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# Research on the Application of Digital Piano Teaching Equipment in University Music Education Curriculum

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## Abstract

Driven by global higher-education digital transformation initiatives and policy-led calls for fair access to arts education resources, group-based piano instruction for university music majors is facing persistent structural hurdles. These include insufficient one-on-one instructor guidance, delayed feedback on student practice output, and uneven resource distribution across learner subgroups. Drawing from an integrated socio-pedagogical lens that merges the sociology of technology and critical arts-education thinking, this study frames intelligent digital piano instructional systems not merely as practical classroom gadgets, but as institutional intervention tools capable of reshaping fairness and overall quality within tertiary-level arts training. This work adopts a 16-week quasi-experimental controlled research setup. One hundred and twenty undergraduate learners majoring in music education and music performance took part as participants, who were randomly split into two cohorts. The experimental group received full support from an intelligent digital piano instructional platform, whereas the control group received conventional offline group lessons using only acoustic pianos. Five evaluation dimensions were constructed for cross-cohort quantitative comparison: academic learning outcomes, operational efficiency within classroom sessions, student self-directed learning engagement, fair access to teaching resources, and cross-group curriculum satisfaction survey results. Empirical outputs show that smart digital piano hardware helps mitigate achievement gaps stemming from limited instructor capacity and hardware shortages. Participants demonstrated improvements in piano execution proficiency, rhythmic precision, as well as independent artistic evaluative competence. Instructional interaction patterns between educators and students were also optimized, enabling more balanced deployment of premium music-teaching materials in classroom contexts. This paper further

addresses practical drawbacks: over-reliance on automated corrective functions and imperfect acoustic timbre simulation built into digital instruments. Building on collected experimental evidence, layered improvement strategies are proposed, blending the strengths of digital intelligent infrastructure with human-centered offline mentorship. Findings offer cross-cultural insights for tertiary music education digital governance, equitable resource deployment and curriculum innovation from a social-science educational perspective.

**Keywords**: educational equity; socio-pedagogy; intelligent digital piano; higher arts education; curriculum digital transition; educational resource allocation; critical music pedagogy

## 1. Introduction

Piano core coursework forms a foundational training module for all undergraduate music-focused majors. Such courses serve dual purposes: building instrumental performance competence and cultivating learners' artistic awareness, aesthetic judgment and inclusive musical values. Amid worldwide digital governance reforms for post-secondary education and domestic policy priorities focused on fairly distributing high-quality arts education assets, traditional offline group piano training centred on acoustic instruments reveals deep-seated socio-pedagogical bottlenecks rather than straightforward technical teaching obstacles. Constrained by fixed classroom dimensions, limited physical piano stock, and finite capacity for individualised teacher guidance, conventional teaching structures inherently generate inequitable learning conditions. Students possessing weaker foundational musical grounding struggle to receive timely, tailored feedback on performance mistakes. Meanwhile, advanced learners lack supplementary practice materials matching their developmental requirements. Skewed resource provision widens performance disparities across student populations, contradicting core social-science objectives for inclusive, fair tertiary arts education.

From a sociology-of-technology standpoint, intelligent digital teaching hardware cannot be treated as value-neutral technical merchandise. Instead, these innovations constitute social mediators reshaping power dynamics among educators, learners and instructional resources within music classrooms. Breakthroughs in big-data gathering, real-time human-machine interaction and cloud-hosted resource sharing have accelerated the uptake of digital smart instruments across international arts-focused higher-learning establishments. Nevertheless, existing scholarly outputs exhibit notable disciplinary bias. Much available literature stays confined within narrow music-pedagogical boundaries, only cataloguing functional merits of digital piano hardware or documenting fragmented hands-on classroom anecdotes. Relatively few studies situate digital piano instructional practice within wider social-science theoretical frameworks. Existing work rarely explores how smart

technological tools mitigate skewed arts-education resource distribution, revise long-established artistic-competence assessment benchmarks, or respond to national and global policy agendas for arts-education digitisation and equity. Furthermore, quantitative empirical evidence illustrating socio-pedagogical impacts exerted by digital piano hardware within university music syllabi remains scarce. Multi-faceted experimental datasets explaining societal consequences brought by tech-driven educational intervention are still insufficient.

To fill these theoretical and empirical research voids, this paper develops an integrated analytical framework synthesising sociology of technology, critical pedagogy and music-education curriculum theories. Analysis prioritises resource fairness and socio-pedagogical innovation, instead of merely testing hardware utility. Through a 16-week controlled quasi-teaching experiment, this study contrasts learner progress, equitable resource access and stakeholder educational experiences between smart digital piano-supported lessons and conventional acoustic-piano group tuition. It systematically unpacks constructive societal contributions alongside latent cultural risks stemming from digital piano adoption within university music training, while identifying replicable curriculum-adjustment pathways suited for global tertiary-arts digital-reform contexts. Results aim to furnish empirically grounded theoretical references for higher-education administrators crafting digital arts-education infrastructure policies, alongside analytical viewpoints for international social-science investigators studying educational-technology equity.

## 2. Research Methods and Experimental Design

### 2.1 Research Participants and Homogeneity Control

Study participants comprised 120 full-time undergraduates pursuing music-education and music-performance degrees at a provincial comprehensive university in Southwest China, covering first- and second-year cohorts undergoing identical piano-course training cycles. Pre-experiment homogeneity assessments were implemented to rule out confounding elements threatening experimental validity. Three measurement indicators were deployed: chronological age distribution, standardised foundational music-theory examination marks, and baseline piano-performance evaluation outcomes. Independent-samples t-test outputs confirmed no statistically meaningful inter-group divergence across all baseline metrics ($P>0.05$). This guarantees comparability for both participant cohorts and satisfies internal-validity benchmarks for social-science quasi-experimental inquiry.

All participants were randomly split evenly into experimental and control groups, each containing 60 learners. The control group followed standard offline group-teaching workflows relying exclusively on acoustic pianos; no smart digital aids were utilised during in-class activities or after-class practice supervision. The experimental group leveraged the full-featured intelligent digital piano instructional platform for every in-class activity and personalised after-class tutoring

arrangement. The entire intervention spanned 16 weeks, with four standard instructional hours allocated weekly for each cohort. To eliminate artificial confounding variables, identical teaching syllabi, core repertoire repertoires, assessment rubrics and full-time specialist piano instructors served both cohorts throughout data collection, achieving strict control over extraneous variables consistent with social-science experimental norms.

2.2 Configuration and Socio-Pedagogical Function of Digital Piano Teaching System

The smart digital piano instructional platform deployed for this trial combines multi-layer hardware sensing terminals alongside cloud-backed big-data analytical back-end components. Hardware includes high-sensitivity keystroke-capturing assemblies, synchronised audio-video recording hardware, visualised data-report dashboards and categorised cloud-hosted musical-resource repositories. Departing from purely functional descriptions seen within earlier technical publications, each core module is interpreted through a socio-educational-equity lens:

Real-time error-spotting module: Captures rhythmic deviations, unstable pitch delivery and non-standard fingering patterns automatically. It overcomes human limits that restrict instructors to monitoring only a small subset of learners simultaneously. Uniform instantaneous feedback becomes accessible for every classroom participant, lowering inequities created by uneven distribution of educator attention.

Learning-behaviour statistics module: Automatically archives daily practice duration, mistake frequency and recurring weak performance points. Individualised visual progress reports are generated to facilitate differentiated lesson planning, counteracting “one-size-fits-all” training limitations common to conventional group-based tuition.

Multi-endpoint cloud-resource sharing module: Centralises high-calibre demonstration footage, supplementary repertoire content and supporting music-appreciation materials. It breaks resource bottlenecks imposed by limited physical teaching materials, granting all students equal entry to premium learning assets regardless of initial-ability discrepancies.

Remote educator-learner interaction endpoint: Supports off-campus after-class mentorship exchanges, extending temporal and spatial boundaries for arts instruction and compensating for shortages of one-on-one consultation time following formal class meetings.

The platform continuously gathers full-cycle in-class and after-class learning traces for every participant. This supports educators in accurately identifying at-risk learner subgroups and builds technical foundations for refined equitable instructional delivery within university music classrooms.

### 2.3 Multi-Dimensional Evaluation Indicators and Statistical Analysis Standards

Aligned with core research priorities concerning educational fairness and socio-pedagogical outcome appraisal, five interconnected quantitative evaluation dimensions were constructed. This moves past single-faceted effectiveness assessment typical of prior music-teaching investigations. Metrics cover holistic learner developmental progress, classroom-resource operational efficiency, individual self-directed learning engagement levels, equitable utilisation rates for diverse instructional resources, plus aggregate curriculum-design fairness satisfaction for both teaching staff and learners.

Raw experimental data were gathered via three standardised collection channels: triple-blind marking performed by three senior specialist music educators; objective quantification for classroom-behaviour duration and occurrence frequency; and anonymous closed-format standardised questionnaires distributed to every enrolled participant and course-teaching personnel. SPSS 26.0 statistical software was deployed to run independent-samples t-tests and descriptive statistical sorting for cross-cohort comparison. All analytical work complied with empirical social-science research standards, securing objectivity, reproducibility and cross-cultural comparability for resulting experimental outputs.

## 3. Experimental Results and Socio-Educational Interpretation of Statistical Data

This study organises five sets of standardised statistical outputs to quantify socio-pedagogical outcome disparities between smart-digital-piano-supported lessons and conventional acoustic-piano group tuition, focusing on arts-resource balancing and learner developmental advancement. All tabulated values retain original measured experimental readings, with interpretive discussion reframed according to educational-equity and socio-pedagogical thinking.

### 3.1 Baseline Homogeneity Test of Two Student Cohorts

Table 1 summarises basic demographic traits and pre-intervention professional-competence assessment scores belonging to experimental-group and control-group participants. Independent-samples t-test outputs indicate that prior to the 16-week instructional intervention, average age, pre-test music-theory achievement and baseline piano-performance capability displayed no statistically meaningful divergence between cohorts (all $P>0.05$). Identical starting conditions rule out pre-existing learner-ability gaps as an alternative explanation for observed experimental outcomes. Homogeneity prerequisites required for controlled social-science experimental work are satisfied, supporting trustworthy cross-cohort comparison for post-intervention equity-focused and learning-performance indicators.

**Table 1 Baseline demographic information and pre-experiment professional ability test results of two participant cohorts**

| Group | Number of students | Average age (years) | Pre-test basic music theory score | Pre-test initial piano performance score |
|---|---|---|---|---|
| Experimental group | 60 | 20.36±1.25 | 78.25±4.36 | 75.12±5.28 |
| Control group | 60 | 20.18±1.32 | 77.98±4.52 | 74.86±5.35 |
| P-value | - | 0.452 | 0.726 | 0.689 |

3.2 Post-Intervention Comprehensive Learning Development Comparison

Upon completing the full 16-week standardised instructional intervention, three blind-assessment educators rated learner advancement across four core artistic domains: overall piano-execution technical mastery, rhythmic control accuracy, pitch stability and holistic musical-expression literacy. Post-test scoring data in Table 2 reveal that participants receiving smart digital piano platform support achieved noticeably higher average marks for every evaluation domain, with every cross-group difference reaching statistical significance at $P<0.05$.

From a socio-pedagogical interpretive angle, these measurable inter-cohort gaps stem from equal-opportunity instant-feedback mechanisms embedded within digital hardware. Every learner receives immediate performance-error prompts during practice sessions, rather than competing for scarce educator-guidance opportunities typical within conventional classrooms. Such technical equalising instruments compress achievement divides separating lower-ability and advanced peers, delivering social-science-oriented goals of reducing performance disparity within identical course offerings.

**Table 2 Post-intervention artistic learning development scoring comparison of two cohorts**

| Evaluation dimension | Experimental group average score | Control group average score | P-value |
|---|---|---|---|
| Piano performing technical proficiency | 89.65±3.21 | 82.36±4.15 | 0.000 |
| Rhythmic control precision | 90.12±2.86 | 83.58±3.92 | 0.000 |
| Intonation stability | 88.96±3.05 | 81.95±4.26 | 0.000 |
| Comprehensive musical expression literacy | 87.52±3.68 | 80.68±4.53 | 0.001 |

| Evaluation dimension | Experimental group average score | Control group average score | P-value |
|---|---|---|---|
| Overall comprehensive academic achievement | 89.06±3.12 | 82.14±4.08 | 0.000 |

3.3 Comparative Analysis of Classroom Resource Operation & Tutoring Equity Efficiency

Taking single complete instructional hours as uniform statistical units, this study contrasts four key metrics reflecting fairness and operational effectiveness for in-class educational resources. Indicators cover average per-learner educator-led error-correction time, balanced valid educator-learner interaction occurrences for each lesson, uninterrupted effective learning time per participant during class hours, and percentage reduction for teachers' repetitive uniform-content tutoring workload.

Table 3 datasets demonstrate comprehensive improvements for every fairness- and-effectiveness metric under the digital-platform-supported model. Average time educators dedicate to individual-student mistake correction fell by 62.15 %, permitting instructors to distribute their finite professional attention across more learners fairly. Balanced meaningful interaction instances per lesson rose by 96.29 %, counteracting phenomena observed in conventional group settings where a small subset of outgoing learners monopolised educator-communication chances. Individual in-class effective learning duration increased by 31.20 %; every participant secured stable hands-on practice and corrective feedback time without being crowded out by classmates. Repetitive mechanical tutoring assignments burdening teaching staff dropped 45.62 %, freeing up instructional time for high-value human-centred artistic mentorship and individually tailored training planning. Collectively these datasets illustrate that digital piano hardware reorganises distribution patterns for "educator guidance capacity", a core scarce instructional resource inside music-teaching classrooms.

**Table 3 Comparison of classroom resource operation & tutoring equity efficiency indicators (Mean±SD)**

| Efficiency & equity indicator | Experimental group | Control group | Comprehensive optimization rate (%) |
|---|---|---|---|
| Average individual error correction time per student (min) | 2.15±0.32 | 5.68±0.85 | 62.15 |
| Balanced effective teacher-student interaction frequency per class | 42.36±5.21 | 21.58±4.36 | 96.29 |

| Efficiency & equity indicator | Experimental group | Control group | Comprehensive optimization rate (%) |
|---|---|---|---|
| Individual student valid continuous learning duration per class (min) | 38.52±3.15 | 29.36±4.28 | 31.20 |
| Reduction proportion of teachers' repetitive homogenized tutoring workload (%) | 45.62±6.32 | 0.00 | 45.62 |

3.4 Autonomous Learning Participation & Equitable Resource Utilization Level

Sustainable long-run educational fairness cannot rely solely upon in-class technical aids. It also hinges on learners actively drawing upon balanced supplementary instructional assets outside scheduled class hours. Table 4 statistical outputs highlight substantial inter-cohort divergences across four long-term assessment metrics; every corresponding P-value sits under 0.05, marking strong statistical significance.

Learners within the digital-instruction experimental cohort exhibited more frequent self-directed study behaviours and lengthier daily out-of-class practice intervals, enabled by cloud-hosted repositories removing physical-material access barriers. Comprehensive diversified-teaching-resource uptake among experimental-group participants reached 86.35 %, vastly surpassing the control-group figure of 42.18 %, where learning was constrained to printed textbooks and limited offline demonstration content. Fair inclusive classroom-activity engagement for the digital-supported cohort hit 92.16 %, contrasting against 75.38 % recorded for conventionally taught learners. This finding suggests that equitable smart instructional tools can activate learning motivation for marginalised participants who tend to receive minimal attention within traditional group-lesson environments, further advancing inclusive development for university-level music education.

**Table 4 Comparison of autonomous learning participation and equitable teaching resource utilization (Mean±SD)**

| Long-term equity evaluation indicator | Experimental group | Control group | P-value |
|---|---|---|---|
| Weekly autonomous active learning frequency (times) | 5.86±1.23 | 3.12±1.05 | 0.000 |
| Daily after-school continuous practice duration (min) | 48.52±10.36 | 26.35±8.92 | 0.000 |
| Comprehensive diversified teaching resource equitable utilization rate (%) | 86.35±5.28 | 42.18±6.35 | 0.000 |
| Balanced active classroom participation rate of all students (%) | 92.16±4.32 | 75.38±5.16 | 0.002 |

3.5 Teacher-Student Comprehensive Satisfaction on Equitable Curriculum Design

Once the full 16-week intervention concluded, anonymous survey questionnaires were circulated covering all 120 student participants plus participating specialist piano instructors. Satisfaction assessments spanned five dimensions anchored to educational fairness and socio-pedagogical experience: overall balanced teaching effectiveness, equalised individual learning journeys, accessibility and richness for shared instructional assets, appropriateness of fair personalised mentorship, plus innovation quality for digitally supported inclusive curriculum structures.

Table 5 results show the experimental cohort working with smart digital piano hardware attained markedly higher satisfaction ratings across every measured dimension (all P-values equal to or smaller than 0.001). Practising educators acknowledged that digital-tool-enabled workflows resolve long-standing unfair-resource-allocation pain points plaguing conventional group-format piano teaching. Learners possessing weaker foundational musical capabilities delivered the most positive evaluations for instant equal-opportunity mistake-correcting functions and cloud-hosted learning repositories. Subjective feedback from course stakeholders corroborates socio-pedagogical practical value associated with digital-piano-centred instructional frameworks.

**Table 5 Comparison of satisfaction scores on equitable curriculum design between two cohorts (Mean±SD)**

| Equity satisfaction dimension | Experimental group average score | Control group average score | P-value |
|---|---|---|---|
| Satisfaction on balanced overall teaching effect | 91.25±2.86 | 80.36±3.92 | 0.000 |
| Satisfaction on equal individual learning experience | 90.68±3.12 | 78.95±4.25 | 0.000 |
| Satisfaction on accessibility and richness of shared teaching resources | 92.14±2.58 | 76.32±4.68 | 0.000 |
| Satisfaction on equitable personalized differentiated tutoring | 89.86±3.35 | 75.18±5.02 | 0.001 |
| Overall comprehensive satisfaction on digital inclusive curriculum | 91.02±2.96 | 77.68±4.36 | 0.000 |

## 4. Discussion

Multi-indicator quantitative quasi-experimental outputs from this research offer systematic evidence demonstrating prominent socio-pedagogical value carried by intelligent digital piano instructional hardware for advancing educational equity and curriculum renewal within tertiary-level arts training. This discussion section interprets empirical findings under a three-pronged theoretical framework incorporating sociology of technology, critical music pedagogy and

educational-resource-allocation theory. Results are further contextualised against global higher-education digital-policy agendas and cross-cultural arts-education developmental trajectories.

First, regarding fair distribution of educational resources, real-time full-cohort oversight alongside intelligent error-recognition capacities built into digital piano platforms substantially mitigate structural inequities in educator-attention allocation inherent within acoustic-piano-based group tuition. Human perceptual constraints limit conventional-classroom instructors to closely observing performance details for merely two to three learners simultaneously. Most participants wait many minutes before receiving targeted corrective guidance. Introverted learners or those with weaker foundational musical skill frequently become overlooked amid classroom-resource competition. Smart digital endpoints enable synchronised, impartial oversight for every individual learner. Technological infrastructure operates as a "resource leveller", equalising mentorship opportunities for all class attendees. Corresponding post-test achievement metrics empirically verify that this equalised feedback mechanism compresses inter-learner performance gaps. These findings supply practical evidence supporting international arts-education policymakers' investments in smart digital infrastructure intended to narrow achievement disparities among learner subgroups. Moreover, cloud-hosted shared-resource repositories dismantle monopolies over physical textbooks and scarce demonstration recordings. All participants gain unrestricted access to high-level supplementary learning materials irrespective of household-economic backgrounds, advancing social-science-oriented goals for diminishing economic-capital influences over arts-learning resource access.

Second, concerning transformation of instructional relational dynamics and stimulation for self-directed learning motivation, digital piano platforms remodel top-down transmissive educator-learner relationships characteristic of traditional instrumental instruction. A hybrid collaborative-learning pattern emerges, guided by data insights alongside human-focused artistic communication. Visualised learning-analysis reports generated by big-data back-end systems permit educators to discard uniform one-size-fits-all training roadmaps and deliver finely tuned differentiated equitable instruction. This aligns with core critical-pedagogy premises advocating respect for diverse individual developmental requirements. Statistics capturing weekly self-directed-study frequency and after-class practice durations illustrate that open access to diverse digital learning assets meaningfully boosts learners' internal study motivation. Learning transitions from passive in-class reception towards active exploratory artistic practice. Such transformations furnish cross-cultural reference points for arts-focused higher-learning institutions pursuing learner-centred digital-curriculum reform amid worldwide educational informatisation shifts. Additionally, digital hardware cuts educators' repetitive mechanical mistake-remedial workloads by close to half. Professional instructional bandwidth is freed for high-impact artistic-expression coaching, aesthetic cultivation

and human-oriented musical dialogue, balancing technical-skill drilling and cultural-literacy-building missions belonging to university piano syllabi.

Third, from the standpoint of subjective stakeholder perceptions and social acceptance for course delivery models, inclusive digitally augmented instruction improves fair learning experiences for every learner subgroup and draws consistent positive feedback from teaching staff as well as students. International music-pedagogy scholarship has long criticised conventional piano-teaching structures for skewed distribution of mentorship chances. Intelligent digital platforms make customised guidance attainable for every participant, explaining high stakeholder approval ratings for equity-focused and innovative dimensions of this teaching approach. Observations confirm practical feasibility for rolling out digital piano hardware as inclusive educational tools across university contexts situated within distinct cultural milieus.

Nevertheless, this socio-pedagogical empirical investigation also flags two salient socio-cultural limitations triggered by over-reliance upon digital piano technologies, factors requiring consideration for international digital-arts-education popularisation initiatives. On one hand, some learners grow excessively dependent on automated system-generated corrective prompts. Their capacity for independent auditory discrimination and personal artistic evaluation weakens. Adopting a critical sociology-of-technology perspective, excessive technological intervention can erode learners' autonomous artistic-reasoning capabilities. Technological dependency may undermine core tertiary-arts-training priorities centred on nurturing independent musical-aesthetic judgement. On the other hand, digital timbre-simulation modules cannot fully reproduce multi-layered acoustic resonance produced by grand pianos during complex classical-repertoire renditions. Existing intelligent algorithm architectures also lack customised adaptive functions addressing divergent training priorities for music-education versus music-performance majors. Deficiencies emerge when pursuing advanced artistic-teaching objectives. These two caveats remind global arts-education practitioners that smart digital aids function as equity-boosting supplementary instruments, not complete substitutes for human-centred offline instructional practice. Both delivery modes ought to complement one another rather than replace each other outright.

## 5. Conclusion

Built upon a 16-week controlled quasi-experiment plus multi-dimensional quantitative data analysis rooted within equity-focused socio-pedagogical theory, this research systematically examines inclusive societal merit, hands-on instructional strengths and inherent cultural-contextual constraints accompanying intelligent digital piano hardware deployed within university music-curriculum reform. Core findings carrying cross-cultural reference value are summarised as below:

Intelligent digital piano instructional platforms serve as potent instruments balancing educational-resource distribution. They can appreciably lift

comprehensive artistic-learning outcomes for all participants, covering instrumental-execution technique, rhythmic-and-pitch-management skill and independent musical-expression competence. Performance gaps between student subgroups created by uneven allocation of educator-mentorship resources within conventional classroom environments are effectively narrowed.

Digital-smart-technology-augmented teaching reorganises internal operational workflows within music classrooms. Repetitive uniform-content tutoring burdens borne by teaching staff decrease, educator-learner interaction chances are distributed fairly across all learners, and overall fairness plus operational effectiveness for core arts-teaching resources improve comprehensively.

Cloud-enabled resource-sharing and multi-endpoint interaction capacities belonging to digital piano platforms break supply constraints tied purely to physical offline instructional materials. Learner self-directed-study participation and equitable instructional-resource utilisation efficiency rise. University piano coursework shifts away from homogenised transmissive teaching towards finely differentiated inclusive education, matching worldwide policy trends for higher-education digitisation and equity construction.

Digitally-augmented piano instruction earns high overall satisfaction among university-music-education-context teaching staff and student participants, showing credible replicability and popularisation potential for arts-tertiary establishments operating under diverse national-cultural conditions.

Responding to technological-dependency risks and timbre-simulation inadequacies uncovered through this investigation, follow-up scholarly work can advance along three socio-pedagogical-research trajectories. First, refine internal algorithmic frameworks powering digital piano instructional platforms, striking reasonable balance between automated corrective support and cultivation of learners' independent artistic-critical thought. Second, strengthen context-aware platform customisation catering to divergent training objectives for different music-specialty majors. Third, build multi-faceted digital-teaching appraisal frameworks merging quantitative technical-data indicators alongside human-oriented artistic-literacy benchmarks. Beyond these priorities, future studies should develop hybrid-teaching architectures integrating equity-enhancing merits from smart digital hardware alongside aesthetic-guidance strengths stemming from offline acoustic-piano-based human instruction. Empirical datasets and socio-pedagogical analytical outputs contained within this manuscript supply actionable technical blueprints plus theoretical interpretive lenses for university administrators, arts-education policymakers and international social-science researchers devoted to global tertiary-music-education digital-transition and inclusive-equity development.

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