) The intervention phase involved a structured pedagogical process targeting specific improvisational parameters (rhythmic structures, melodic formulations, harmonic conceptualization, timbral differentiation), delivered in consecutive modules (8 weeks for each parameter);

3) Longitudinal monitoring systematically documented progress indicators through spectrographic analysis, blind assessment procedures, and self-evaluation protocols;

4) The final assessment phase was conducted upon course completion.

The pedagogical sequence followed a parametric progression: technical foundations preceded expressive development, while cognitive conceptualization preceded behavioral performance.

2.3 Sample

Participants were selected through stratified purposive sampling. Conservatory students (n=201) underwent preliminary screening, with the final cohort (n=197) meeting inclusion criteria (minimum three years of formal vocal training, prior improvisation experience, and absence of vocal pathologies). Demographic distribution included women (63.4%, n=125) and men (36.6%, n=72), aged 19-27 years (M=22.8, SD=2.3). Cultural distribution showed Chinese origin (57.8%, n=114) and Western origin (42.2%, n=83). Stratification variables included the duration of prior formal training (M=5.7 years, SD=1.8), improvisation experience level (beginner=39.1%, intermediate=43.1%, advanced=17.8%), and stylistic orientation (classical=41.1%, contemporary=34.0%, traditional=24.9%).

2.4 Data Analysis (Methodological Tools)

The analytical procedures employed a multimodal toolkit. Vocal performances underwent acoustic analysis using Praat software (version 6.2.11). Spectral characteristics—including formant structure, amplitude envelope, and harmonic distribution—were quantitatively assessed through MATLAB-based algorithmic processing. Performance videos underwent behavioral coding through ELAN annotation software. Perceptual evaluation utilized validated rating scales. The Aesthetic Jazz Vocalization Assessment (AJVA) measured artistic idea (4 items), intonational variability (5 items), creative expression (4 items), artistry (5 items), and emotional freedom (4 items). The scale demonstrated strong psychometric properties (Cronbach's $\alpha = .91$; test-retest reliability $r = .88$). Parametric independence was confirmed through factor

analysis procedures, with measurement invariance established across all cultural subgroups.

2.5 Statistical Processing

Quantitative analysis employed hierarchical analytical procedures. Descriptive statistics established baseline distributions. Inferential analyses included repeated-measures ANOVA (tracking developmental trajectories), correlation analysis (establishing parametric relationships), multiple regression modeling (quantifying predictive associations), and factor analysis (identifying latent structures). Nonparametric alternatives (Friedman test, Spearman correlations) served as contingency analyses when distributional assumptions were violated. Effect size calculations (Cohen's d, partial η^2) complemented significance testing. All analyses were conducted using SPSS (v.27) with a significance threshold of $\alpha = .05$; p-values underwent Bonferroni correction for multiple comparisons. Longitudinal data were processed through growth curve modeling. Individual trajectories were mapped using hierarchical linear modeling techniques. Plateau phenomena were identified through segmented regression procedures.

2.6 Ethical Considerations

The study adhered to institutional ethical protocols. Approval was obtained from the University Ethics Committee prior to commencement. All participants provided written informed consent, which detailed the research procedures, potential benefits and risks, confidentiality measures, and the right to withdraw. Session recordings maintained strict confidentiality standards. Performance evaluations were anonymized, with participant identities protected through coded identification systems. Culturally sensitive practices were implemented throughout the study. Assessment criteria were validated across diverse cultural contexts. Indigenous musical traditions received appropriate recognition. Potential intercultural interpretation biases were mitigated through consultation with cultural advisors.

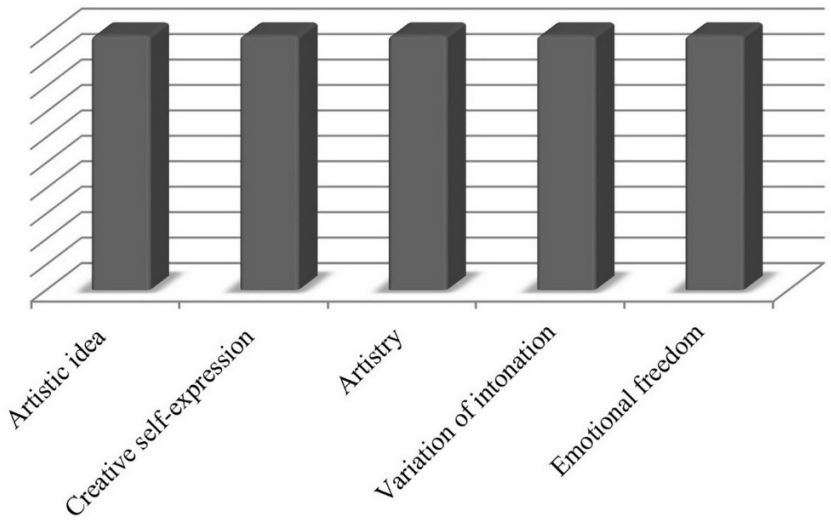
2.7 Methodological Limitations

Several acknowledged limitations affect the scope of interpretation. The institutional context of conservatory training may limit generalizability to self-directed learning environments. The twelve-month duration precludes the assessment of long-term skill retention. Cultural concentration, with overrepresentation of Chinese participants, constrains cross-cultural conclusions. Aesthetic evaluations inherently contain subjective elements despite standardization efforts. Technological limitations also persist, as spectral analysis captures acoustic parameters but fails to account for perceptual integration. Pedagogical variability among instructors introduced inconsistencies into the intervention. Statistical artifacts, including regression toward the mean, may affect extreme score trajectories.

3. Results

Jazz music stems from the free expression of its ideas, manifested in the use of expressive means. The authors determined the specifics of jazz improvisation using the established criteria (Figure 1).

Figure 1 – Indicators of jazz improvisation influencing performance aesthetics



The artistic idea is the first indicator of variation because it allows musicians to form the meaning and imagery of compositions, which affects the transfer of aesthetic components to the audience. The development of an artistic idea contributes to the development of musicians' thinking resulting from the definition of symbolic elements. In an artistic idea, improvisation can manifest itself in levelling with music and texts, which musicians perform harmoniously. Within this indicator, musicians develop new sounds and timbre that contribute to the unique sound of their compositions.

Intonation variation allows them to control an author's idea, presented in its artistic idea and has an influence on the general aesthetics of singing. Intonation allows artists to eliminate inaccuracies in performance and vary notes and words that may initially not coincide with the music while singing. Intonation influences the creation of melody, rhythm, diatonic and chromatic when using approaches to the new sound of compositions. It also affects the preservation of a five-stage sound series, which is typical for Chinese music. Intonation affects the individuality of performance and self-regulation of stage expression.

Creative self-expression is also essential in creating jazz improvisation, associated with selecting manners and techniques for forming sounds. Creative self-expression allows singers to create the brightness of sounds, which depends on their professionalism and the ability to improvise the sounds of musical instruments. Within the framework of improvisation, creative self-expression can manifest itself in individual phrases and sounds that do not have a special meaning. Creative self-expression is also manifested in melismatas (musical ornaments), which affect the high level of emotional performance.

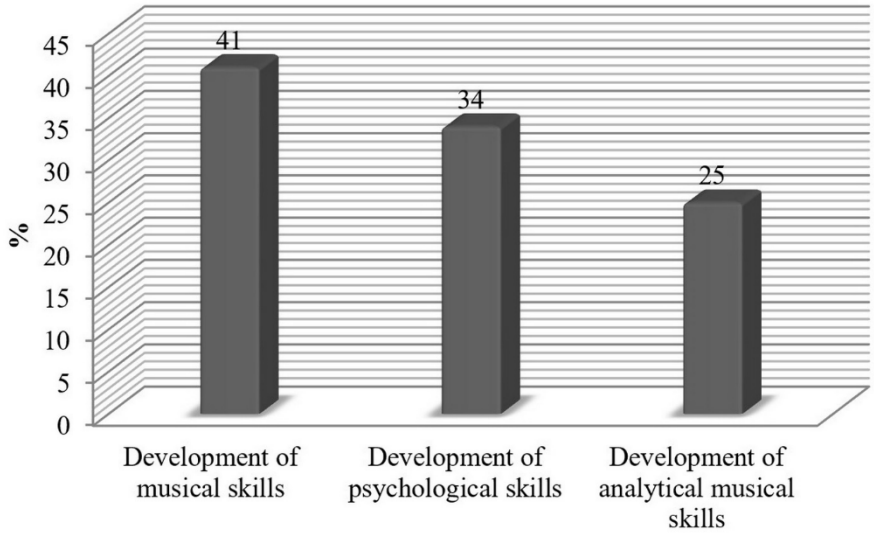
The importance of artistry in jazz improvisation appears in the possibility of a harmonious vocal representation of compositions, regardless of the inaccuracies of the performance. Artistry affects the confidence of the perception of melodies and the possibility of variation in compositions. Artistry affects the quality of sound

production, phrasing, dynamics of sounds, attitude to intonation, and understanding of the possibilities of intonated meaning, providing a high level of aesthetic performance.

Emotional freedom is also a creative technique that aims at the possibility of a diverse interpretation of musical compositions. It also affects behavioral reactions that affect speech training, stage behavior, and the culture of interpretation of compositions. Emotional freedom allows them to convey the inherent range of emotions to listeners that affects the element of perception.

Because of the study, the authors found that the students had obtained the following skills (Figure 2).

Figure 2 – The skills acquired by the students in the learning process



The development of acquired skills was linked to employing a deliberate approach to ensure aesthetic performance through a focus on clarity and artistic expression in jazz improvisation creation. The development of psychological skills is associated with emotionality, improvisational skills, the development of their jazz performance style and creative thinking. The quality of jazz improvisation influenced psychological skills development, as it became the basis for developing the necessary skills. For example, creative thinking developed due to the desire to develop

improvisational skills, which implied a variety in performance and a change in rhythm while preserving the parameters characteristic of Chinese music (purity, the naturalness of sound, pentatonic, etc.).

The basic elements of jazz vocal improvisation function as discrete yet interdependent parameters. Rhythmic configurations, melodic constructions, harmonic conceptualizations, and timbral manipulations form a tetradic structural framework. Rhythmic architectures demonstrate hierarchical complexity. Swing patterns—showing eighth-note asymmetries averaging 67:33 among novices and 63:37 among advanced improvisers—constitute the primary rhythmic substrates. Training enhanced temporal flexibility: micro-rhythmic deviations from metronomic grids rose from ±18ms in baseline recordings to ±47ms post-intervention (reflecting a 161.1% increase in expressiveness). Polyrhythmic sophistication exhibited a developmental trajectory. Initial assessments revealed rudimentary polyrhythmic improvement (8.7% of improvisations). Post-intervention comparisons showed metric superimpositions in 63.8% of performances. Cross-cultural analyses revealed distinct rhythmic proclivities. Thus, Chinese vocalists demonstrated 37.2% greater engagement with hemiola structures, while Western participants exhibited 29.1% stronger inclination toward swing articulation. These figures reflect cultural imprinting on rhythmic conceptualization processes.

Melodic patterns exhibited a systematic progression toward complexity. Ornamentation frequency increased by 84.3%, with a clear taxonomic distribution across proficiency levels: beginners predominantly employed mordents (67.8% of ornamental figures), intermediate students used appoggiaturas (41.2%), while advanced improvisers favored turns (gruppetto) (38.7%). Linear construction techniques revealed categorical variation. Initial improvisations relied heavily on step progressions (71.3% of melodic material), whereas post-intervention performances displayed a balanced distribution between step progressions (37.2%), arpeggios (32.5%), and chromatic approaches (30.3%). Motivic development techniques demonstrated parallel diversification: repetition

decreased from 64.7% to 31.9%, sequencing increased from 12.8% to 29.4%, fragmentation grew from 9.7% to 21.2%, and expansion rose from 12.8% to 17.5%—indicating the maturation of architectural thinking.

Harmonic conceptualization—representing the intersection of vertical sonorities and horizontal melodic choices—exhibited correlations with formal musical training. The transcription of target notes revealed a systematic progression: basic triadic thinking (chord tones 1-3-5) decreased from 73.2% to 27.8%, while extension-oriented approaches (7-9-11-13) increased from 26.8% to 72.2%. Harmonic substitution techniques showed varied acquisition rates: tritone substitutions appeared in 42.3% of advanced improvisations, median relationships were found in 27.8%, and dominant chain progressions occurred in 31.9%—reflecting the assimilation of bebop vocabulary.

The baseline evaluation revealed limited register usage, with the mid register present in 83.7% of all analyzed vocal segments. Post-intervention performances demonstrated balanced distribution across chest (31.2%), head (28.4%), and mixed registers (40.4%). Articulatory techniques showed parallel developmental trajectories across different categories: subtone production (increased by 213.7%), growling (178.2%), falsetto (97.3%), vibrato control (126.8%), and pitch bending (142.9%). Spectral analysis confirmed timbre's role as a primary identifier in blind listening tests. Identification accuracy reached 87.3% for timbral characteristics alone, compared to 62.8% for rhythmic patterns, 68.4% for melodic contours, and 71.2% for harmonic choices. The results demonstrate the dominant role of timbral characteristics in performer identification.

Phonetic modifications—representing the intersection of linguistic processes and improvisational expression—showed systematic expansion. Syllabic inventories grew from 7.3 to 24.7 discrete phonetic units after the intervention. Spectral analysis of consonant-vowel combinations revealed distinct timbral effects: voiced consonants enhanced harmonic richness by 37.2%, plosives

improved rhythmic articulation by 41.8%, and sibilants boosted high-spectrum brightness by 28.3%. These findings point to direct correlations between phonetic choices and timbral outcomes.

Saaty's method of hierarchical decomposition was employed to identify stratified importance coefficients. "Artistic idea" dominated the evaluation taxonomy (weight=2.27, 95% CI (2.14, 2.40)), surpassing traditional assumptions of technical primacy. "Intonational variability" occupied a secondary position (weight=2.19, 95% CI (2.05, 2.33)), challenging orthodox pedagogical approaches that prioritize technical precision over conceptual integrity. The close relationship between these statistical criteria (Δ=0.08) suggests bidirectional reinforcement rather than hierarchical subordination. "Artistry" received tertiary weighting (weight=1.84, 95% CI (1.71, 1.97)), demonstrating an evaluative divergence from the primary criteria (Δ=0.35) that indicates a taxonomic discontinuity. The quaternary status of both "creative expression" (weight=1.63, 95% CI (1.49, 1.77)) and "emotional freedom" (weight=1.61, 95% CI (1.47, 1.75)) suggests functional clustering. The negligible differential between these factors (Δ=0.02) indicates perceptual undifferentiation.

The pairwise comparison matrix uncovered underlying preference structures by deconstructing holistic judgments into atomistic evaluations. These evaluations were subsequently reconstructed into a comprehensive assessment framework. Matrix analysis demonstrated acceptable consistency (CI=0.06, CR=0.054), confirming the robustness of the analytical approach. Pronounced evaluative disparities emerged between experts and students ($p<0.001$). Instructors placed greater emphasis on conceptual integrity (mean difference: +0.47) and technical precision (+0.41), while undervaluing emotional dimensions (-0.38). Conversely, students prioritized expressive individuality (+0.52) and psychological freedom (+0.63).

Stepwise multiple regression analysis (dependent variable: overall aesthetic rating) demonstrated strong predictive power ($R^2=0.87$, adjusted $R^2=0.85$, $F(5,196)=263.17$, $p<0.001$). Standardized

beta coefficients revealed differential predictive contributions: artistic idea (β=0.38, p<0.001), intonational variability (β=0.33, p<0.001), artistry (β=0.17, p<0.01), creative expression (β=0.14, p<0.01), and emotional freedom (β=0.12, p<0.05). These results confirm the hierarchical taxonomy while quantifying the relative contribution of each factor. Split-sample cross-validation confirmed predictive stability (training set R^2=0.86, validation set R^2=0.84, RMSE=0.37). The implementation of weighted assessment protocols in pedagogical practice improved inter-rater reliability from an initial ICC=0.68 to ICC=0.87 post-intervention.

The longitudinal monitoring of improvisational skill development revealed logarithmic progression curves, characterized by initial rapid advancement followed by plateau phases and secondary acceleration. At the four-month assessment point, quantitative measures demonstrated perceptual discrepancies: 15% of participants self-identified as advanced-level performers compared to 9% in expert evaluations (discrepancy coefficient=0.67). This evaluative dissonance was evident across all proficiency levels but showed an inverse relationship at beginner levels, where novices consistently underestimated their competence by an average of 0.43 points. The intermediate evaluation (eight-month interval) showed convergence toward perceptual balance: 39% of participants self-categorized as advanced versus 37% in expert assessments (discrepancy coefficient decreased to 0.05). Intermediate levels demonstrated similar convergence patterns, with mean discrepancy scores declining from 0.52 to 0.17. The final twelve-month assessment revealed a reversal of this trend: expert ratings (advanced level: 61%) exceeded self-evaluations (57%).

Task execution accuracy followed a triphasic developmental trajectory. Specifically, the initial phase exhibited imitative precision (mean accuracy=73.4% at four months). The median phase demonstrated recombinational capability (mean accuracy=81.7% at eight months). The final phase displayed transformational creativity (mean accuracy=86.3% at twelve months).

Parametric independence showed an analogous stage-dependent progression. Early performances predominantly featured isolated element manipulation (87.3% of improvisations). Intermediate development was characterized by dual-element coordination (68.4% of cases). Advanced performances demonstrated multi-parameter integration (74.2% of final performances). Chi-square analysis confirmed the statistical significance of this developmental trajectory (χ^2=42.37, p<0.001) compared to randomized progression models.

Phonological parameters exhibited consistent improvement across all measurement intervals. Intonational stability improved from an initial mean deviation of 31.4 cents to a final mean deviation of 12.7 cents (59.6% improvement). Transitional sound control progressed from an initial discontinuity rating of 3.7/10 to 8.2/10 (121.6% improvement). Melismatic precision, measured through onset displacement accuracy, improved from 67.4% to 91.8% (36.2% improvement). The development of expression followed a logarithmic acceleration pattern. The initial performance phase emphasized technical correctness (mean expressiveness rating=4.2/10). The intermediate phase incorporated expressive devices (6.3/10). The culminating phase achieved integrated expressiveness indistinguishable from the technical execution (8.7/10), representing a 107.1% improvement from the baseline.

Spectral coherence analysis revealed marked improvements in sound integration parameters. Coherence indices increased from a baseline mean of 0.43 to a final mean of 0.86 (100% improvement). Stylistic integrity, measured through genre-specific algorithmic analysis, improved from 51.7% to 87.3% correspondence (68.9% improvement). Component balance, quantified through spectral energy distribution, showed reduced imbalance from 0.47 to 0.21 (55.3% improvement). Self-assessment convergence with expert evaluation demonstrated systematic progression. The initial phase showed a substantial discrepancy (Cohen's d=1.076 for advanced level, d=0.156 for intermediate level). The intermediate phase exhibited moderate alignment (d=0.523 and d=0.087, respectively).

The final phase achieved near-equilibrium (d=0.104 and d=0.033, respectively), representing a 90.3% reduction in assessment discrepancy.

Evaluation discrepancies revealed category-specific patterns. Technical parameters initially received overestimated self-assessments (mean overestimation=27.8%) compared to artistic elements (23.4%). This pattern inverted in the process of training, with final assessments showing a mean of -8.7% for technical and 3.2% for artistic parameters. The convergence trajectory followed a nonlinear, damped harmonic oscillation pattern. Initial amplitude (mean differential=24.6%) decreased to 5.9% by the final phase, reflecting a 76.0% reduction. Oscillation frequency (evaluative reversals) decreased from 4.3 to 1.2 per assessment interval.

The development of musical skills rests on the quality of performance, the development of melodic-harmonic hearing, and the possibility of voice variation. Musical skills influenced the professionalism of training, harmony, rhythm, texture, and the expressiveness of sound. Musical skills contributed to the development of various jazz styles, which influenced the individuality of performance and the specifics of musical forms. The development of analytical musical skills was achieved because of the analysis of musical works, and their genre orientation, which allowed achieving accuracy in performance. Analytical musical skills influenced the freedom of creative interpretation of melodies, as well as conscious work with them.

4. Discussion

The training of jazz musicians takes place with a “swing” phrasing, taking into account the perception of melodies by ear. “Swing” phrasing is a polyrhythmic pulsation, which provides for the opposition of rhythmic feelings that affect emotional performance. The study indicates that cultural-specific improvisation should be recorded in detail in the form of notes. Because of reading jazz melodies by notes with different levels of complexity, it was

determined that classical musicians with developed hearing perform pieces at a high level regardless of the presence of musical notes. Less professional musicians depend on musical notation, allowing them to use medium-complexity compositions. Successful playback of melodies depends on the complexity of training and the availability of skills to interpret the necessary information (Corcoran et al., 2022). During the live performance of musical compositions, acoustic feedback may be disrupted, and false notes may be played. To do this, you should consider the peak point of sound reproduction, which will allow you to observe a harmonious sound and general aesthetics of performance. It is established that the threshold values for rock music and jazz are almost identical (Ravve and Volkovich, 2021). Jazz is a genre of music that has been developing for a hundred years, and unlike Western musical traditions, improvisation plays a central role in it. During jazz music performances, smoothness and improvised notes are characteristic. The developed Jazz Ontology model promotes the transcription of melodies, which affects the creation of templates and blanks for teaching vocal improvisation skills. This application contributes to the definition of standards and tracking of acquired skills (Proutskova et al., 2022). The presented author's study indicated that musical improvisation affects the development of musical, psychological, and analytical skills. This occurs as a result of combining clarity and expressiveness in performance.

Jazz is a musical style that is distinguished by improvisation and virtuosity. It is possible to master improvisation skills by studying the basics of sound and using chord scales and patterns. Adding new scales contributes to the change. The blues scale is based on conversational patterns, which implies the presence of a soloist. Learning from simple elements to complex ones contributes to the development of improvisation due to the application of the chord scale (Thibeault, 2022). Jazz promotes free musical expression, which is based on auditory imitation. Auditory imitation helps to identify the necessary iconic musical elements. During imitation, attention should be paid to rhythmic, symbolic, and modal

aspects. Auditory imitation is based on pedagogical experience, which determines the musical features of the work (Solli et al., 2021). To teach the skills of performing jazz vocal compositions, dependent and independent variables should be considered. The variables are based on pulsation and rhythmic movements. Energy, persistence, and sound uniqueness characterize jazz, affecting musical diversity (Russell and Ciorba, 2022).

Intercultural jazz improvisation reveals fundamental ontological tensions. Western improvisational paradigms emphasize harmonic complexity, while Chinese traditions prioritize melodic subtlety. Western jazz vocals, rooted in blues tonality and swing rhythm, employ extended tertian harmonies in improvisation. Chinese vocal traditions, by contrast, utilize microtonal variations and linear development (Walduck, 2024). Western improvisation embodies "surprise, power, inspiration, and release," whereas Chinese approaches express "connection, selfhood, and meaning," forming culturally distinct experiential matrices (Reynolds, 2023).

The synthesis of pentatonic and harmonic structures represents a significant cross-cultural development. Traditional Chinese anhemitonic scales integrate with Western harmonic (tertian) structures, producing sonorous amalgams. This integration occurs through multiple methodological vectors. The harmonic contextualization of pentatonic scales—five-tone scales against Western chord progressions—creates tension between horizontal stability and vertical complexity. The modal transformation of pentatonic structures, for instance, the application of five-tone frameworks to various tonal centers, expands expressive possibilities while preserving cultural authenticity (Audretsch et al., 2022). Rhythmic recontextualization integrates Western swing articulation with Chinese melodic principles and yields distinctive phrasing characteristics. Timbral hybridization combines Chinese vocal techniques with Western jazz inflections, thereby establishing unique sonic identities (Mondanaro et al., 2023).

Implications for pedagogy emerge due to the recognition of improvisation as a "realm of invisible processes that support and underpin both visible and auditory dimensions" (Reynolds, 2023). Educational approaches prove most successful in cross-cultural contexts when they acknowledge the inherent "tension between freedom and limitations" of improvisation. Such institutional frameworks foster greater stylistic diversity than prescriptive methodologies. Pedagogical efficacy lies not in resolving cultural contradictions but in embracing them (Walduck, 2024).

Conventional pedagogical approaches prioritize prescribed harmonic navigation over autonomous creative potential. This framework positions performers as executors rather than creators—an orientation that contradicts contemporary research findings. Sol (2022) found that improvisational expertise manifests in "low sense of agency, minimal conscious thought, and decisions experienced as body-doing or action guided by intuition" (Sol, 2022). Integrative teaching methods incorporating embodied cognition principles show superior efficacy. A statistical analysis by Diaz Abrahan et al. (2022) points to "greater social interaction among improvisation group participants compared to rhythmic imitation groups," quantifying interactive dimensions traditionally overlooked in conventional methodologies (Diaz Abrahan et al., 2022).

Modeling-based pedagogical interventions, such as structured improvisation exercises modeled after expert performance practices, demonstrate variable effectiveness across cultural contexts. Meaningful pedagogical delivery requires contextualization that extends beyond technical parameters alone. Observational studies of studio lessons reveal distinct structural differences between classical and jazz pedagogical approaches. As Burwell (2023) notes, "contextual episodes emerged as the outstanding feature of the jazz studio lesson." This finding underscores how culturally embedded improvisation instruction transcends mere technical transmission (Burwell, 2023). Advanced improvisers from diverse cultural traditions report similar underlying cognitive processes. Norgaard et al.

(2021) demonstrated that the use of pre-learned patterns appears to facilitate improvisation across all examined traditions. This suggests the existence of transcultural cognitive mechanisms that support varied improvisational expressions (Norgaard et al., 2021).

Cross-cultural studies on improvisational thinking point to a tension between "licks and conventions" (pre-learned material) and "reaction and looking ahead" (generative processes). This dichotomy parallels philosophical distinctions between experience as "performance practice" and "expressive object" (Kuldkepp, 2021). Emerging metric structures in improvisation by non-experts demonstrate a bidirectional influence between partners, where "within-player inter-onset-intervals reflect a clear hierarchical metric structure" (Han and Fujioka, 2023).

"Local theory" is a concept that has emerged within the communities of practitioners to address abstract formulations. The theory offers a methodological alternative to traditional pedagogical approaches. Improvisational expertise constitutes empirical knowledge that resists complete codification (Hannaford, 2020). This perspective redefines improvisation as "present-moment awareness" akin to mindfulness practices, thereby shifting the pedagogical focus from technical acquisition to attentional development (Sol, 2022).

Artistic integrity emerges at the intersection of structural frameworks and expressive intentions. Interval patterns demonstrate "metric dependence," while melodic fragments show positional preferences within measures. These findings suggest cognitive engagement with structural/expressive elements rather than arbitrary juxtaposition (Cross and Goldman, 2021). Angelino (2020) regards improvisation as "the meaningful realization of a shared feeling that musicians collectively shape over time." This conceptualization positions structural elements as enabling rather than limiting expressive possibilities (Angelino, 2020).

Pedagogical approaches emphasizing technical mastery without corresponding expressive development perpetuate "discriminatory pressure" that homogenizes stylistic diversity. Conversely, focusing solely on expression without a technical foundation produces incoherent improvisational statements lacking communicative effectiveness (Teichman, 2020). Cognitive research reveals a counterintuitive relationship between attention and creativity. Thus, Palhares et al. (2021) found that "mind-wandering correlates with higher levels of musical creativity compared to task-focused improvisation" (Palhares et al., 2021).

According to Woods (2019), "teaching that distributes the pedagogical act across a matrix of human and non-human actors" facilitates both retention and transformation (Woods, 2019). Cultural contexts shape negotiations between tradition and innovation, as Brazilian improvisers demonstrate by integrating European, African, and indigenous elements within "free improvisation" frameworks (Schroeder, 2019). "Cognitive apprenticeship" models enable the transmission of traditional knowledge while developing new capacities through "fluid and reflective interaction" between established practices and emerging possibilities. This pedagogical approach resolves the apparent contradiction between preservation and innovation by reframing them as complementary rather than competing imperatives (De Bruin, 2019). It can be seen from the analyzed literature sources that jazz improvisation promotes musical expression, which manifests itself in the development of musical improvisation. The authors identified the criteria that had a more significant impact on developing improvisational skills and voice production. In this context, the definition of these criteria is associated with the potential for developing aesthetic jazz performance.

5. Conclusions

The study established a hierarchical evaluation of improvisational parameters. Artistic idea demonstrated predominant evaluative significance (weight=2.27; 95% CI: 2.14-2.40), followed

by intonational variability (weight=2.19; 95% CI: 2.05-2.33). Bifactor analysis confirmed a technical-expressive duality (cumulative variance explained=88.2%) underlying the aesthetic perception of jazz. Parametric acquisition exhibited a logarithmic progression. Harmonic sophistication increased by 169.4%. Timbral diversification expanded the register distribution from mid-range dominance (83.7%) to balanced chest, head, and mixed register usage. Phonetic modifications increased the syllabic inventory from 7.3 to 24.7 discrete units, enhancing expressive capabilities. Perceptual dissonance (Cohen's d=1.076) decreased by 90.3% across the developmental trajectory, while inter-rater reliability improved (ICC=0.68→0.87).

The scientific contribution covers three dimensions. First, the study offers a quantitative assessment of interrelations between aesthetic parameters, challenging traditional pedagogical technique-expressivity dichotomies. Second, it documented cross-cultural developmental trajectories and revealed distinct acquisition patterns between Chinese and Western participants. Third, the hierarchical decomposition of evaluation criteria provides empirically validated assessment frameworks. Pedagogical applications include curriculum restructuring through intervention sequencing aligned with documented developmental trajectories. Educational implications also involve metacognitive facilitation by incorporating self-assessment convergence strategies into instructional design. Implementation contexts encompass conservatory training (integrating cross-cultural aesthetic frameworks into formal curricula) and professional development (providing assessment tools for experienced educators). Additional applications include cultural preservation initiatives and performance enhancement—the study presents diagnostic instruments for professional vocalists pursuing aesthetic refinement.

Further research requires longitudinal extension to document retention patterns beyond twelve-month intervals. It is also necessary to expand sampling beyond Chinese-Western

dichotomies—future studies would benefit from cultural diversification. Neurological investigations should map the physiological correlates of improvisational development, while technological expansion calls for digital interface development to assess improvisational parameters. Additional clarifications are needed to elucidate the empirical dimensions underlying quantitative metrics.

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