

Sonogram-Based Digital Scores and Flipped Learning: Breaking Down Hierarchies in Chinese Electroacoustic Music Education

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ABSTRACT

This paper investigates how sonogram-based “digital scores”—realised through Acousmographie, eAnalysis, and TIAALS (Tools for Interactive Aural Analysis)—can enable flipped learning models that challenge the top-down hierarchies prevalent in Chinese music education. Through three case studies, we explore how digital listening interfaces can facilitate interdisciplinary and learner-driven approaches to electroacoustic (e-a) music analysis. Case 1 revisits *Ambush on All Sides*, a fixed-media composition based on the Chinese pipa, visualized through Acousmographie. Case 2 analyzes *Fugue of Electronic Waves*, a waveform-based fugue rendered in eAnalysis with visual annotations resembling children’s cartoons. Both compositions were created by the first author and are analyzed by the second author, a pre-doctoral trainee originally trained in classical music theory. In Case 3, the second author applies TIAALS to study timbral mimicry between Western and Chinese instruments. To support a bottom-up learning process and reduce teacher–student dependency, an invited postgraduate contributor with a background in music therapy provided perspectives grounded in therapeutic practice. The study argues that while sonogram tools are sometimes considered outdated, they remain effective scaffolds for conceptual transformation in music-technology learning. This pedagogical framework encourages critical listening, cross-cultural dialogue, and flipped power structures in contemporary e-a music training in China.

Keywords: sonogram-based analysis, digital score, flipped learning, electroacoustic music pedagogy, Acousmographie, eAnalysis, TIAALS, cross-cultural analysis

Author Contributions:

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The first author conceptualized the project, composed the fixed-media works for Cases 1 and 2, supervised the second author’s training in electroacoustic analysis, and led the development of the flipped learning methodology and manuscript.

The second author initially observed works created in Acousmographie and eAnalysis, before undertaking her own analytical project using TIAALS and applying her background in classical analysis while developing new competencies in music technology through a pre-doctoral research project.

The third author served as an invited reviewer of Case 3, using her expertise in music therapy to support and evaluate the flipped learning process, and contributed critical insights on bottom-up pedagogy.

All authors contributed to the interpretation of results and approved the final manuscript.

1. INTRODUCTION

Electroacoustic music (e-a music), as both a creative and analytical field, has long struggled with inherited pedagogical hierarchies in certain cultural contexts. In China, education in music and technology remains predominantly top-down, characterised by a centralised system where the teacher leads and the student follows. This system typically impacts a student for many years—extending from undergraduate to postgraduate and even doctoral levels—often resulting in cohorts of students who reflect a kind of pedagogical self-similarity. As De Ritis (2022) observes, “individualism and nonconformity are discouraged – the group supersedes the individual” [1]. While recent shifts in China’s academic and creative sectors have begun to acknowledge the value of “individual slices of genius,” the pedagogical implications of this shift for electroacoustic music remain underexplored.

At the same time, the field of electroacoustic music has benefited from decades of development in tools for listening, analysis, and visualisation. One such tool is the sonogram—also referred to as a sonograph or spectrogram—which represents sound as a two-dimensional image over

time. As Roads (1995) explains, “a sonogram... represent[s] a sound signal as a two-dimensional display... The vertical dimension depicts frequency... and shades of grey indicate amplitude, with dark shades indicating greater intensity” [2]. This visualisation technique, though originally developed for acoustic analysis, has become central to how composers and analysts work with sonic material. What we now refer to collectively as digital scores, in a much broader sense, builds upon this visual foundation and introduces a spectrum of software platforms that integrate image, sound, and interactive interpretation.

Sonogram-based tools have served as quiet agents of bottom-up learning in Chinese e-a music education over the past two decades. Through three case studies, we revisit a body of work that has implemented digital score practices as an interface for sound-based thinking, rather than notation-based one, since the early 2000s. These cases reveal that such tools were used to encourage creative agency, long before flipped learning became a recognised educational model. Through the lens of visual analysis, cross-cultural identity, and “flipped environment”, we argue that the sonogram is more than a display—it is a pedagogical interface. The following sections outline the methodological framework and discuss how digital scores may be re-contextualised as tools of pedagogical disruption, challenging the enduring teacher-student hierarchy in Chinese music and technology education.

2. METHODOLOGY

This study adopts a pedagogy-driven methodology to examine the role of sonogram-based tools—referred to here as digital scores—in reshaping electroacoustic (e-a) music education in China. Drawing from flipped learning theory and comparative tool analysis, the research approach challenges the traditional teacher-student hierarchy by engaging learners as active participants and co-constructors of knowledge.

2.1. Flipped Learning as Pedagogical Framework

The pedagogical core of this study is informed by flipped learning, a model that redefines the teacher’s role from knowledge authority to learning facilitator. According to Straw, Quinlan, Harland, and Walker (2015), while in a traditional classroom “the teacher’s role is to lead the lesson/pass on knowledge,” in a flipped model “the teacher’s role is mainly to facilitate student-led learning” [3]. This reorientation is particularly relevant in Chinese higher education, where cultural norms often discourage independent exploration and emphasize conformity as mentioned earlier by De Ritis in 2022. By integrating flipped learning into e-a music training, this study seeks to enable a bottom-up pathway in a historically top-down educational culture.

The flipped model was implemented in two directions:

In Case 2, a struggling undergraduate student re-engaged with music technology through hands-on interaction with visual tools.

In Case 3, a classically trained music analyst used a psychoacoustic lens to reinterpret sound-based representations, guided but not dictated by her supervisor.

This dual-flip allows for student-led inquiry from both low-entry and high-expertise perspectives, disrupting conventional hierarchies in both technical and conceptual domains.

2.2. Digital Scores as Analytical Tools

Technologically, this study is grounded in the evolution of sonogram-based tools as discussed in *The Computer Music Tutorial*, Second Edition (Roads, 2023) [4]. While the first edition (1995) introduced the sonogram primarily as a spectral display, the second edition expands this foundation by documenting many systems that build upon it, such as *Acousmographie*, *eAnalysis*, and *TIAALS*, which collectively support what we now refer to as digital scores in a broad sense. The following three systems play a central role in this paper:

Acousmographie “supports a transcription of electroacoustic music starting from a spectrogram representation” and “lets the user inscribe a library of colour graphic symbols onto a spectrogram” (p. 1436) [4]. Developed in 1993 at the *Groupe de Recherches Musicales*, it remains an influential tool for bridging analytical notation and perceptual listening.

eAnalysis (2016) “provide tools for creating analytic text and graphics for music study,” (p.1440) [4] which interface is more accessible, lending itself particularly well to teaching environments.

TIAALS (Tools for Interactive Aural Analysis), introduced in 2013, “enable users to develop interactive analyses in an environment integrating a sonogram and a chart maker” (p. 1439) [4]. Unlike sonogram objects, “objects placed on the chart are visually abstract—a symbolic mode of representation,” offering an open-ended structure for interpretive and comparative study.

These tools represent a methodological shift: from static representations toward exploratory environments for music analysis. Their pedagogical relevance lies not only in the data they display, but in how they allow learners to actively construct meaning—by inscribing, annotating, and interpreting sound.

This triad of digital-score systems allows for a flexible interface for flipped environments, where students engage in interpretation before formal instruction. Each system encourages student-led perception and contextualised learning, making them particularly effective for bottom-up strategies in music technology education.

2.3. Case Study Design

Three case studies were selected to reflect different periods, perspectives, and levels of experience:

Case 1 uses *Acousmographie* to analyze an electroacoustic work derived from traditional Chinese music.

Case 2 explores a student’s reinterpretation of digital waveforms using *eAnalysis*.

Case 3 examines how *TIAALS* supports a trainee’s shift from classical to technological analysis, with added input from a third-party observer.

Each case is situated at a different point on the composer–student–analyst spectrum, with the aim of assessing how digital scores function not only as analytic tools but

as interfaces for flipped learning. The combination of temporal breadth (2003–2023) and multiple user identities offers a comprehensive look at how sonogram-based approaches have evolved pedagogically, and how they may continue to foster independent inquiry in Chinese e-a music education.

3. CASE STUDY 1: AMBUSH ON ALL SIDES AND ACOUSMOGRAPHE

The first case study explores *Ambush on All Sides*, a fixed-media electroacoustic composition created in 2003 by the first author during a transitional moment in his musical identity. With a strong background in Western classical music, the composer had only recently encountered acousmatic practices, though he had many years experiences with technologies on recording and mixing for music productions. *Ambush on All Sides* marked his earliest venture into sound-based composition, reflecting a critical juncture at which he moved beyond notation-based frameworks and into electroacoustic idioms grounded in sonic gesture and spatialized sound.

The work draws conceptual inspiration from the famous Chinese pipa piece *Ambush from Ten Sides*¹, but radically reinterprets its sonic materials. Rather than recording directly, the composer sourced pipa material from commercial CDs, treating them as plunderphonic samples. These were subjected to basic sound manipulations—such as reversing, time-stretching, and pitch-shifting—to generate transformed textures. Additional layers included children’s vocal shouts, transposed by an octave to resemble adult male voices, contributing to a disorienting and dramatic soundscape at the climax. This approach preserved the martial intensity of the original while aligning with the acousmatic principle of separating sound from its source.

A recomposed version titled *New Ambush on All Sides*² (2004) retained only the opening ten seconds of the original. It introduced a digital sampler and automated controllers, significantly expanding both the structural depth and sonic complexity of the work. However, this experimentation coincided with the composer’s growing disillusionment with local educational practices. While pursuing his postgraduate degree at Central Conservatory of Music in Beijing China, he observed that most e-a students—undergraduates and postgraduates alike—were encouraged to follow uniform procedures dictated by teachers. The essential aesthetic foundations of acousmatic music (e.g., reduced listening) were often ignored or misunderstood, even by instructors. This top-down teaching model limited creative independence and failed to cultivate sound-based awareness.

In response, the first author began developing his own terminology and teaching strategies, laying the groundwork for what would later evolve into a bottom-up, student-centered pedagogy for electroacoustic music. In 2011, he revisited *Ambush on All Sides*, recognizing that its relative simplicity made it especially suitable for analysis using Acousmographie. This visual representation was

conceived not merely as a supporting aid, but as an interface for sound-based thinking—a pedagogical bridge designed to articulate structural form, dynamic gesture, and spectral density to musicians trained primarily in notation-based traditions.

The Acousmographie³ (CHEARS, n.d.-a) [5] version premiered in China in 2012 (see figure 1), in a concert curated by the composer to introduce electroacoustic music to colleagues and students at Shenyang Conservatory of Music, Liaoning China. At the time, sound-based listening was still foreign to most Chinese musicians, whose training was almost entirely notation-based. The visual score became a necessary bridge, facilitating comprehension by “compensating the missing part for the eye”—that is, enabling a visual frame for sounds whose sources were invisible. After its success in China, the piece and its Acousmographie rendering were also presented at De Montfort University, Leicester UK as part of the composer’s doctoral research.

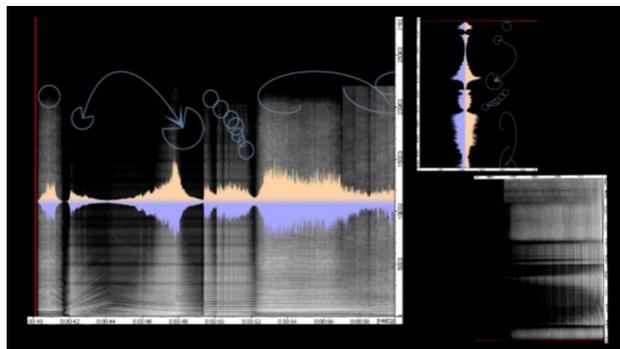


Figure 1. *Ambush on All Sides* on Acousmographie

Importantly, the use of Acousmographie did not originate from a teacher’s instruction, but from the composer’s own inquiry, dating back to 2005. At that time, the dominant institutional model required students to outsource video representations to multimedia technicians in order to present fixed media works with visuals—an arrangement that reinforced the notion of visuals as supplementary rather than integrated. In contrast, Acousmographie represented a non-hierarchical, reflective tool—an early act of resistance against the prevailing top-down model.

In this study, the second author (a pre-doctoral trainee with a background in Western classical analysis) re-engaged with the piece using Acousmographie to provide an objective analytical perspective. This re-reading emphasized how digital score tools can empower analysts to explore complex sonic forms independently. The second author’s interpretation—without guidance from the composer—reaffirming Acousmographie’s potential as both an analytical platform and a pedagogical instrument in flipped environments.

This case thus exemplifies how a digital score can act as a bottom-up mechanism for cultivating electroacoustic literacy. It also testifies to the potential of digital visualisation tools to democratise analysis, provide access to non-

¹ 《十面埋伏》: *Ambush from Ten Sides*

² <http://chears.info/frontend/concert/works.aspx?worksid=5>

³ <http://chears.info/frontend/terminology/allterms.aspx?alltermsid=11>

notated music, and subvert traditional teacher-student hierarchies, particularly in regions where acousmatic practices are not yet institutionally embedded.

4. DIGITAL SCORE AS A PEDAGOGICAL INTERFACE: COMPARATIVE CASE STUDIES

4.1. A Tool for Divergent Learners in Transition

This section examines two contrasting cases—an undergraduate student on the brink of academic failure and an independent scholar on the verge of doctoral research—who both engaged with digital score tools to overcome systemic and conceptual barriers in the study of electroacoustic (e-a) music. Despite their different circumstances, each found in the digital score a transformative interface: not only for navigating unfamiliar content, but for reclaiming agency within an educational environment traditionally driven by top-down structures.

The pairing of these cases highlights a core argument of this paper: digital score technologies such as eAnalysis and TIAALS can serve as student-centered platforms, fostering sound-based thinking in learners conditioned by notation-based traditions. These tools not only support technical comprehension of sound phenomena but can also catalyze new modes of artistic and academic inquiry.

4.2. Case Study 2: From Conceptual Breakdown to Visual Intuition

The second case features a Chinese undergraduate student who failed his initial entrance into the centralised conservatoire system and was forced to seek alternatives abroad. In 2016, during his first year studying music technology in the UK, he faced major challenges, most notably a language barrier that severely limited his grasp of theoretical concepts. After failing all modules, he was given one last opportunity to resit the year—but only if he could complete an essay on timbre, a concept that had so far eluded him.

The first author selected *Fugue for Electronic Waves* (2003), an early electroacoustic work composed using various waveforms—sine, triangle, square, and saw—as the basis for the student's investigation. Using eAnalysis⁴ (CHEARS, n.d.-b) [6], which was designed by “Simon Emmerson, Leigh Landy...and [Pierre Couprie]...at the Music, Technology and Innovation Research Centre at Leicester's De Montfort University” [7], the student was able to explore these waveforms visually via sonogram, contrasting their spectral properties by freely drawing cartoon-like shapes—intuitively and playfully—from the depths of his childhood imagination. The cartoon-like (see figure 2) sonogram layout became a crucial bridge for understanding: for instance, he could finally grasp how differences in harmonic content shape tone colour. The essay

he submitted was sufficient to qualify for the resit, marking a pivotal turnaround in his studies.

From the first author's perspective, this intervention validated the need for learner-led, bottom-up pedagogies in e-a music. With neither the capacity to survive China's rigid conservatoire system nor the linguistic fluency to align with standard instruction in the UK, the student required a tailored, visually guided method of access to core concepts. The digital score thus served not only as a pedagogical tool but as a lifeline.

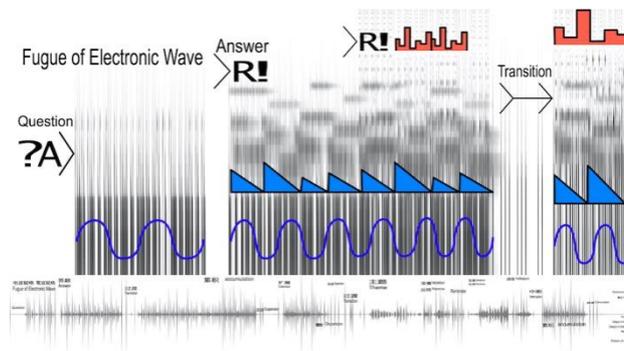


Figure 2. Fugue of Electronic Wave on eAnalysis

The second author, who later encountered this piece herself, noted the balance between technological design and musical structure. The micro-level rhythmic sequences were algorithmically generated, while the macro structure reflected a fugal design across waveforms. In her view, the piece offered an accessible and elegant fusion of sound design and compositional thinking—an ideal educational example.

4.3. Case Study 3: From Theoretical Imprisonment to Sonic Discovery

In stark contrast, the third case focuses on an independent researcher (the second author) with a master's degree in contemporary music analysis. Having previously completed her undergraduate studies in “electronic music composition” at Shenyang Conservatory of Music, she had been deeply disillusioned by the split between theory and practice in her training. The curriculum had been divided: one part focused on commercial DAWs for producing note-based music; the other promoted sound manipulation for acousmatic composition—without any conceptual grounding in aesthetics, listening modes, or sound-based analysis. Key concepts such as the acousmatic condition, reduced listening, or even timbre were absent.

This left her in a theoretical vacuum. Pursuing a master's in note-based analysis helped rebuild her academic confidence, but it also distanced her further from sound-based creative practice. By the time she began considering doctoral study, she was uncertain where to begin or whom to work with. In China's PhD system, access is often limited by a shortage of supervisors and reliance on private

⁴ <http://chears.info/frontend/terminology/allterms.aspx?alltermsid=892>

lessons long before entrance exams—a structure that perpetuates elitism and restricts independent research paths.

The first author, recognising her potential, introduced her to foundational vocabulary in acoustics, psychoacoustics, and 20th-century aesthetic movements such as formalism, minimalism, and radicalism. As her conceptual framework developed, she was introduced to TIAALS. Through this tool, she discovered that the most vivid instance of sonic mimicry—originally assumed to involve Western instruments imitating Chinese timbres, a process she considered only a halfway transition from notation-based to sound-based thinking—was, in fact, the erhu mimicking a horse’s neigh at the very end of the piece. This marked a successful shift in her conceptual approach toward a fully sound-based analytical paradigm, as evidenced in her own words (see figure 3):

“As we can see, there are two sonogram-based scores: the upper one is a real horse neighing, and the lower one is the erhu mimic. The real horse neighing shows that the greatest intensity of amplitude (Roads, 1995) is concentrated around 1-2 kHz in the shades of grey. Although other frequency bands have energy distributions, they are not as dark as the band at 1-2 kHz. The erhu mimic also shows that the greatest intensity of amplitude is concentrated around 1-2 kHz, but the other frequency bands have very little energy distribution. The analysis reveals that both sound signals exhibit their primary energy concentrations around 1-2 kHz, demonstrating similar spectral characteristics in this dominant frequency range for human hearing, as perceived through the skills of critical listening.”

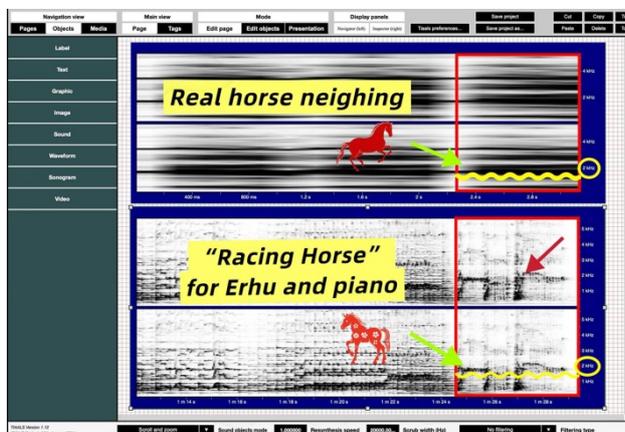


Figure 3. Horse-shaped symbol in Chinese paper-cutting art in TIAALS (Tools for Interactive Aural Analysis)

Using TIAALS, she highlighted this moment in the sonogram, marking the frequency band with horse-shaped symbols—one of which was stylised in Chinese paper-cutting art (also see figure 3). This act fused cultural reference, sonic analysis, and visual symbolism into a powerful new research direction: exploring mimicry across East-West musical aesthetics, through the lens of sound-based and visual-auditory analysis. While her PhD research is still in preparation, this moment marked a breakthrough.

For the first time, she was able to conceptualise her research question not through borrowed theories or imposed structures, but through direct interaction with sound.

4.4. Comparative Reflection: Resistance, Reorientation, and Sound-Based Thinking

While these two case studies differ in level and scope, they reflect parallel journeys of resistance against the constraints of a top-down educational system. Both learners had been misaligned with institutional expectations—Case 2 due to academic and linguistic struggles, Case 3 due to structural barriers and historical bias in her field. In each case, the digital score provided a medium for reclaiming direction. The table below summarises the comparison (see table 1).

Aspect	Case 2: Survival Learning	Case 3: Transformative Inquiry
Background	Struggling undergraduate with weak conceptual/language base	Independent analyst with advanced degree, but misaligned training
Challenge	Understanding timbre conceptually and visually	Bridging note-based training with sound-based research
Digital Tool Used	eAnalysis (simplified, cartoon-like)	TIAALS (interactive, symbolic, analytical)
Learning Outcome	Passed resit; internalised key sonic concept	Formulated original PhD research idea using digital analysis
Pedagogical Insight	Visual scaffolding supports abstract comprehension	Symbolic sonogram encourages conceptual autonomy and creativity
Wider Implication	Necessity of bottom-up, adaptive teaching in e-a	Digital score as interface for decolonising and rethinking research paradigms

Table 1. Summarises the comparison in Case 2 and 3

Together, these cases support the argument that sonogram-based digital scores are not simply tools for analysis, but instruments of pedagogical transformation. Whether simplifying timbre for a beginner or enabling advanced cross-cultural research questions, they shift the student’s role from passive recipient to active discoverer. In this way, they embody the very essence of a flipped environment, enabling students to build their own sonic literacies and research trajectories.

5. DISCUSSION

The issues observed in centralized music education, particularly within conservatoire systems, are not rooted in

the knowledge itself—much of which originates from the West—but rather in the rigidity of how that knowledge is transmitted. Over the past four decades, these systems have tended to reinforce top-down, prescriptive pedagogies, often prioritizing notation-based models and suppressing alternative sonic perspectives. This stagnation reflects a broader resistance to pedagogical innovation: when an entrenched framework dominates teachers’ and students’ thinking, any new paradigm—such as sound-based thinking—must struggle to find entry. The analogy to legacy energy industries is apt: just as oil dominates infrastructure and markets even as cleaner alternatives emerge, note-based conventions continue to overshadow exploratory sound practices.

Flipped learning, also developed in Western contexts, offers one potential corrective—but its adoption in Chinese music education remains limited. Many students and educators, as the 3rd author personally experienced around 2019–2020 in China, are familiar with the concept only through its translation—without fully engaging with its underlying pedagogical implications. Here, digital scores emerge as an essential tool—not only as a form of media, but as a conceptual key for unlocking the potential of flipped, bottom-up learning. This is particularly evident in the first author’s long-term research trajectory. While foundational texts such as *The Computer Music Tutorial* (Roads, 1995; 2023) are updated only once in several decades, bottom-up experimentation has progressed in parallel through field-driven initiatives like CHEARS (China Electroacoustic Resource Survey), which not only integrates tools like Acousmographie and eAnalysis—as referenced in this paper—but also provides a comprehensive bilingual terminology for the field of electroacoustic music in both English and Chinese. Initiated as part of the first author’s doctoral research, CHEARS established a platform to implement and test learner-led methodologies in electroacoustic music. After confirming success in the undergraduate case (Case 2), this trajectory continues to evolve in postdoctoral contexts, including the support provided to the doctoral-bound researcher in Case 3.

Informed by her background in music therapy, the 3rd author offers an additional layer of insight into the pedagogical implications of digital score tools. She identifies a strong resonance between the subversion of traditional teacher-student hierarchies—central to the bottom-up approach—and the core therapeutic principle of egalitarian collaboration. In music therapy, therapists serve not as authoritative instructors but as facilitators who accompany clients in co-creative processes. Here, the visual and interactive affordances of sonogram-based digital scores (e.g., symbolic annotations in TIAALS) mirror therapeutic practices by validating individual sonic expressions without judgment. This approach aligns well with therapeutic work involving clients with limited verbal communication—such as children with autism—by enabling them to label or graphically annotate their sound expressions. Such methods reduce reliance on conventional musical literacy and reposition clients not as students conforming to norms,

but as autonomous agents whose sound-making carries intrinsic value.

6. CONCLUSIONS

Top-down and bottom-up approaches are often seen as opposites, yet they can also be complementary. Top-down systems are undeniably effective for the majority, especially when efficiency and structure are paramount. However, a single model cannot fit every learner or context. When top-down systems reach an impasse—be it due to rigidity, cultural mismatch, or learner diversity—bottom-up alternatives naturally emerge. Once successful, these grassroots solutions may rise to broader acceptance and eventually influence top-down policy, until a new cycle of adaptation is required. This dynamic interplay resembles the philosophical balance of Yin and Yang—constantly shifting yet interdependent.

In this study, flipped learning was not merely cited as an educational trend but was actively embedded within the notion of the digital score. Here, the egalitarian potential of digital score becomes evident: a teenager drawing freely may express just as valid an insight as a professor with decades of training. Drawing is perhaps our most primitive means of expression—prehistoric cave markings and early Chinese characters both remind us that images came before formal language. Once freed from semantic constraints, these elements can be creatively reused as part of today’s visual-musical discourse as Fields quoting the “new composite character designed by Zhang Ruibo” [8] for the changes of sound with a further development (see figure 4):

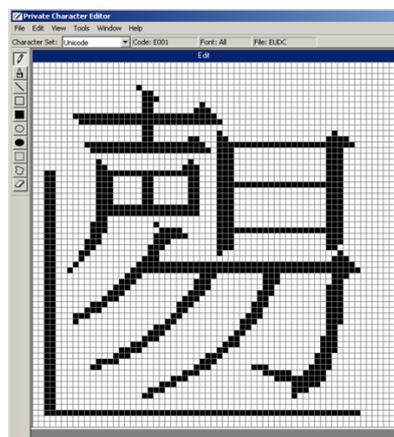


Figure 4. The further development to the new composite character for Sound Changes.

Through case studies, we demonstrated how digital score practices supported flipped learning in intuitive ways. Whether through cartoon-like drawings or symbolic Chinese paper-cuttings, the visual nature of digital score allowed students to take control of their learning process. As shown in Case 2, this tool helped a student reclaim his academic path, and in Case 3, it helped another redefine her scholarly identity from her previous educational traumas.

Beyond education, the visual and participatory qualities of digital score extend its relevance into therapeutic contexts, where it supports broader processes of healing, self-

expression, and emotional awareness. As the 3rd author (a music therapy specialist) points out, the visualization feature of sonogram tools opens new pathways for sound awareness in clinical practice. Clients who struggle with verbal communication—such as those with PTSD (Post-Traumatic Stress Disorder) or, in less severe cases, post trauma syndrome—can visualize their sonic expressions using tools like Acousmographie, eAnalysis and TIAALS. These tools not only allow clients to better perceive and understand their emotional states but also help therapists monitor patterns and evaluate change over time. In this way, digital score serves as both expressive aid and analytic instrument, reinforcing the client’s autonomy while supporting therapeutic goals.

At the other end of the spectrum, digital scores have the potential to evolve into extremely complex systems—particularly in electroacoustic (e-a) music. Scholars and practitioners in the 21st century are increasingly experimenting with new representations of musical thought.

As Stolet (2024) argues, this pursuit challenges centuries of conventional notation practices: “Traditional Western notation confirms the importance of starting and stopping musical events as does the need to perform musical events in a coordinated and synchronized way... We can observe this spatial orientation in Western musical scores where vertical positions of note heads signify events in 'pitch space', and where a note's horizontal placement in space indicates its position in time.” [9]

As digital scores become more intricate, however, printed reference materials such as *The Computer Music Tutorial* (Roads, 1996; 2023) lack the flexibility to accommodate this expansion. In such cases, frameworks like CHEARS (China Electroacoustic Resource Survey)⁵ become vital—not only for managing bilingual terminologies in e-a music but also for classifying and contextualizing emerging forms of musical representation. This raises an important question: is digital score a genre, a presentation method, or something else entirely. Just as Zhang (2024) notes in his doctoral thesis, the need for alternatives becomes urgent when a system grows too sophisticated or exclusionary:

"As a dichotomy, the top-down scheme was used by 'big-man' who obtained massive knowledge and was able to organise these concepts into an arrangement of a scientific system... The bottom-up scheme was used by a 'small-man'... who merely obtained limited knowledge and tried to put these concepts into an arrangement for the best interests of their own... When [top-down] classification is too sophisticated to a (Chinese) user, an alternative is always available to the user in a mode of flipped learning." [10]

In sum, digital score serves not merely as a tool for visualizing sound, but as a conceptual key to unlock stagnant systems. Whether rescuing a struggling undergraduate, inspiring a researcher in transition, or providing therapeutic insight, it enables learners to draw their own path—literally and figuratively. It represents a convergence of art, technology, and pedagogy—bridging East and West, tradition and innovation, top-down and bottom-up.

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