A superannuated physicist's attempts to master music theory: Resolving cognitive conflicts and a paradigm clash

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Abstract

A sexagenarian retired physicist (the first author) set out, with the assistance of members of a university music department, to acquire some insight into Western music theory. For a lifelong singer and seasoned autodidact, this appeared to be a not too formidable challenge, yet he experienced significant difficulty in penetrating the music theory paradigm. He discovered an entry point in the layout of black and white keys on the keyboard, which presented a "mental model" amenable to his physicist's mindset. The experience could prove valuable in further exploration of the use of the keyboard layout in teaching music theory to students of all ages with little or no exposure to the piano or other keyboard instruments. The process also suggests new perspectives of familiar learning challenges for mature candidates.

The first author (RPS), who is a retired physicist, set out as a mature learner, at the suggestion of the second author (CvN), in her capacity as professor of music education, to acquire insight into Western music theory by joining a third-year music theory class for students who had started their first year of tertiary studies with a very limited background of such formal theory. The rationale was that his life experience and proven abilities would be too advanced to join a lower level class, and he would be capable of closing the gap between his limited knowledge and desired level of understanding in a concentrated period of application, with an experienced lecturer willing to assist. This article explores the differences between his motivation and learning style and those of more typical youthful candidates, and seeks to create a theoretical context for his learning process before describing the experience in some detail. The outcomes achieved and insights gained are

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presented and suggestions made for possible innovative teaching practices of general application as well as for future research.

Why learn music theory and how?

In the teaching of Western music, especially Western classical/art music, it is widely accepted that learning practical music/music performance/playing an instrument or singing should be accompanied by concomitant study of the theory of the music. This is even a prerequisite of many examination bodies, such as the Associated Board of the Royal Schools of Music (ABRSM). In their book *Raising an amazing musician: You, your child and music*, music theory is described as follows:

> Ideally a teacher will develop pupils' theoretical knowledge in tandem with their practical skills, so that as they learn to play they gradually learn about the "nuts and bolts" of how music works – the way in which music is written and constructed, its rules and its language, what the signs and symbols mean and how to interpret them. (ABRSM, 2009, p. 49)

Elsewhere in the book is noted: "Music theory exams test a candidate's ability to understand the rules of *notation, melody, harmony* and *rhythm*" (ABRSM, 2009, p. 176). The emphasis is clearly on exams, and also, as per the book's title, on "Raising . . . your child" rather than developing musicians of all ages.

However, the authors' own teaching and life experiences resonate well with a constructivist approach to learning, and its founding principles, as elucidated by Walker and Lambert (1995, pp. 17–19):

- Knowledge and beliefs are formed within the learner.
- Learners personally imbue experiences with meaning.
- Learning activities should cause learners to gain access to their experiences, knowledge, and beliefs.
- Learning is a social activity that is enhanced by shared inquiry.
- Reflection and metacognition are essential aspects of constructing knowledge and meaning.
- Learners play an essential role in assessing their own learning.
- The outcomes of the learning process are varied and often unpredictable.

Clearly, what can be described as conventional teaching of Western music theory reflects virtually none of these seven points, whether aimed at young or older learners. RPS's experience in his journey towards music literacy will be reviewed in relation to these points.

RPS as a mature learner: His approach in context

Motivation for learning music theory

A 1998 conversation with CvN on the use of technology in teaching music planted the germ of a thought about possible post-graduate studies in music, with some technology link, when RPS retired. His final management role saw him taking up a variety of innovation challenges facing a major technology organization in the throes of ongoing and rapid change. Tackling new things held no fears for him then – his career had seen him develop significant expertise in many areas, without ever reaching top specialist status in any of them.

The years immediately post-retirement in 2002 were filled with ad hoc work assignments and some Business School teaching in Information and Knowledge Management, a recent focus area for him. By 2010, these activities had diminished significantly and he felt that he had "mind space" for new challenges. He joined a choir of significant reputation, on a trial basis. Having been a singer all his life, RPS had learned new pieces by a combination of listening to a repetiteur playing a part and associating the memory of the notes with what he "read" on the score. He might have appeared to sing from sight, but this was far from true, as confirmed when he found himself surrounded by experienced sight singers in this new choir. The experience was paramount when he approached CvN with a view to exploring innovative methods in teaching music. CvN quickly divined that improving RPS's practically non-existent knowledge of music theory would enhance his competence as a music education researcher while assisting with his sight-reading. She accordingly proposed that he should sit in on third year music theory classes for BA Music students. With the lecturer's kind agreement, this was arranged.

What challenges might a mature learner face?

Most aging people complain about loss of mental acuity, typically memory. This is commonly related to "loss of grey matter," reinforced by popular quotations of the ongoing devastating loss of brain neurons. However, neuroplasticity, the brain's ability to reorganize itself by forming new neural connections throughout life and thereby compensating for injury and disease (MedTerms Online Dictionary, 2011) is now widely believed to persist into later life. Indeed, in their overview of the literature in *Neurosciences in Musical Pedagogy*, Edwards and Hodges (2007, pp. 1–25) make no mention of the effect on learning of loss of neuroplasticity in aging. This suggests that any challenges RPS experienced would be due to causes other than "an aging brain."

In reflecting on the structure of knowledge, a recent compendium on adult learning refers to the work of Anderson (2005, pp. 157–162), who emphasized the importance of prior knowledge as well as knowledge being accumulated: The authors state:

> We all carry around with us our own individualised set of schemata that reflect both our experience and our worldview. Therefore, as adult learners, each of us comes to a learning situation with a somewhat different configuration of knowledge and how it can be used. (Merriam, Cafferella, & Baumgartner, 2007, p. 402)

One could characterize RPS's lifetime learning process as the accumulation of such "schemata;" mastering novel fields of knowledge was no new experience to him. Two examples from early and late in his career may suffice to illustrate this.

A physicist's worldview. One of the characteristics of education in Physics is respect for fundamental principles, which creates a capacity for understanding a wide range of technical topics. Early in his career, RPS was fortunate to spend a few years in the Rand Mines Ltd research laboratories under the mentorship of the late Derrick Beadle, a celebrated dust physicist. Beadle drove him to sit for the Advanced Certificate in Ventilation and Dust Prevention within 6 months in order to establish his credibility with Chief Ventilation Officers and Head Office Engineers. This was a new field for RPS, but able to apply the physics principles engrained in his thinking patterns, he met Beadle's expectations.

In another challenge Beadle also "volunteered" RPS to convert the units of measurement employed in the standard text on Mine Ventilation (Le Roux, 1972) to the then new Systeme

Internationale (SI).[1] This too was grist to the physicist's mill; the SI system was not only metric, but also coherent.

This discipline of rooting out basic principles and applying them coherently formed RPS's thinking frameworks to great effect in his subsequent career, especially on frequent occasions when he had to work his way into a new field "on the job." However, his attempts to penetrate the music theory paradigm in this way were initially frustrating.

The knowledge management view. The upsurge of interest in Knowledge Management around the turn of the century created RPS's last professional growth opportunity as he was tasked to pioneer this approach in his organization. This worldwide management initiative was energized by availability of large scale digital storage and networks required to access it remotely, but it was soon clear that the knowledge held "within and between"[2] the minds of personnel is a key organizational asset. A breakthrough development was the postulation by Snowden (2002, pp. 2–25) of his three Heuristics for Knowledge Management:

- Knowledge can only be volunteered, it cannot be conscripted
- I only know what I know when I need to know it (i.e., knowledge is highly contextualized)
- We always know more than we can say, and we always say more than we can write down.

Together with a common definition of Knowledge, viz. "The Capacity for Informed Action" (Sveiby, 1997, p. 29), this has obvious links to Anderson's schemata. It also links to the constructivist approach to learning. Management innovations such as Action Learning Programmes, team learning and other actions to promote transfer and capture of essential learning skills (Armstrong & Fukami, 2009) were everyday experiences in this phase of RPS's career. He had thus come to regard himself as a proficient autodidact and expected that minimal teaching support would be required in his endeavor to master Music Theory, targeting ABRSM Grade 5.

Such was the background to RPS's new learning experience.

Action learning via a class presentation

Music lecturers and many tertiary level music students seem not to appreciate the challenge of memorizing details of all the scales and modes. As competent musicians they learnt to do this as children, who approached the task not as a comprehensive body of knowledge, but piecemeal, with little sense of the extent of the task. These details had been etched into early memory and continually refreshed by practice. Here was a man, starting from "scratch," about 50 years later than those around him. Having enjoyed a modest reputation for incisiveness in the world of science and technology, where he was frequently the quickest to unravel complex issues, he was already feeling embattled by the casual facility of his, much younger, fellow students and struggling with the sense of being "the slowest in the group."

RPS welcomed the opportunity to make a presentation to his class, designated MAM 301 in the university; making presentations was familiar territory. The assignment involved the Whole Tone Scale, and thus begins the narrative portion of his auto-ethnographic account.

RPS's class presentation on the whole tone scale

> The whole tone scale (WTS) is probably the most boring subset of the chromatic scale. I'm grateful for this perspective to N . . . who pointed out earlier that all scales are subsets of the chromatic scale.

[Expectant faces tell me I have the attention of my audience: fellow students and our lecturer. This is probably less due to my dramatic opening than to their curiosity as to what this old toppie[3] will have to say. I have been attending their classes for 5 weeks but they have little sense of who I am and what I am about.]

The definition is simple: The Whole Tone Scale is a scale in which each note is separated from its neighbours by a whole tone, but the interest in the scale emerges when looking at the detail.

[I make my way to the keyboard. Relief! I can identify Middle C unaided – my back-up plan of marking its position on the keyboard with a paper sticker appears to have been unnecessary.

Laboriously I work my way up the scale with a forefinger, trying not to think of the performance of an earlier presenter who could dart both hands up and down a variety of scales with that bewildering speed that leaves me floored whenever competent pianists do it.]

Starting on C, the first three notes separated by whole tones are on white keys: C, D, E but now I hit the "semitone gap" between E and F and have to move to a black key, F#, in order to have a whole tone. So then three black keys: F#, G#, A#, and the next semitone gap leads me to a white key, C. Note there are only 6 intervals and 7 notes making up the "Octave"; C, D, E, F#, G#, A#, C. Clearly the "whole tone" criterion means the notes "take up too much space on the keyboard" to fit 8 notes into the octave. That's this scale's first interesting feature. The second is related to it – no Leading Note or any semitone intervals. Does this mean the scale is relatively uninteresting?

[I attempt to illustrate this, running up the scale as fast as my 67-year-old forefinger can manage.]

The sound does seem to lack charm – some commentators describe it as having a "blurred effect." Perhaps, but we'll get to better illustrations later. Suppose I start on C#: the notes would then be C#, D#, F, G, A, B and C#. [That forefinger comes into play again] In fact, these two groups of notes are the only ones which one can generate on a keyboard, that meet the whole note separation condition. They are indeed the two complementary Whole Tone Scales. Now we can see why Olivier Messiaen [I had checked pronunciation on a web service – they seem to be impressed] identified this scale as one of his "Modes of Limited Transposition."

What I find exciting about this demonstration is how easy it is for me, not a pianist, to come to terms with the structure of scales by working them out on a keyboard. Indeed, I find the layout of the keyboard to be an excellent model to aid my understanding. As a physicist, I have spent my life with Mental Models, so this really works for me.

[They now know a little of who I am. It's time for a demonstration.]

My research revealed many situations where composers or performers have introduced a bar or two using only the Whole Note Scale. I'll play you such an excerpt from a piano improvisation I found on the Web; it's based on the standard Moonlight in Vermont. Are any of you familiar with this piece?

[Ignoring the few nods – I'm going to sing it anyway! – I do so. Friendly smiles confirm this was successful in boosting my flimsy musical credentials. My laptop provides the excerpt.]

The portions I am playing are labeled WTS by the improviser, but I can't claim to hear anything characteristically WTS in them! This is perhaps because they are so brief, or perhaps my ear is not well enough attuned to the scale.

My search for a musically "characteristic" full-length example ended with Debussy's Piano Prelude, "Voiles"; in English "veils" or "disguises".

[The laptop provides the music again.]

This is described as having "a rather mystical, dreamy effect"[4] – I can certainly hear that.

So there you are – The Whole Tone Scale: as an earlier presenter described it – the most boring subset of the Chromatic Scale. Thank you.

[More smiles and the group set about recording their individual assessments of my project; the class average will be averaged with the lecturer's mark. Students receive feedback the following week: to my astonishment and gratification, I have the second highest mark, 91%. My euphoria is destined not to accompany further "marked" efforts, however. I could bring a lifetime of making scientific and management presentations to this exercise, but this was the last time these well-honed skills (or any others of mine) would play a role.]

The mental model

RPS's class reference to a Mental Model related to the practice among physicists of creating models that provide common descriptive frameworks for "managing the invisible." The most familiar example to many would be the Bohr model of the atom, devised in the 1930s as a "nucleus" of white and red spheres, the latter each carrying a positive electrical charge, surrounded by orbiting electrons of much lower mass but each bearing a negative charge. Add energy levels associated with the diameter of the electron orbits and one has a model that continues to cope with practically any inorganic or physical chemical process 80 years later. No physicist "believes" the atom "looks like" this, but the model persists because it supports understanding and use.

A range of cognitive conflicts

The discovery of a Mental Model was an important breakthrough for RPS; it removed an obstacle that had intimidated him and enabled him to enter the paradigm of scale structures. This was the start of his learning breakthrough, removing a number of misunderstandings and conflicts between his well-established cognitive patterns and those of Western music theory. For brevity's sake, these have been dealt with under the heading of cognitive conflicts, although some fit this category more accurately than others.

The grand staff

RPS's style of learning music (see above) had never required knowing the names of the notes and his score was used as an aide-memoire to the sounds he heard. Having started as a boy-treble in a cathedral choir – singing exclusively from the Treble Clef – he later became a tenor, joining that (un)happy band of church choir tenors obliged to sing from both Treble and Bass clefs. A lingering frustration that the positions of notes on the two staves did not correspond to their letter names reflected his physicist's desire for consistency, but his technique for learning new pieces overcame this. He "knew" his sung notes were now an octave lower than written on the Treble Clef and had speculated idly on the linkage between the staffs without following it up. Great was his delight at discovering the Grand Staff – where the leger line above the Bass staff and the leger line below the Treble staff host the same note, middle C, a revelation after some 50 years in the dark! On this topic he had much to memorize. Thus the first cognitive conflict revealed itself – this one based on life-long ignorance.

Intervals

Mastering intervals, chords and their figuring was a real challenge and RPS became aware of a number of cognitive gaps and incompatibilities as he grappled with the content. (Had he accepted an offer of occasional private tuition sessions he might have saved himself considerable effort, but

he was wearing his autodidact mask, attempting to counter his bewilderment at the pace of the class with a number of books and, his favourite, Dolmetsch Online (Blood, 2011).

Another conflict was that his mathematical brain initially rejected any system where "one third added to another third makes a fifth," because he pictured the process

$$\tfrac{1}{3} + \tfrac{1}{3} = \tfrac{1}{5} \text{ or } 0.33 + 0.33 = 0.20. \text{ Which is absurd! } [5]$$

Further conflict arose from the convention for naming intervals, which are, reasonably, defined as the difference in pitch between two notes (Scholes, 1955, p. 521) of a musical scale. But they are "named" by the number derived by counting from the lower pitched note, called "1," and then naming the interval by the number of the higher note in the count, e.g. if the note is number 5, the interval is a "fifth." Note-naming thus relates to positions in a sequence, not fractions, but the practice of naming an interval not as a "difference" as intuitively expected, but in terms of the number of the top note if the bottom note is labeled "one", wins no prizes for accessibility.

Recognizing notes and intervals in principle was one thing, mastering their use in sight-reading was another. The above experiences made it clear that improving sight-reading at any age would involve, firstly, understanding, which he believed he had achieved, and much practice – for which he had limited appetite.

Chords

For RPS, to describe triads meant to write down the name of each note, say, G C E – starting from the lowest, seek an alphabetical order in which the alternate letters are omitted, in this case C (D) E (F) G, which identifies the root as C, and then work out the degree, counting from the key letter. Since the fifth is at the bottom, this must be the second inversion. It was clear that experienced musicians, including fellow students, did all or most of this subconsciously, having had the detail filtered into their minds over a protracted period "parenthetically and contextually".[6] Then there were mysterious terms for describing an interval's quality (Major, Minor, Perfect, Augmented?) or the traditional and non-traditional figuring of chords.

The difference between understanding how chords are made up, as RPS now did, and writing or identifying them rapidly, was considerable, constituting a nice illustration of the difference between Education and Training.

What were the positive gains of all this? RPS's new-found knowledge was turning into insight, with better understanding of the structure of music. He also found something to be gained in exploring chord sequences of well-known hymns. With time, sight-reading improvement on a praxis basis would doubtless occur.

Some less challenging aspects of the Grade 5 music theory curriculum

Essentials relating to duration of notes and assembly of bars came intuitively – a matter of simple arithmetic. RPS mastered the quaint English practice of naming semibreves, minims and crotchets only during the MAM 301 exposure and was surprised to note the relative simplicity of North American practice (whole note/half note/quarter note). This contradicts the North-American resistance to the adoption of the well structured SI System for physical units of measurement (see above) in favor of the less structured Imperial System.

And tonic sol-fa?

That RPS's quest for music literacy included an interest in improving his sight-reading inevitably brought him into contact with Tonic Sol Fa. This is widely used in South Africa by competent choristers who have not been taught to sing from Western staff notation, even to the limited extent that choristers like RPS are able to fake this. Many singers who do read from staff notation also seem to use the heard intervals, e.g. Doh-Soh, to anchor their interval reading, but most he has encountered learnt this skill at an early age. Mastery for RPS seemed likely to require much rote-learning, which presented a challenge as he was finding the richness of opportunities for growth in retirement to be so great that the effort required to master Tonic Sol Fa could be disproportionate to its value.

ABRSM Grade 5 Theory Examination – Analysis of the outcome

RPS sat the examination at a local school, surrounded by about 100 pupils, mostly younger than his grandchildren. He felt reasonably optimistic of a pass. However, he scored 62%, short of 66% required. Taking a while to recover from the smart of failing, a hitherto remote possibility, he soon decided to make the most of the learning experience and applied for a re-mark. This was granted and came accompanied by insightful comments from the ABRSM Quality Control Department. These provided useful insight into how the "cognitive conflicts" were being resolved.

In general terms, he scored well for the first question on describing chord sequences and progressions, and got full marks for identifying progressions for cadences. This suggests that his singer's interest in chords and how they are used in four-part harmony had led to ongoing reinforcement in the many recreational singing events that are part of his life. Equally, a good mark was easily achieved for putting a melody to a verse.

An avid orchestral music consumer since his teens, RPS was not surprised at scoring full marks on instrumental questions. Naming melodic intervals, on the other hand, was disastrous and writing a named scale (he gave C# minor instead of C minor) not much better, although he might simply have misread the question. A possible reason for poor results in naming intervals was that, despite having identified the virtues of the keyboard layout as an aid to understanding, he only later started using this layout in detail to identify intervals. This was confirmed by a repeat attempt at the interval questions in the trial papers he had written: his average score rose from 55% in the trials to 85% in this revision, simply by using the keyboard rather than the staff to count the number of intervening semitones in marked intervals.

A typical process in teaching theory moves from intervals, to chords and much later to harmony; RPS, however, scored poorly on intervals but much better on harmony. The apparent inconsistency is probably due to the difference between recognizing the "semitone count" in an interval and writing its quality accurately, the latter involving memorizing a number of (non-intuitive) conventions. This could be characterized as a lack of Training. When it came to harmony, however, RPS understood the principles (Education) and could apply them – his physicist's stock-in-trade. The picture confirms several of RPS's pedagogic presumptions:

i.   Adults master best what is useful to them or captures their interest (in this case chords and cadences, and melody writing).
ii. Sheer memorizing is perceived to be difficult for aging candidates, accustomed to "looking it up" (naming of intervals and incorrect use of C minor vs C# minor).

iii. Much is acquired "parenthetically and contextually," for example, with correct identifica-
tion of musical instruments.

The paradigm clash or autodidacticism?

The music theory paradigm with its many – to a physicist – counter-intuitive elements, was inher-
ently opaque to RPS and the "Mental Model" he identified in the keyboard layout gave him an
entry point to understanding. However, one cannot discount stubborn autodidacticism[7] having
played a role. What constructive options are there in devising a teaching programme for a mature
candidate seeking to master much music theory speedily and typically in his preferred style rather
than picking it up "parenthetically and contextually"? A different autodidactic approach is recounted
by Iritani (2002, pp. 1–12) who skipped simple piano pieces, proceeding directly to major works.
Her rationale is that, unlike young pupils, a mature candidate can take advantage of a mind full of
well-known music, acquired "parenthetically and contextually," drawing on this to support learn-
ing. This is analogous to the cognitive processes of "chunking," for example grouping letters into
a word, words into a phrase, or notes into an arpeggio, then recognizing and learning them as single
entities (Gobet et al., 2001, pp. 236–243). Iritani's chunks were typical tonal harmonies and groups
of notes used in repetitions and modulations by the composer. She commenced the process when
over 60 years old and has apparently achieved performance standard for Beethoven's Appassionata
Sonata within 5 years.

Another strong element in describing her experience was a deep desire for rapid progress to her
objective; such objective-driven learning is known to be useful for adult learners.

The common features of the RPS and Iritani experiences must include:

- A desire to develop competence within a familiar field, in this case, music;
- Established cognitive patterns, modeling in RPS's case, remembered music passages in
  Iritani's, which proved quicker than the conventional routes to success.

What was different for RPS was overcoming counter-intuitive (to him) obstacles to understanding.

Perhaps RPS's overall experience has been more a matter of identifying appropriate routes to
penetrate a new paradigm. The processes by which sounds constituting music are made and propa-
gated are all part of physics, meaning that various accounts of historical development of conven-
tions in music theory presented no great challenge to his understanding.

The learning experience and principles of constructivism

With a background of a constructivist approach to learning, it is relevant to evaluate RPS's learning
experience against the seven points, mentioned earlier, on which such an approach is founded.

- Knowledge and beliefs are formed within the learner.
- Learners personally imbue experiences with meaning.
- Learning activities should cause learners to gain access to their experiences, knowledge, and
  beliefs. The awakening of RPS's insight and understanding could hardly be better described
  than by these three statements. The third is especially relevant – RPS now has a sense of
  how his half-formed impressions fit into music theory and has been able to relate the physics
  of sound to the key structures.

- Learning is a social activity that is enhanced by shared inquiry. This was inhibited by the relatively isolated nature of the experience. Another person might have engaged the MAM301 students, but differences in age, experience and lifestyle inhibited this option.
- Reflection and metacognition are essential aspects of constructing knowledge and meaning. RPS's decision to diarize details of the learning experiences and the creation of much of this report from the diary was key to the subsequent "reflection and metacognition" beloved of autodidacts.
- Learners play an essential role in assessing their own learning. The re-mark of the examination paper, with comments from ABRSM, provided an invaluable benchmarking framework to enable this.
- The outcomes of the learning process are varied and often unpredictable. Motivation for learning music theory can obviously have various objectives, some of which might relate to the learner's stage in life. RPS started from a desire to deepen his appreciation of music, which is a major part of his enjoyment of life, although poorly supported by theoretical knowledge; for a physicist boasting of interest in "underlying fundamentals," this was a significant lacuna. He had sought a route to sight-reading competence and found a mental model that should facilitate this, although the rote learning involved still seemed formidable. His experience in learning songs and appreciating music – his own and others – has nevertheless been greatly enriched by an understanding of the underlying framework of intervals, chords and scales. Having recently sat through the (apparently) interminable repetitions in Philip Glass's Satyagraha, RPS was delighted to recognize that Gandhi's final aria commences with a simple C major scale! Describing such transformation of experience is akin to articulating appreciation of good wine to teetotalers; it is so difficult to project back into one's earlier state of mind.

On a more practical note, if this experience can result in a new element in the teaching approach to music theory this would be a most welcome, albeit unpredicted, outcome.

A contribution to the teaching of music theory?

RPS had hoped to contribute to the teaching of music partly with Information Technology in mind. A brief encounter with teaching aids now readily available via the World Wide Web, of which Dolmetsch Online is an excellent example, had diminished this option's appeal, but a less "high-tech" option was presenting itself.

Many South African music students have little keyboard exposure, focusing on string or melodic instruments and voice and/or coming from homes or schools where pianos are rarely found. This begs the question – *Would exposure to the key layout on a keyboard assist such students in learning music theory?* It may even be possible, where funds for keyboard instruments are not available, to provide printed pictures of the keyboard layout, several octaves, full-scale, for exploration. Taddy Blecher, founder of the CIDA City University in Johannesburg (Nussbaum & Schiefer, 2005, pp. 1–9), recounts how his first students taught themselves touch typing on photocopies of computer keyboards while they waited for him to find donations of computers, so this suggestion is not outrageous.

Conclusions and suggestions for further research

RPS was disconcerted by apparent memory challenges, initially in mastering scales; this despite a long demonstrated ability to master new topics. The identification of a mental model, that familiar

cognitive device to physicists, constituted a breakthrough. Also the elements of the music theory study course that he found most interesting and engaging, viz. aspects of harmony, were what he mastered most effectively, cf. the ABRSM exam outcome.

For the first author, therefore, after a lifetime working at the interface between knowledge generation and its application, this experience will be really worthwhile if it can be put to use in teaching practice, which would also gratify the second author, as a music education professor.

Notes

1. The Système Internationale (SI), often inaccurately characterized as the Metric System, replaced the Imperial System in many British Commonwealth countries in the 1970s.
2. "Between minds" knowledge is what makes a working team with shared experience more effective than a group of equally competent individuals thrown together for the first time.
3. In this city and among students of this university, this is gentle teenage slang for an elderly person.
4. According to Leonard Bernstein (1958–1972).
5. RPS was subsequently struck by how few accomplished musicians of his acquaintance grasped the significance of this without further exposition.
6. After Elliott (1995, pp. 61–62) who argues that students adopting his preferred "praxis-based" learning style, learn "parenthetically and contextually."
7. One wonders whether Frank Sinatra could have made a hit with this title rather than "I did it my way"?

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Author biographies

Roy Page-Shipp: On completing his Master's Degree in Physics, Roy Page-Shipp entered into a career in Occupational Hygiene, and in 1975 joined the South African Council for Scientific and Industrial Research. There he performed several management roles, including Director of the Division of Building Technology and a 2-year secondment to manage development projects in President Nelson Mandela's Office in the new democratic government. He retired in 2002.

Despite having been a singer all his life, he had only a rudimentary knowledge of music theory. Efforts to augment this developed his interest in research in music education, in which field he has co-authored several publications.

Caroline van Niekerk is Emeritus Professor of Music Education. In addition to her studies in Music, Education and English literature she holds a variety of qualifications in the fields of translating, editing, television presentation, leadership and negotiating skills. Her book publications are mostly in the field of music theory teaching. Recent articles published have focused more on aspects of musical identity.