Research and analysis

Research review series: music

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Introduction

Music touches the very heart of our humanity and a sense of the wonder of music has touched human societies throughout history.[footnote 1] Music education offers young people the chance to understand, perform and create in an aural dimension that often sits outside our capacity to describe in words. For many pupils, the music they love will be part of the narrative of their lives and bring colour to the experiences that shape them.

In England, all pupils should study music until the end of key stage 3. The requirement for maintained schools and academies to offer a broad and balanced curriculum is set out in the Education Act 2002 (for maintained schools) and the Academies Act 2010. This expectation is reflected in the national curriculum and is at the heart of the education inspection framework.[footnote 2]

In this report, we have:

- outlined the national context in relation to music
- summarised our review of research into factors that can affect the quality of music education
- considered curriculum progression, pedagogy, assessment and the impact of school leaders' decisions on provision

The report draws on a range of sources, including a review of research and published literature, and is underpinned by previous research that informed the 'Education inspection framework: overview of research' and 'Principles behind Ofsted's research reviews and subject reports'.[footnote 3] This report is supported by research into how people learn music from a number of academic disciplines, including education, expertise and cognitive psychology.

The current context of music education in England

The fruits of England's musical culture, in both community and commercial terms, are plentiful. The musical scene in England includes thousands of community groups, with long-running orchestras and ensembles from all the major world traditions. The tradition of choral singing alone has resulted in a multitude of choirs and in many of the country's 42 cathedrals, the service of evensong has been sung daily for centuries. Commercially, the music industry is a powerhouse. In 2019, the value of the music industry to the UK economy was £5.8 billion.[footnote 4] Seven times this century, the top-selling album globally has been by a British artist.[footnote 5]

It may be that the success of the country's musical life is underpinned by the variety of pathways into music. Young children can encounter the joy of music through singing and playing in the early years. Pupils' pathways into music might carry on through choir schools and Pentecostal churches, bands in sheds and gigs in pubs, one-to-one lessons, assessed grades, community performances or creative endeavours online. The voluntary sector supports school provision and enhances children's experiences.[footnote 6] Music hubs support music education through their core and extension roles,[footnote 7] including whole-class instrumental tuition. This review acknowledges England's diversity of opportunity, and the key role played by schools and music hubs.

Across the country, there are schools whose quality of musical education is world-leading and, in some cases, reaches professional standards. The trajectory of recent years, however, has been one in which pupil numbers at key stages 4 and 5 have steadily declined, key stage 3 provision has been reduced and trainee primary teachers have been offered shrinking amounts of musical training.[footnote 8] Reduced lesson time has been accompanied by lower levels of the staffing that would support a rich musical life.[footnote 9] Adequate staffing levels not only support the curriculum but also the balance of formal and informal musical learning that can be so important for musical development.[footnote 10]

The decline in the number of pupils taking music at key stage 4 applies to both BTEC and GCSE.[footnote 11] Notably, the fall at GCSE between 2010 and 2019 has been far more pronounced for boys, with male uptake falling from 24,000 entries to 15,500 and female from 21,500 entries to 19,000.[footnote 12] Uptake has also fallen over the last 10 years at key stage 5.[footnote 13] It is notable that the number of pupils taking music A level nationally implies an average uptake of around one to two pupils per school. This means that, if a normal size school has 5 pupils opting for music A level, the cohort is over double the average. It may be helpful for senior leadership teams to know this context and plan for the likely small class sizes at key stage 5.

Making the case for music

This review starts from the assumption that a central purpose of good music education is for pupils to make more music, think more musically and consequently become more musical.

The case for music in the curriculum is often made from a range of different starting points. Music's place in school life is sometimes justified by reference to literature that supports its wider benefits.[footnote 14] Among these are benefits to concentration, phonemic awareness, literacy, memory and academic achievement.[footnote 15] This focus on the wider benefits, however, is not always helpful if it encourages a view of music as existing in the service of other subjects and competencies.[footnote 16] Furthermore, the whole basis of music's contribution to other areas of competence has been challenged in a recent meta-analysis.[footnote 17] Other benefits have been called into question, including those of general creativity and wider transferable skills.[footnote 18]

One framework for thinking about these transferable skills is through a scale of 'remoteness':[footnote 19]

"The degree of transfer of one's expertise to a new situation depends on the specificity of the match between that situation and one's experience."[footnote 20]

As an example of the challenge even experts face, an excellent teacher of A-level music might still need quite a lot of new knowledge and experience of the early years before being as successful teaching music to a Reception class.

This points to constraints on competence and expertise, a feature also highlighted by a widely evidenced finding in the field of chess: [footnote 21] expert performance is based on extensive domain-specific knowledge. This finding has been replicated in other fields, [footnote 22] including music.[footnote 23]

Therefore, what can be said with a degree of certainty is that learning music is good for becoming more musical. Playing the piano is helpful for improving piano performance, singing in a choir supports becoming a good choral singer and writing lots of songs is a foundation for expertise in song-writing. These are wonderful things in and of themselves and need no further justification.

Curriculum planning

Summary

School music curriculums set out pathways for progression that enable pupils to develop their musical knowledge. Progress in music requires pupils to develop musically across 3 pillars that interrelate in musicianship.

- The first pillar is the ‘technical’ development necessary for pupils to translate their intentions successfully into sound. This will often involve instrumental playing or singing but, if the resources are available, may also focus on music technology.
- The second pillar is the ‘constructive’ pillar. This refers to knowledge of how musical components come together both analytically and in the creative process.
- The third pillar, the ‘expressive’ pillar, is focused on the more indefinable aspects of music: quality, meaning and creativity.

Curricular content supports pupils in developing these 3 pillars, which in turn support the activities of performing, composing and listening. Before discussing these pillars in detail, we will first set out what the review means when it refers to ‘knowledge’ and ‘learning’.

Learning and classes of knowledge in the music curriculum

The central finding of this review is that, to become successful musicians, pupils must use both their conscious and unconscious minds, with the latter being developed by learning and experience. The idea that our actions rely heavily on unconscious processes has been written about widely.[footnote 24] This idea is important in understanding progression in music. Automated low-level processes free the mind from mundane considerations. This cognitive liberty allows a focus on the musical quality in performing and composing.

This review will refer to ‘learning’ as a change to long-term memory.[footnote 25] We consider long-term memory to be the chief enabler of development. These changes may occur through the acquisition of tacit, procedural or declarative knowledge, and when the review refers to ‘knowledge’ or ‘curriculum content’, it is with reference to these 3 classes, not just to the facts of declarative knowledge.

Table 1: Classes of knowledge

Classes of knowledge	Examples
Tacit – *Tacit knowledge* refers to the *knowledge* gained through experience that is often difficult to put into words.	An awareness that the opening of Schubert’s ‘Erlkönig’ is tense and dramatic, even without understanding the text or knowing about minor keys and triplet rhythms.
Procedural – Procedural knowledge is the knowledge exercised in the performance of a task.	Well-developed competence in creating drum grooves.
Declarative – *Declarative knowledge* refers to facts or information stored in the memory.	Factual knowledge about eras, styles, composers or performers, as stated in a written essay about musical culture.

This review notes that pupils may forget a lot of what they learn after their first encounter.[footnote 26] Consolidation is therefore essential for newly learned knowledge to become embedded as learning.[footnote 27] As an example, devoting a unit of work to the keyboard without considerable further practice and application is unlikely to result in any degree of fluency.

Tacit knowledge

The most widely shared musical knowledge comes about through enculturation, whereby members of a culture gain some tacit knowledge of the workings of the main musical systems they hear, usually from a very early age.[footnote 28] The importance of exploring this form of knowledge is highlighted by Polanyi’s dictum that ‘we know more than we can tell’.[footnote 29] Tacit knowledge is most often acquired through informal listening:

“Repeated experiences of an event with a comparable functional relation to oneself and a comparable outcome, over varying details of context… providing a rich basis for developing meaningful knowledge.”[footnote 30]

Pupils engaging with music move from this undeclared and highly abstract knowledge – a ‘receptive expertise’ – to the more concrete forms that start the path to productive expertise.[footnote 31] As an example, pupils can gain a sense of what makes an idiomatic melody through listening informally to the type of music (for example, salsa). It is later that productive expertise in melodic composition leads to

the creation of new pieces in the style.

Procedural knowledge

Procedural knowledge, such as playing an instrument or being fluent in using multi-tracking software, is the foundation of performing and composing. Well-developed procedural knowledge depends on pupils acquiring an array of automated procedures that they need to develop technical and expressive competence on an instrument.[footnote 32]

The acquisition of procedural knowledge is particularly prone to cognitive overload.[footnote 33] Humans can only deal with small amounts of new information at any one time – somewhere between 4 and 7 pieces of new information.[footnote 34] This constrains the amount of content that teachers can introduce in lessons and therefore across curriculums. As an example, for a beginner to play a notated melody on the piano, their working or long-term memory is likely to deal with, among other things:

- note names on the treble clef
- a key signature
- a time signature
- dynamics
- tempo
- the geography of the keyboard
- the link between the written note and the played note
- which right-hand finger to play with
- which finger to play with to set your hand up for the next note
- how hard to press the individual notes
- how the level of pressure will change note to note to shape a phrase

If some of these aspects have not become unconscious through thorough learning, then the pupil will experience cognitive overload and will be unlikely to succeed.[footnote 35] Avoiding cognitive overload is helpful for learning, a factor that infants seem to understand implicitly.[footnote 36] A carefully judged level of difficulty is therefore necessary to promote learning, and this will be supported by developing the components of composite tasks and consolidating them.[footnote 37] This difficulty level chosen may push at the boundaries of competence because:

“some ‘desirable difficulties’ – some cognitive load – helps learners to build their determination and understand material more.”[footnote 38]

‘Little and often’ has also proven to be a useful approach with regard to acquiring procedural knowledge.[footnote 39]

Procedural proficiency, as opposed to expertise, can be gained relatively quickly in narrow areas (a good example might be learning to drive).[footnote 40] This is both hopeful and challenging. If pupils can gain some procedural knowledge in tens of hours rather than thousands of hours, it would certainly put procedural proficiency – crucial for any level of productive musical fluency[footnote 41] – within the scope of a school curriculum. Tens of hours, though, is a substantial amount of lesson time in which to practise, and practice is effortful.[footnote 42] The most useful forms of practice may not be the most enjoyable.[footnote 43] It has also been suggested that pupils generally need much more practice than teachers assume to gain procedural fluency.[footnote 44] Not all practice is made equal,[footnote 45] particularly for novices, whose metacognition is limited.[footnote 46]

Curriculum plans should therefore set out the schedule of task-relevant practice episodes, keeping in mind how much can realistically be learned.[footnote 47] Despite its challenges, practice is, eventually, liberating.[footnote 48]

Declarative knowledge

Declarative knowledge underpins advanced thinking.[footnote 49] It is the presence of this knowledge in long-term memory that allows the conscious mind to process complex concepts.[footnote 50] It can be hard to achieve, like putting toothpaste into a tube, to use the metaphor from Oakley and Sejnowski’s ‘Learning how to learn’.[footnote 51] It is better to give pupils regular, spaced-out re-encounters with lesson content than to block the time, to help them build knowledge in long-term memory.[footnote 52] As an example, primary school pupils learning about instruments are more likely to remember through these regular, spaced-out re-encounters than if the learning is gathered into rarely repeating blocks. The active recall that is involved in retrieval practice can also help pupils reinforce their learning of declarative knowledge.[footnote 53] This can be done through informal testing (including of musical response) or through asking pupils to restructure information or teach the information to another pupil (without notes).[footnote 54]

In a musical context, examples of declarative knowledge might include that of notation, keys and chords or of the works and songs that illuminate musical culture. This knowledge of shared and historical musical culture has an important role to play in offering a broad and balanced education that supports cultural literacy.[footnote 55] This is one of the reasons that Ofsted considers music to be an important part of an education that is broad and balanced.

Curriculum scope

Having addressed the definitions of learning and knowledge, we will now look at curriculum scope.

Curriculum music teaching for most pupils in England currently may consist of 30 minutes a week from Years 1 to 6 and one period (40 to 60 minutes) a week in key stage 3, although some secondary schools have reduced even this.[footnote 56] Many primary and some secondary schools enhance this core provision with singing assemblies and whole-class instrumental tuition.[footnote 57] However, taking into consideration training days, examination weeks, trips and cover lessons, time for music over the 9 foundation years, even in the most generously timetabled curriculums, is short. Typical time allocations might result in, for example:

- between 90 and 120 hours of music at primary school, on the basis of 30 minutes per week throughout Years 1 to 6 – that is, between 15 and 20 hours a year
- between 60 and 120 hours of music at secondary school in key stage 3, on the basis of an hour a week throughout Years 7 to 9 – that is, between 20 and 40 hours a year

These yearly allocations of time are mostly less than a typical adult working week and these limits increase the importance of good curriculum construction to plan for the best possible use of time. Overly grand claims of what can be learned in this time will be unfair to teachers and pupils and it will not be possible to include every valuable aspect of music without the curriculum becoming a mile wide and an inch deep.

Curriculum scope is therefore constrained by time and realism about the extent of long-term learning that can take place.[footnote 58] Inevitably, this involves difficult choices about what to include and what to omit,[footnote 59] as understanding is dependent on the procedural and declarative knowledge pupils have acquired and this is often domain-specific.[footnote 60] Examples of ways in which knowledge underpins and constrains instances of understanding include Westerners' misconceptions of metre in certain non-Western music, as in these referenced examples from South African and Bolivian music.[footnote 61]

At a deeper level, the example of how different cultures structure time is further evidence of how understanding is dependent on context. Some cultures, for instance those influenced by Christianity and Islam, see time as linear and progressing ever forwards: a teleological view of time. Many other cultures, such as those influenced by Buddhism, see our human experiences as being part of a recursive understanding of events: a cyclic view of time.[footnote 62] These philosophical approaches have been seen as paralleled in teleological and cyclic conceptions of temporal organisation in music. Scholars have suggested different ways in which temporal organisation of music might be related to its social context, such as the cyclic structures of Javanese gamelan or the teleology of Mozart's composing.[footnote 63] These are domain-specific differences and knowledge of one does not generalise to the other. Some possible implications that curriculum designers may want to consider include:

- that it may not work to map curriculum sequences onto a tour of genres – this may be like trying to complete a jigsaw of a steam train with pieces from a puzzle depicting the pyramids; teachers should be clear when units build on prior learning and when they are starting afresh and building new concepts
- that it is sensible to decide on what the curriculum goals are and the specifics of curriculum content, rather than articulating principles and assuming that any content will work to realise these principles
- that the form of pupils' musical understanding will then be dependent on the specific curriculum content

Curriculum scope should also be informed by current research on human cognition and the role of the phenomenon that cognitive psychologists refer to as working memory.[footnote 64] The limits of our working memory/conscious minds constrain our processing and attention. This is notably highlighted by recent research showing multi-tasking under conscious control to be a myth.[footnote 65] All is not lost, however: complex thinking can come about as a result of learning and automaticity from long-term memory as set out in cognitive load theory.[footnote 66] Development of concepts in pupils' long-term memory expands curricular possibilities:

"As learner experience in a domain increases, working memory limitations could become less important because relevant knowledge structures may already be available in long-term memory."[footnote 67]

These knowledge structures in long-term memory are referred to as 'schemas'. A helpful way of thinking about these schemas is through the metaphor of a jigsaw, mentioned above. Authors use it when discussing learning, with the instances of learning forming the pieces that come to make the whole from which pupils can draw meaning.[footnote 68] The necessity for pupils to develop schemas in long-term memory to reduce their cognitive load as they progress within a domain is clear.[footnote 69] For example:

- automaticity in finding chord shapes on the ukulele helps free up working memory for strumming patterns or singing
- learning music off by heart enables more focus on expression and movement in performance
- well-embedded knowledge of triads and inversions underpins thinking about voice leading

Building these schema is supported by the pre-planned, well-sequenced curriculum found to be effective in a wide range of educational settings.[footnote 70] In contrast, challenges have been made to the efficacy of curriculums that rely on minimal guidance.[footnote 71] This has been found to be particularly true for students from low-income backgrounds and those with low prior attainment:[footnote 72]

"Such strategies negatively affect lower aptitude students as they're often too abstract and are based on partly automated knowledge which beginners don't possess."[footnote 73]

Curriculum leaders therefore need to consider cognitive load when setting out curriculum cope so that all pupils can access the curriculum, consolidate learning in long-term memory and progress further. Curricular expectations that do not take cognitive load and time into consideration are extremely unlikely to be met.

Based on the above, high-quality music education may have the following features

- Curriculum content that might reasonably be mastered in the time available, remembering that sometimes less is more.
- Plentiful opportunities for pupils to return to and consolidate their short-term learning.
- Repetition of key curricular content with the gradual introduction of new ideas, methods and concepts.

Pillars of progression

In this section of the review, we will categorise 3 pillars of progression in music education: technical, constructive and expressive.

In making decisions about curriculum content, it is important to consider how the sequence of content develops pupils' musical knowledge and competencies over time. This review proposes 3 pillars as the basis for progression in the musical activities of performing, composing and listening/appraising. A good music education is underpinned by robust, direct and incremental teaching that provides knowledge of music's technical and constructive aspects. This knowledge is learned in the context of music's history and provenance, allowing pupils to make increasingly sophisticated, expressive responses and gain musical meaning. Together, these pillars contribute to what could be described as 'musical understanding'.

Figure 1: Pillars of progression

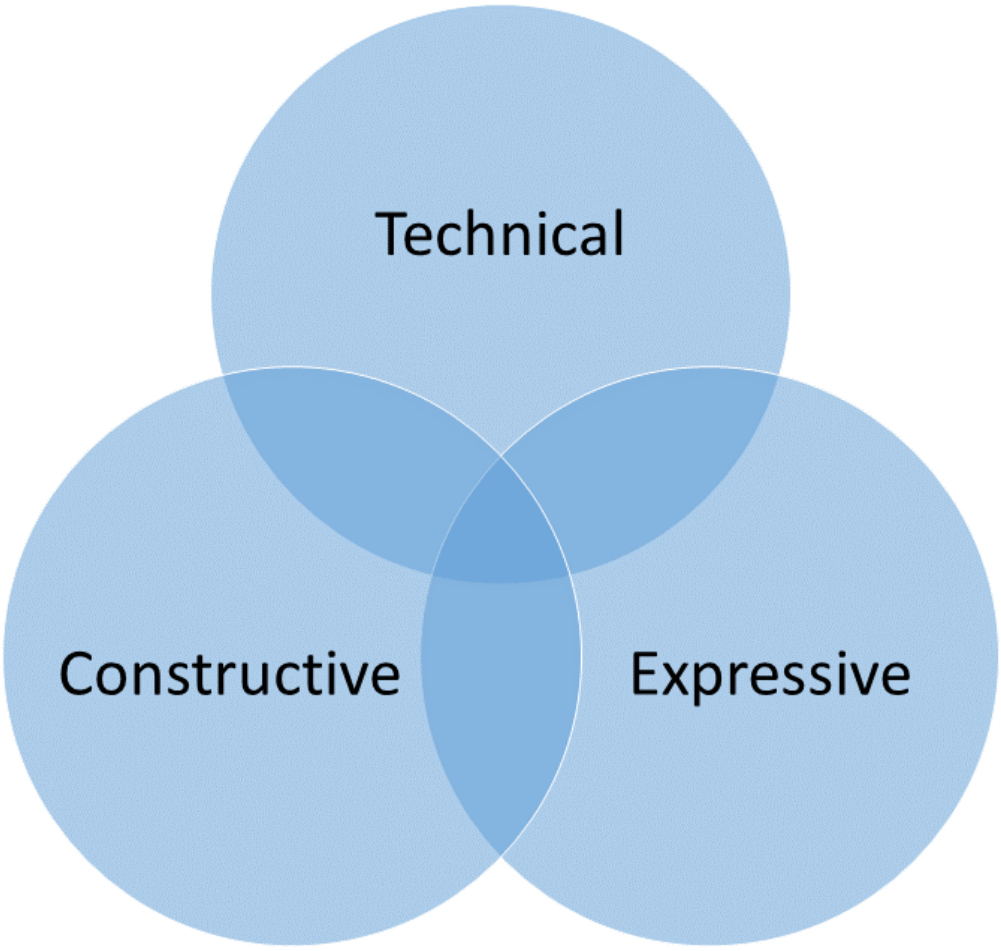


Table 2

Technical	Constructive	Expressive
- Competence in controlling sound (instrumental, vocal or with music technology) - Use of a communication system, such as staff notation or guitar tab	- Knowledge of the musical elements/interrelated dimensions of music - Knowledge of the components of composition	- Musical quality - Musical creativity - Knowledge of musical meaning across the world and time

Technical

Sound production

Development of motor skills for music is an important component in controlling and understanding sound. It seems to be the case that musical training is most successfully embedded when there is an earlier age of onset.[footnote 74] The ability to manipulate sound is central to both performing and composing. It also impacts on how we listen. Performance is unlikely to be an entirely satisfying

experience for performers or listeners if it is undermined by technical inaccuracies. Composition flows from explorative improvisation and technical expertise expands the range of compositional possibility.

A variety of sound production theorisations include a stage where the pupil translates musical thoughts into the external world. The stages of good sound production have been theorised in the fields of music psychology, expertise and neuroscience, as laid out in Table 3.[footnote 75]

Table 3: Stages of good sound production

Music psychology	Expertise	Neuroscience
1) Attention to sound production 2) Coding/categorising individual sounds 3) Hold these together in a structure or pattern 4) Translate into response	1) Imagine 2) Represent 3) Implement	1) Auditory 2) Sensory-motor 3) Influenced by 'imagination, colour, fantasy, and emotion'[footnote 76]

A school's curriculum should therefore enable pupils to develop their capability to realise their imagination in sound, otherwise:

"If technical stability is not achieved then we would have the possibility that an individual is able to form a representation of a heard expressive device, generate a performance intention in which this device is present and thus intended for performance, but fail to translate the intention into an adequate motor program."[footnote 77]

Curriculum designers may therefore wish to consider research on the most effective ways to sequence procedural knowledge for long-term learning as outlined earlier.

A challenge for curriculums that develop technical competence over a long span of time is the extent to which pupils' learning can generalise across instruments and styles.

"As the individual engages with a particular domain, the characteristics of expert performance begin to be acquired. These characteristics are specific to a particular domain, and even within a domain, transfer of skills can be problematic."[footnote 78]

Expressive musical outcomes are a function of progressively more advanced technique enabling the colours of the imagination to be realised in sound.[footnote 79] This fine motor skill is instrument-specific and is the product of both practice and knowledge of the music.[footnote 80] Fine motor skill development on any instrument needs a lot of time. Shallow encounters with lots of instruments will limit pupils' musical outcomes to the most mechanical and least expressive level. This means that school curriculums require either more time or narrower instrument choice to improve the expressive quality of pupils' sound production.

As stated above, technical development also has an impact on listening. A pupil's aural perception changes with the amount of training in instrumental playing they have had, even at a young age if it is regular and sustained.[footnote 81] These changes in perception are instrument-specific:

"The increased acuity of the senses and their intimate interrelatedness with the motor system are restricted to the stimuli musicians typically encounter when playing their respective instruments."[footnote 82]

Examples include:

- pianists, who audiate (like visualising, but for sound) when moving their fingers[footnote 83] and when observing others playing[footnote 84]
- conductors, who are adept at separating sounds in the auditory field[footnote 85]
- violinists and trumpeters, who hear tones better within the ranges of their own instruments[footnote 86]

In summary, pupils' ability to control sound, through singing, instrumental playing or music technology, therefore supports their performing, composing and listening. It is an important part of a curriculum, operates within specific fields of progression and is the foundation of practical music-making.

Based on the above, high-quality music education may have the following features

- Curricular scope that includes enabling pupils to gradually develop control over the sound they are producing.
- Practice episodes to support the consolidation of procedural knowledge.
- Consistency with regards to the medium for developing sound control, recognising the weak transfer of procedural knowledge.

Communication systems

Music has an array of representational systems, ranging from staff notation, guitar tab and chord symbols to verbal description[footnote 87] and graphic notation. The music of many traditions is learnt by ear. The national curriculum requires pupils to learn to understand and use staff notation.[footnote 88]

The field in which the research base for symbolic systems is most extensive is that of early reading. The cross-over between this and musical symbols has been noted by recent writing.[footnote 89] In the research on early reading, core principles are at work – principles that are particularly important for weaker readers.[footnote 90] These suggest that the curriculum should help pupils to:

- pay attention to the foundational components of the system (phonemes, not words)
- decode to automaticity
- consolidate their understanding of the components of reading
- develop fluency and then attend to higher-level structures

In music, as with reading, research shows how early exploration of sound should be a precursor to encounter with a system of notation.[footnote 91] This suggests that pupils should be familiar with music and musical activities, such as singing, before they are introduced to reading music notation. Children's musical experiences and play in their early years are therefore very important for gaining familiarity with musical concepts before engaging with notation. In later years, the way in which pupils' aural and practical knowledge of music supports reading fluency extends to structures such as chords, phrases or tonality.[footnote 92] Pupils need this understanding of music to read notation fluently, just as familiarity with subject matter affects fluency of reading.[footnote 93]

Being able to decode the notation automatically, however, is central to pupils being able to use the system musically. The goal of teaching a notation system is for pupils to be able to use it fluently and independently. Once decoding takes place subconsciously, the mind is free to focus on musical goals. It is not surprising therefore that accuracy correlates with expressive quality.[footnote 94] We can see this further in the expressive quality of sight-reading by those who have complete fluency in the use of notation and in the musical way in which adjustments to the written music are made.[footnote 95]

Beyond the early encounters, notational systems also change our internal conceptions of musical features rather than merely representing them. This can be seen in perception of imposed metrical categories such as 3/4 or 6/8:

"First, we should differentiate metric information in a visual score from that which meets a listener's ears… given an unfamiliar melody, a listener often does not "know" its designated meter; people don't have scored bar lines in their heads."[footnote 96]

This brings us to a further point, that symbolic systems are helpful in developing abstract concepts, as has been shown in maths with the concept of discrete numbers.[footnote 97] This is not to say that symbolic systems are uniquely powerful, after all blind pupils can still become maths professors[footnote 98] and jazz musicians do not need short score to be masters of voice-leading, but that nonetheless symbolic systems are a useful way of accessing abstract concepts.

Based on the above, high-quality music education may have the following features

- The goal of automaticity in using the components set out in the curriculum, such as reading the treble clef or chord symbols.
- Large amounts of practice to enable pupils to develop reading fluency at the level set out in the curriculum.

Constructive

Musical elements/interrelated dimensions of music

The interrelated dimensions of music, commonly known as elements, are set out, as in the national curriculum, in Table 4. The description of elements in the national curriculum as interrelated encourages teachers to avoid teaching them separately or assuming that progress occurs through teaching them in silos.

Table 4

| Pitch | Texture | Tempo | Structure | Timbre | Dynamics | Duration |

The elements of music describe the constituent parts of music in a broad and abstract fashion. This has implications for the situations in which people can generalise their knowledge of the elements to new situations or contexts.[footnote 99]

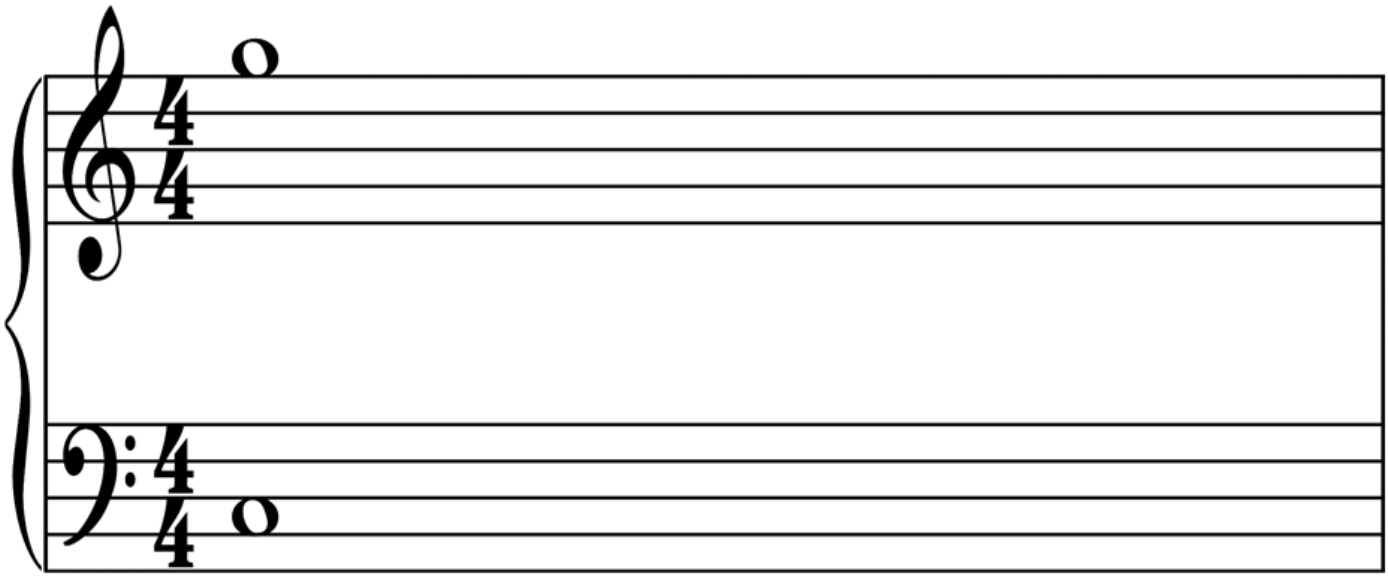
Research into how pupils learn about concepts such as elements[footnote 100] suggests that pupils have:

"the capacity to learn any quality that is exemplified through examples and the capacity to generalise to new examples on the basis of sameness of quality."[footnote 101]

Once curriculum leaders have made decisions about how musical elements will be included in the curriculum, they should include well-chosen and numerous examples to make it as likely as possible that pupils will develop an understanding of the boundaries and ranges of chosen concepts.[footnote 102]

A consequence of the high level of abstraction at which elements operate is that they can either be simple and general, or complex and specific. This can be seen in the way in which the pitch of the following notes can be described:

Figure 2



Description 1 of pitch: there are 2 notes. One is high and one is low.

Description 2 of pitch: There are 2 notes. The lower note is a fairly low C on the tonic. The upper note is a high G, a compound perfect 5th, on the dominant.

The first description is accurate. The second could be accurate and, if so, reveals much more about the music. However, its accuracy depends on the cultural and theoretical context. It is not a description that generalises across any instance of these 2 notes being played. It is a useful description in a piece of:

- Western classical music in C major

yet not:

- an Indian raga
- atonal Western music
- or even Western classical music in G major

The form of pupils' knowledge of the elements can therefore be simple and general, in which case learning can be shallow, or detailed and specific, in which case pupils' learning is deep but less likely to transfer to new situations.

Curriculum designers therefore need to decide which elements to draw out and in which situations, while ensuring that they are not siloed. In the early years, pupils may be gaining a simple understanding of pitch in terms of high or low. This knowledge is a crucial by-product of group singing. As pupils progress, their deepening understanding will depend on the broader choices made by schools. Learning the ukulele, steel pans or violin at primary school will all lead pupils to understand pitch more deeply, but it will be in different ways according to the instrument. Understanding musical elements involves a trade-off between depth/high resolution and breadth/low resolution. This is why schools should avoid organising their whole curriculum by single elements, even though they may be the focus in particular lessons, such as the importance of rhythm.

Based on the above, high-quality music education may have the following features

- Learning of the concepts and terminology of musical elements through examples embedded within wider units of work, taking prior learning into account.

Components and composites in composing

Composing is a highly complex composite activity:[footnote 103]

“for our perceptual and cognitive processing abilities not to be overwhelmed, composers have to work within tight constraints.”[footnote 104]

This perspective led the composer Igor Stravinsky to write:

“The more constraints one imposes the more one frees one’s self of the chains that shackle the spirit.”[footnote 105]

This aligns with research that suggests that pupils can make progress most successfully when the curriculum identifies and develops components of composite tasks, enabling learning sequences that lower cognitive load followed by effective feedback.[footnote 106]

It is also important to recognise that, in coming to composing work, pupils bring with them not just their knowledge of constructive musical components, but also their technical knowledge and their expressive knowledge. This includes knowledge acquired procedurally and that gained tacitly, from their individual contexts and experiences. It also includes their personal feelings and humours.

Rehearsing the components of composition takes many different forms. It can range from young pupils rehearsing idiomatic rhythms in samba, to ukulele players generating chorus chord sequences, to A-level pupils learning about the cadential 6/4 progression in Bach chorales. Curriculum designers are faced with the challenge that:

“the very acts of deciding what a component is, of how it might work in complex interplay with other components and of how to select from a potentially infinite array of possible components requires profound subject-informed judgement.”[footnote 107]

What teachers consider to be crucial components will therefore depend on what the school’s music curriculum covers and the level of consolidation that will enable pupils to approach creative opportunities on a firm foundation. Increasing facility with these components through the curriculum will give pupils an opportunity to build knowledge from diverse starting points and help to avoid any tendency towards cursory encounter.

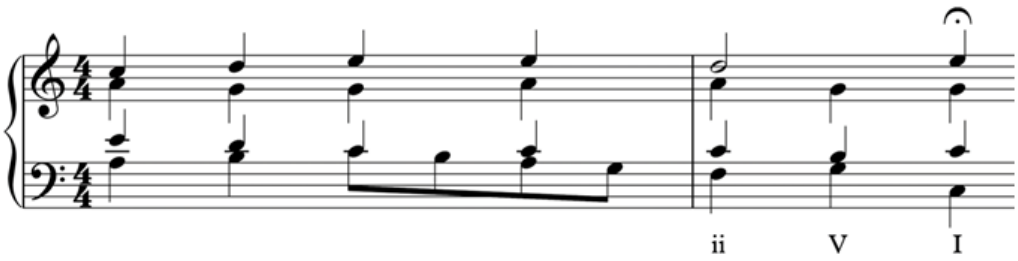
A crucial issue for schools to consider in this part of a music curriculum is the nature of creativity itself. There are proponents on both sides of the debate on whether creativity is more domain-general or domain-specific.[footnote 108] In these arguments, the domains are the high-level subject areas but the arguments around domains also pertain to a much more granular level: for instance, there is a huge challenge even for professionals in crossing contrasting domains, for example those of the concert pianist and jazz improvisation.[footnote 109] When looking at creative products, the contribution of domain-specific knowledge is well evidenced, even within narrow sub-domains.[footnote 110] Given the cultural and domain-specific nature of aural perception, which is dependent on a person’s knowledge of particular musical systems, styles and repertoires,[footnote 111] it is not surprising that domain-specific procedural knowledge is helpful in creating music. Curriculum designers might therefore consider the way in which creative opportunities, which may be domain-general, build pupils’ competence, supported by task-level, domain-specific knowledge.

This last paragraph needs exemplifying for its implications to be clear to curriculum designers. One question is whether there are ways in which teaching harmony in one tradition can support understanding in another. Near transfer of similar components suggests that this could be the case, as long as the claim is not overblown.

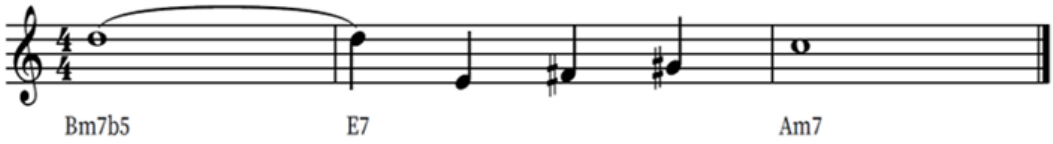
The following examples all contain variants on the ii-V-I chord progression. Pupils can understand this component through learning about a diverse range of musical genres.

Figure 3: excerpts from a Bach chorale, ‘Autumn Leaves’ by Joseph Kosma and ‘Picture Me’ by Dave

Example 1 – Bach chorale



Example 2 – 'Autumn Leaves' by Joseph Kosma



Example 3 – 'Picture Me' by Dave

Am | G | F | Eb | Dm | C | Bdim | E | Am

Each of these pieces contains a phrase or cycle that comes to a close as a result of the ii-V-I chord sequence. Curriculum designers would therefore be justified in using Bach, jazz or grime to teach perfect cadences (V-I) while recognising the stark contrasts in the manner in which they use harmony more generally. Dave's parallel harmony is markedly different to the voice-leading of Bach chorales.

Curriculum sequences on composing should therefore develop pupils' procedural knowledge through well-chosen components that serve a clear purpose. The cumulative development of these components helps pupils to compose in ways that do not overwhelm them with complexity or require limitless supplies of time.

Composing is, in many ways, the ultimate composite activity in music education. It also, arguably, makes composing the most challenging activity for teachers to plan and manage in the music classroom. It is important for the planning of any composing activity to take into account the individual knowledge that pupils bring to the classroom, and to make room that allows for the personal response to composing tasks. This is true for all learners, from the early years to the sixth form. But, in order for pupils to make progress in composing work as they move through the school, the curriculum should ensure that pupils increase their knowledge of the components that come together to make stylistic wholes.

Based on the above, high-quality music education may have the following features

- Opportunities to develop knowledge of the components of composition that pertain to chosen school curriculums and support work towards stylistic composites.

Expressive

Expressive quality

Whether musical performance or composition is 'good' or not may be a difficult judgement to make objectively but teachers should still put quality front and centre when listening to pupils' offerings. It is crucial to the whole purpose of music and must be part of any good music teaching. A few points are therefore worth making:

- Musical expression in performance is dependent on the highly developed technical expertise of the performer.[footnote 112]
- This is combined with what a performer knows and understands about the music they are playing, both specifically and in terms of the wider culture in which the music exists.[footnote 113] Pupils' listening as part of the curriculum can also enable them to gain a tacit understanding of unfamiliar musical systems.[footnote 114]

- The fine motor microvariations, like the subtlety of a pianist's touch or a singer's timbre, that underlie each performer's expressive outcomes have been shown to be highly systematic.[footnote 115] This is due to the fact that, for example, Western listeners base their expectations on the rules of Western music theory, whether or not they are explicitly aware of the rules.[footnote 116]
- Our understanding of the way in which musical systems impact on emotion may be underpinned by findings that emotion can arise out of a complex web of realised and disrupted expectations.[footnote 117]

Based on the above, high-quality music education may have the following features

- Extensive listening opportunities to help develop pupils' expressive intentions.
- Tasks at a technical level appropriate for pupils to be able to realise their expressive intentions.

Creative output

The earlier section on components emphasised the Apollonian aspects of creativity: clarity, logic and the carefully thought-through development of components. The review of the literature makes clear that creativity is also of the more instinctive, less controlled Dionysus: freedom and constraint must exist in balance.[footnote 118]

Learning components requires choices about inclusion and omission, since musical components are not all-purpose. There is no reason for this to inhibit pupils' creativity so long as pupils are given the freedom to use the components of composition in varied and idiosyncratic ways. Focusing on chord sequences, drum grooves and bass lines, for instance, could be the starting point for music as different as electronic dance music, indie, funk or a myriad of other genres.

There are many ways in which opportunities to be creative can be considered. One is that if they disengage from the moment, pupils are able to explore the world of imagination.[footnote 119] Creative solutions are not merely right or wrong answers but take our experiences and recombine them to make something new. This process is helped by exploring the internal world created by these experiences without the mind being consumed by the here and now.

The importance of enabling pupils to improvise their way to creative outcomes without inhibition is highlighted by the apocryphal Miles Davis quote: 'Do not fear mistakes, there are none.'[footnote 120] Fear of error can be a huge barrier to creativity.[footnote 121] It is therefore important for 'teachers to take creative risks and encourage this in their pupils'.[footnote 122]

The role of autonomy has been highlighted in writings on classroom music[footnote 123] and the part it plays in motivation, which needs to be in place for creative potential to become creative reality.[footnote 124] Having been provided with the tools to compose by the teaching of components, pupils will benefit from a degree of autonomy in how they use them. The degree will be moderated by context, bearing in mind that too much autonomy can also be unhelpful and that creative exploration cannot be endless, otherwise the outcomes may never see the light of day.[footnote 125]

Based on the above, high-quality music education may have the following feature

- Space for exploration, inconsistency and independence.

Knowledge of music

As well as developing the procedural knowledge of how to perform and compose, curriculum music enables pupils to learn about musical culture and history.[footnote 126] Inevitably, this means that they need to explore musical 'meaning'. The literature suggests some broad categories of how musical meaning can be understood.[footnote 127] These are summarised in Table 5.

Table 5: Categories of musical meaning

Category	Example
Formal	The internal logic of the music itself, for example music that has a tonal centre, creating a formal sense of closure.
Symbolic	The extra-musical associations, for example the funereal narrative of Parry's 'Crossing the Bar' or the nocturnal sky in 'Twinkle, Twinkle Little Star'.
Personal	The meaning that comes from memorable experiences, for example, Metallica's 'Enter Sandman' (not a romantic song) meaning so much to a couple that it is played at their wedding.
Social	Music's meaning in the communities in which it is practised, for example in the dance and music of Brazilian carnivals.

Gaining the knowledge of these musical meanings might sit within practical activities or be separated in the curriculum, always bearing in mind that 'music-making is more important than music information'.[footnote 128] However this content is delivered, it should still meet the definition of learning set out at the start of this review. Consolidation of this knowledge in long-term memory is learning. Gains in depth and breadth underpin pupils' engagement with musical meaning. The presence of knowledge in long-term memory is supported by a curriculum that considers:

- the privileged place that stories hold in long-term memory, hence the prevalence of music with a narrative programme in both primary and secondary schools[footnote 129]
- emotional engagement as a powerful facilitator of memory[footnote 130]
- that learning episodes should be spaced out, interleaved and consolidated with opportunities for low-stakes testing and retrieval practice[footnote 131]

Based on the above, high-quality music education may have the following features

- Opportunities to gain knowledge of musical culture and repertoire, which is part of a broad education and a joy in and of itself.
- Realistic scope concerning this knowledge which, if it is to be meaningful and remembered, is unlikely to be vast.

Developing the knowledge and skills of pupils with special educational needs and/or disabilities

The principles of cognitive load, components and clarity of instruction are particularly important for planning the learning of pupils with special educational needs and/or disabilities (SEND). Other reviews have already explored the benefits of explicit, systematic instruction and rehearsal of declarative and procedural knowledge for pupils with SEND.[footnote 132] The specific curriculum adaptions that some pupils need will, of course, be highly contextual and there is no one-size-fits-all set of solutions. It is also the case that some pupils with SEND may have enhanced musical perception, just as evidence suggests that some children who are blind may have enhanced working memory.[footnote 133] We noted earlier the successes of blind mathematicians and they, alongside the many successful blind musicians, demonstrate how potential can be fulfilled when barriers are overcome. These examples highlight the importance of having high expectations for all pupils, understanding their strengths and needs, and implementing appropriate interventions, including using adapted instruments.

Some planning for pupils with SEND will occur in careful decisions about curriculum delivery, with research suggesting the importance of:

- breaking down tasks
- reducing the burden on working memory
- the use of appropriate supportive routines
- combining learning modes to enhance clarity/accessibility
- adapting materials to ensure a good but achievable level of challenge[footnote 134]

The implications for teachers here are that pupils need high-quality curricular resources that can be reasonably adjusted so that their access to the curriculum gives them the best chance for success.

Further aspects of implementing the curriculum successfully for pupils with SEND will centre more on examples such as the adaptions for learning seen highlighted in Ofsted's music subject report from 2012.[footnote 135] As will be discussed further below, the form that this aspect of pedagogy will take is highly contextual. Whether in curriculum planning or in lesson delivery, this contextual information will be best understood and applied when subject leaders work closely with school special educational needs coordinators to marry subject and specialist knowledge.

Summary questions on curriculum

- Does curricular scope take into account what can realistically be learned, rather than briefly encountered, in the time available?
- Does the curriculum build pupils' procedural knowledge in controlling sound?
- Is this built up in a way that is gradual, iterative and coherent with regard to instrument choice?
- Is curriculum scope regarding appropriate representational systems realistic in the time available? Will pupils gain the fluency to use them musically?
- How will pupils encounter the examples that give meaning to the concepts of musical elements?
- Are compositional components identified for development and given sufficient practice time?
- How does the curriculum take into account the importance of quality and creative diversity in students' musical offerings?
- Where are the opportunities to consider musical culture and meaning?

Pedagogy

Summary

The successful implementation of any curriculum will be highly dependent on teachers' effectiveness, as laid out in the research underpinning the education inspection framework (https://www.gov.uk/government/publications/education-inspection-framework-overview-of-research). Although this effectiveness is contextual, research does highlight some points to consider. Guidance from teachers should be high for novices, a category that could include A-level pupils for certain learning activities. One of the most effective ways in which a teacher can support their pupils is through feedback on task components. We therefore discuss formative assessment in this section. Finally, levels of pupil attention and motivation correlate strongly with positive outcomes.

Curriculum implementation

Up to this point, the review has relied heavily on 2 principles – time and cognitive load. These influence every aspect of curriculum planning. Together with a wide body of research, they suggest ways of setting out content to ensure that pupils acquire the tacit, procedural and declarative knowledge intended. For the curriculum section of this review, we have sought evidence and drawn conclusions from the latest research. To understand why time and working memory only tell part of the story, we will now discuss how music curriculums can be implemented – how supreme organisation, subtly managed teacher–student relationships and memorable lessons can come together into curricular goals.[footnote 136]

That the delivery of a curriculum is an art, not a science, comes through in a study of correlations between teachers' actions in videoed lessons and evidence of students' learning at the end of year.[footnote 137] Almost none of the variance was predicted from observations of the teacher, a finding summarised here:

"This analysis leads us to reject the idea that expertise in teaching can be defined in terms of decontextualized "best practices". Our view is that correlations between teacher actions and student learning are low not because we haven't yet identified the right set of best practices, but because teaching itself is contextual, meaning that such correlations will always be low."[footnote 138]

It is, in fact, the opportunities that teachers give pupils to attend to and learn the most appropriate curriculum content that most successfully correlate with good learning outcomes. Teachers therefore may consider promoting these opportunities, as in the following examples.

Table 6: Examples of high-impact features of curriculum implementation

Feature	Example
Productive struggle[footnote 139]	Creating a desirable level of difficulty for all the pupils in a class is a key challenge for teachers. Presenting pupils with music that is technically too difficult or that provides insufficient challenge might lead to demotivation or frustration instead of the affirming state of flow that can come from satisfying engagement.[footnote 140]
Cognitive activity[footnote 141]	In order to keep pupils thinking musically, teachers may focus on what the pupils are thinking rather than what they are doing: 'active engagement takes place in the brain'.[footnote 142]
Practice opportunities with diagnostic feedback[footnote 143]	Teachers may promote opportunities to practise the components of composite tasks outlined in the curriculum section; this will be more effective if there are regular opportunities for feedback.

Feedback and guidance

The diagnostic feedback mentioned in Table 6 is one of the most important learning opportunities that a teacher can offer:

"Formative "developmental" assessment in music is far more important than making summative judgements as it helps pupils and teachers understand the learning process better and work out the range of possible next steps."[footnote 144]

Research into feedback in education this century has highlighted some important principles for teachers to apply:[footnote 145]

Table 7: Research into feedback from 'The power of feedback'

Principle	Example
If a pupil does not know enough about a topic, then they do not need feedback, they need more instruction.	Example: A novice attempting a C major scale without being sure where C is needs instruction in the geography of the keyboard.
Feedback needs to be context-specific, not general.	Example: A pupil playing all the accents of the son clave rhythm on the beats of a 4/4 bar needs aural and/or verbal feedback to hear where the syncopation happens.
Feedback should require the student to do more work, not the teacher.	Example: Avoid extensive written feedback that would be better expressed as a musical demonstration for the pupil to respond to.

Principle	Example
Feedback needs to be non-threatening to the pupil's sense of self.	Example: Locate the error in the musical action rather than innate musicality.
Praise the task, not the pupil.	Example: Locate the success in the quality of the pupil's playing rather than the quality of their being.
Task feedback is most powerful when it addresses faulty conceptions as opposed to a complete misunderstanding.	Example: Correcting an analysis of G as the subdominant in C major is useful only if the pupil knows what C, G, major, tonic, subdominant and dominant mean.

The feedback that takes place frequently in a classroom will often be the error feedback that will support progress.[footnote 146] This error feedback is most usefully given at the component level.[footnote 147] The clear articulation of these components in the school curriculum supports teachers to identify these components in their feedback; good formative assessment, as with summative assessment, requires 'a clear and concise conceptualization of what is to be learned'.[footnote 148] Components have the advantage of this clarity, unlike level descriptors, which are summative in nature and are 'effectively grades in prose'.[footnote 149]

Components give teachers the opportunity for assessing declarative and procedural knowledge to identify areas for feedback without resorting to summative assessments of composites. Examples might include:

- whether pupils learning about song-writing know named chords and can use them in inversions or with idiomatic rhythm
- checking pupils' knowledge of the treble clef before starting to play a new melody
- checking whether pupils can aurally recognise, for example, a sitar, tanpura, bansuri and tabla before aural analysis of north Indian classical music

In providing opportunities for developmental feedback, decisions need to be made about who provides this feedback. Research suggests that, in particular for novices, the feedback needs to be from someone with much greater expertise. This is highly likely to be a teacher, because the metacognition needed to analyse and correct errors is weak in novice musicians.[footnote 150]

Differences between novices and experts inform teaching practice more broadly, particularly in deciding on the level of guidance from teachers:

- Guidance is important for all pupils, as is demonstrated for even the most advanced pupils who become experts through deliberate practice.[footnote 151]
- It is particularly important for novices.[footnote 152]

Musically, an example of explicit guidance could be in gaining the concept of a riff. For pupils to understand riffs, rather than merely encountering them, teachers might plan:

- listening to riffs in a variety of music styles
- consolidating this aural understanding at well-spaced gaps
- playing some riffs from well-known songs
- consolidating this procedural knowledge at well-spaced gaps
- improvising riffs on the pentatonic scale across a number of lessons at well-spaced-out intervals

This is not to say that this concept cannot be learned informally. In fact, this particular concept is probably most often learned informally. The claim is that in a classroom music setting constrained by time and cognitive load, carefully planned instruction will see the greatest number of pupils having the longest lasting understanding of the concept.

Musical guidance is likely to often include the modelling of musical examples as a method of demonstrating process and quality,[footnote 153] confirming the usefulness of teacher expertise in the music that they are teaching.

Based on the above, high-quality music education may have the following features

- Clarity over the components which will form the basis for formative assessment.
- High levels of guidance for novices, remembering that pupils in every key stage are sometimes novices, with increasing freedom as pupils gain greater competence.

Pupil attention and motivation

As well as exploring the importance of judgements about guidance and feedback, the review will also look at the role of learner attention and motivation. So far, we have looked at the evidence for sequencing and consolidation in long-term memory; it is important to also examine the role of significant or personal experiences.

Children's attention is often limited and highly sought after. In a world where the average teenager's smartphone screen-time may be 4 hours a day, education is competing with the instant gratification provided by the social media giants.[footnote 154] While education will ultimately be more rewarding, the gratification it affords is hugely delayed in comparison. The challenge is exacerbated by the fact that the amount of attention that can be given by pupils is hugely constrained.[footnote 155] The consequences of this limited attention are large and extend to the myth of multitasking under conscious control:

"In any multitask situation whenever we have to perform multiple cognitive operations under the control of attention, at least one of the operations is slowed down or forgotten altogether."[footnote 156]

The implications for classroom practice of these findings around attention are illuminated by further research:

Table 8: Implications for the classroom from research on attention

Findings from research	Implications for the classroom
Pupils are more limited in their ability to think metacognitively while they are learning new material.[footnote 157]	Without good feedback, pupils may just continually play through pieces of music without stopping to isolate and improve mistakes.[footnote 158]
Task structure should be simple and consistent so that pupils' attention can be given to the important musical aspects of the curriculum.[footnote 159]	Changing the surface structure of a task takes attention away from the underlying desired learning. Keeping the unimportant aspects consistent leaves more space for thinking about crucial details such as dynamics and phrasing.
Ambient noise in classrooms can hinder pupils' concentration.[footnote 160]	Music classrooms will hopefully be filled with musical noise much of the time. All noise is not equal, however, and a calm, peaceful classroom will, when appropriate, help all pupils.
When students are allowed to use their smartphones in class, their performance suffers, even months later, when they are tested on the specific content of that day's class.[footnote 161]	Smartphones appear to offer exciting new horizons to music teaching and there is no doubt they could be useful. It is increasingly clear, however, that they can be a detriment to pupils' ability to focus.[footnote 162]
Inattention breeds invisibility.[footnote 163] Pupils will not even have paid attention to the lesson content, let alone remember it.	We cannot be sure whether pupils are paying attention all the time – and indeed, this would be an unachievably high bar. Nevertheless, teachers might usefully remember that all humans filter out the vast majority of what we see and hear. Some learning, such as the tacit knowledge of musical styles, will happen anyway. Other learning, such as how to use and understand musical notation or play a D major chord on a guitar, will not.

Another well-known and advocated finding is that attention is social.[footnote 164] This can have both a positive and negative impact, similar to the 'Matthew effect':[footnote 165] if attention is influenced by our peers, then large amounts of group attention creates more attention from waverers and large amounts of inattention does the same.

Whole-school policies can impact on the culture of attention and adherence[footnote 166] but the individual teacher is only in control of the environment in one class. The creation of an effective learning environment will be an important factor in enhancing pupils' attention and motivating them with interest in the subject. Motivation, of course, helps pupils' levels of attention enormously:

"When pupils are motivated, they pay more attention, put in more effort, persist for longer, and are able to work more independently."[footnote 167]

First, it is important to note that good outcomes can enhance intrinsic motivation.[footnote 168] Providing tasks that have a well-judged level of challenge that pupils can complete is a positive step in the cycle of attainment and motivation. Principles for tasks being 'well-judged' take into consideration the fact that humans have:

- no curiosity for the unsurprising
- no attraction to tasks that are over-complex and, therefore, confusing[footnote 169]

Overly simple or complex tasks may therefore lead to boredom or avoidance. In judging this balance, teachers may wish to bear in mind the short available curriculum time and the level of simplicity this implies for many pupils.

As well as the thinking around task level, there is plenty of evidence that social and cognitive support can help motivation.[footnote 170] This can come through adults or from work with peers, which has the potential to create a virtuous cycle of effort and engagement. As ever, teachers need to make a judgement about when group work will enhance motivation and learning[footnote 171] and when it will not, given the possibility that suboptimal behaviour might ensue.[footnote 172]

In motivating music pupils, there is a case for allowing some ‘student agency’ in their choice of repertoire, with caveats around how dominant this aspect is.[footnote 173] In a study in Sweden, where student agency is a central feature of the music curriculum, pupils appreciate their agency but also feel that repertoire lacks diversity.[footnote 174]

“As a result of a sharp focus on personal social development and individual students’ musical interests, music education in Sweden has become relatively limited in terms of repertoire, content and teaching methods.”[footnote 175]

The case for student choice in repertoire could sit uncomfortably with a pre-planned curriculum. Pupils cannot choose what they do not know exists, so an excessive weight on student choice denies the overall goal of schooling. However, there is no reason why teachers should not give pupils some opportunities to choose repertoire. Teachers should be aware of the possible benefits, and judge when choice will motivate and when it will not.[footnote 176]

Returning to the power of significance in memory, this review also looks at the importance of teachers setting up the powerfully rewarding experiences that support the attention and motivation that underpin learning.[footnote 177] Emotion, or affect, might be one of the most significant factors that determine how and what we remember.[footnote 178] Music is a powerful way of creating human emotion. It is therefore not surprising that memorable musical experiences are a strong predictor of life-long musical learning.

It is the nature of these memorable experiences that they are a strong deviation from the norm. Attempts to create them will sometimes succeed and sometimes fail, and the same lessons and events will succeed or fail differentially depending on the pupil (and so teachers should not be judged on their ability to suddenly ‘be motivating’ during period 4 on a Wednesday). Nevertheless, it is in these occasional significant lessons, concerts or trips that the memories that fuel a life-long love of music will be made. Their contribution is central to any understanding of good music education.

Based on the above, high-quality music education may have the following features

- Occasional outlying moments of powerful emotional impact, created deliberately through careful planning or through seizing the moment and running with it.
- Recognition that attention filters out most of what pupils perceive and that it should not be wasted on ephemera.

Assessment

Summary

This section will focus on assessment that is marked, which can be summative or formative. Less formal assessment was covered in our section on feedback and guidance. One purpose of marking is to enable teachers and school leaders to judge whole-curriculum effectiveness. This summative assessment should be infrequent so as not to distort the delivery of the curriculum. Short-term performance does not always equal long-term learning. A second purpose is to enable teachers to spot gaps and misconceptions in pupils’ learning. A third purpose, or effect, of testing pupils is as a learning activity in and of itself. Testing supports pupils in retaining knowledge in long-term memory. For the latter 2 points, it is worth highlighting that marking does not always need to be recorded to have been useful.

Marked assessment

One of the great challenges for teachers is how to make judgements without negatively affecting the education of our pupils in the process. Teachers and leaders often feel boxed in by a version of the philosophical question about the noise made by unobserved trees falling in forests: if a pupil makes progress and no-one has documented it, has it taken place?

One purpose of marking pupils’ work, as opposed to the informal assessment written about earlier, is to tell pupils, teachers and curriculum designers how well the curriculum has been delivered. This process needs to be managed very carefully so that assessment is used to check on curriculum effectiveness rather than the curriculum being driven by providing evidence for the assessment. Burdensome documentation of progress should be avoided and assessment lessons where learning is interrupted for the purpose of verifying progress may not be a good use of time.[footnote 179]

The reportable examples of this summative assessment include headline public exams at key stages 4 and 5 and non-statutory reporting from schools to parents in key stages 1 to 3, as well as instrumental grade exams by external examination boards. The assessments all confront a similar major obstacle, which is that there are no universal features of music that allow an assessment of attainment in the domain as a whole:[footnote 180]

“More constrained models of specific musical skills or understanding seem to be more successful in explaining musical behaviour and predicting development in a limited number of domains.”[footnote 181]

It may be better to accept this and then narrow the scope for claims that can be inferred about musicality from assessment. As an example, ABRSM piano grades predict technique and expression in piano performance and do not extrapolate one instance of musicality into a wider claim. Curriculum designers may wish to bear this in mind when designing and interpreting assessments at key stages 1 to 3.

Assessment at key stages 4 and 5

Pupils' performance in a summative examination should be the result of complex layers of learning developed cumulatively across many years of study. Too much focus on examination content in earlier stages of learning is likely to be unhelpful because it may limit pupils' opportunities to develop this wider knowledge and therefore their capacity to learn and remember later content. Assessment in the early parts of the courses will more usefully be the formative assessment of components that allow the pupils to develop high-quality composites, such as performances or compositions.

Table 9: Assessment at the end of term 1 in Year 10

Formative assessment of components	Summative assessment of composites
Procedural and declarative knowledge of chords Procedural and declarative knowledge of bass lines Declarative knowledge of how articulation, metre, tempo and tonality link to sound Features quiz on aural identification of the musical features of bhangra and reggae	A completed composition Full melody dictation Analysis of set works GCSE listening questions

Schools should be careful, when setting target grades, about using correlations to make predictions:

"It makes no sense to tie music students' musical achievement to their scores on standardized maths and reading scores."[footnote 182]

In addition, many pupils who take GCSE and A-level music have one-to-one tuition outside the school curriculum. What target grades mean in this context, given the uneven playing field, is unclear.

Assessment at key stages 1 to 3

At key stages 4 and 5, the design of summative assessment is decided outside schools, but in the foundation years, schools have to design their own assessments. If a school wants to report progress once a term, evidenced through a summative assessment, that might amount to a summative assessment every 5 to 10 hours of learning in music (compared with every 40 hours of learning in mathematics). This could lead to assessment driving the curriculum and is a chief danger of subject assessment schedules being driven by one-size-fits-all, school-wide policies.

The curriculum section of this review set out 3 pillars of progression in music education. These could be borne in mind when devising assessments and their interaction over time. Teachers may want to consider progression along these continua and try to avoid attempting to shoehorn unrelated topics into pathways of progression using generic criteria.

Table 10: Interaction of pillars and lesson activities

	Technical	Constructive	Expressive
Performing	Gradual, iterative development of motor skill, playing and singing with increasing accuracy and confidence.	Increasingly fluent use of musical elements in performance	Increasing expression in performance and understanding of musical context and provenance
Composing	Development of motor skill to enable exploration and production of ideas	Knowledge and handling of the components of composition	Increasing sophistication and creativity in musical outcomes
Listening	Development of the inner ear	Conscious awareness of musical elements and their use	Increasing knowledge of musical pieces, genres and cultures

There are 3 points that need to be drawn out further:

- Linearity – some aspects of progression in music may be quite linear, such as the development of technique on an instrument or the gradual increase of declarative knowledge; and others, such as consistency of compositional quality, will not.[footnote 183]
- Consolidation – the amount of consolidation needed for any procedural knowledge to be learned well enough to support the next stage of progression will be significant. Assessment schedules should not assume that one instance of success equals long-term learning and, on this basis, require pupils to demonstrate further 'progress' a term later.
- Quality – as it is particularly hard to reliably judge musical quality, it might be tempting to focus too heavily on technical progression. Musical quality in, for instance, performance is an important part of musical judgement.[footnote 184]

Assessment in early years

Assessment in the early years is highly unlikely to be focused on summative assessments and will be most effective when centred on supportive, encouraging feedback. In line with advice that is generally given, leaders and teachers in early years settings should avoid excessive assessment that takes children away from opportunities to learn and to make music. Instead, leaders and teachers could consider careful observations of whole-class activities involving music – noting whether children are able to clap in time and sing at the right pitch, and whether they know songs and tunes off by heart.

Assessment of music through work in books or through photographs of them engaged in musical activities is of limited use in the early years. It is more important to observe children's musical responses, either live or through recordings. However, book-sharing activities can also incorporate opportunities to share and check whether pupils have foundational knowledge, such as remembering the names of musical instruments. A picture of a class visit to see a brass band play can also be used to help pupils recall words and concepts associated with that activity. This would also serve as a useful time for teachers to check what pupils know.

Based on the above, high-quality music education may have the following features

- Judicious use of summative assessment to check on curriculum effectiveness.
- Use of assessment to identify pupil misconceptions or missing areas of understanding.
- Use of assessment as part of the learning process itself.

Systems at subject/school level

Summary

A high-quality music education depends on effective subject and school leadership. This starts with allocating sufficient curriculum time to teach the music curriculum. The wider musical life of a school will be underpinned by staff having time outside their curriculum hours to run the clubs, workshops and trips that provide the memorable experiences central to a life-long love of the subject. This will be hard for single-person departments or when staff are expected to manage this while also teaching a full curriculum load. Musical activities are often vertical, which can be hard to manage in a school system that mostly works horizontally (for instance, by year group). Schools with a strong musical culture will find creative solutions to enable music to flourish alongside other subjects.

Features of strong school systems

Having evaluated a range of evidence, this review suggests the following features of school systems that are likely to enable high-quality music education.

First, adequate curriculum time will support teachers in enabling learning to take place – the recent 'Model music curriculum' published by the Department for Education suggests at least an hour a week.[footnote 185] Ofsted highlighted the negative impact of limited curriculum time on the quality of the music education in schools in our previous report on music.[footnote 186]

This current review also notes the distorting effects of inappropriate whole-school systems on the operation of music departments. Within the curriculum, these might include assessment schedules, progression models and generic teaching strategies. The wider life of a music department is, like physical education, unusual among the foundation subjects. Good music departments are often underpinned by 3 learning environments:

- music in the classroom (the 'taught curriculum'), compulsory until Year 9, then optional for examination classes (GCSE, BTEC, A level)
- instrumental and vocal tuition (in groups or one-to-one) and ensemble membership
- musical 'events' and opportunities, for example singing in assembly, concerts and shows, trips to professional concerts[footnote 187]

On an organisational level, the success of points 2 and 3 is dependent on music departments being able to run lessons, ensembles and concerts in groupings that are:

- often vertical (for example, choirs)
- one-/two-to-one (for example, instrumental lessons)
- at times that either clash with curriculum lessons or are outside normal contact hours

Few other subjects are so dependent on this necessary flexible support from the school and its systems to flourish. The activities that music entails also have financial implications, particularly given the social justice imperative to ensure equality of opportunity for involvement in the school's musical provision.

In primary schools, an additional consideration is teachers' continual professional development (CPD) and the curriculum support they receive in a subject in which many do not feel confident.[footnote 188] Research suggests that CPD which focuses on the teachers as musicians will be beneficial.[footnote 189] By developing teachers' musicianship, their confidence and understanding in delivering a quality musical education to pupils will be enhanced.

The review started by highlighting the rich diversity of educational pathways that fuel England's musical life. As we re-build after the COVID-19 (coronavirus) pandemic, it is this diversity of excellence that can show the pathways towards greater equality of musical opportunity and the decisions taken by schools will be central to any revival.

Conclusion

This review has explored a range of evidence relating to high-quality music education. It has identified features that might sit behind high-quality curriculums at primary and secondary levels. It is not a simple checklist of activities that we expect to see in school music (and should not be made into one), since there are various ways that schools can construct and teach high-quality music curriculums. Rather, it outlines a conception of quality curricular construction in music viewed through the lens of the education inspection framework.

At the start of the review, we stated that, to become successful musicians, pupils must develop both their conscious and unconscious minds so that they might live in a mountain range instead of a copse. The songwriter experimenting, organist improvising, MC rapping or reviewer making judgements are all able to ply their craft because their art has moved beyond the boundaries of the conscious mind as a result of the knowledge they have gained. While much of this knowledge will be used unconsciously, this does not mean it will be unthinking, cold or mechanical. We are not computers.

In this review, we have focused on how the components of a music curriculum may be best learned in the classroom. While the composites that spring from them will often be more than mere sums of their parts, we have set out the worth of understanding these component parts. Our understanding sits apart from one philosophical tradition of the mind, a tradition that looks back to Descartes and beyond in its view that 'the mind is entirely indivisible'.[footnote 190] That thinking on indivisibility impacts on views of the soul, the mind, human understanding, great art, creative processes, musical meanings, the technical underpinnings of expressive performance and knowledge of the words that allow us to speak of music. To understand the component parts of our wider understanding and capabilities, however, is to illuminate them, not to reduce them. Shining this light on the components of musicality is to liberate our pupils from some of the boundaries that constrain us before we gain more knowledge of the world. In music, this enables pupils to perform the sublime creations of others, to explore their own creative potential and, through wider listening, to come to a broader understanding of musical culture and meaning. Our musical inheritances, as citizens of the UK and citizens of the world, stand among the great wonders of humankind. Our pupils deserve to engage richly with this tradition.

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1. I Cross, 'Music, mind and evolution', in 'Psychology of Music', Volume 29, Issue 1, 2001, pages 95 to 102; I Cross, 'Music, cognition, culture, and evolution', in 'The cognitive neuroscience of music', edited by I Peretz and RJ Zatorre, Oxford University Press, 2003, pages 42 to 56.
2. 'Education inspection framework' (https://www.gov.uk/government/publications/education-inspection-framework/education-inspection-framework), Ofsted, May 2019.
3. 'Education inspection framework – overview of research' (https://www.gov.uk/government/publications/education-inspection-framework-overview-of-research), Ofsted, January 2019; 'Principles behind Ofsted's research reviews and subject reports' (https://www.gov.uk/government/publications/principles-behind-ofsteds-research-reviews-and-subject-reports/principles-behind-ofsteds-research-reviews-and-subject-reports), Ofsted, March 2021.
4. 'Music by numbers' (https://www.ukmusic.org/research-reports/music-by-numbers-2020/), UK Music, 2020.
5. 'List of best-selling albums of the 21st century' (https://en.wikipedia.org/wiki/List_of_best-selling_albums_of_the_21st_century), Wikipedia.
6. D Henley, 'Music education in England: a review by Darren Henley for the Department for Education and the Department for Culture, Media and Sport' (https://www.gov.uk/government/publications/music-education-in-england-a-review-by-darren-henley-for-the-department-for-education-and-the-department-for-culture-media-and-sport), Department for Education and Department for Digital, Culture, Media and Sport, February 2011; 'The importance of music: a national plan for music education' (https://www.gov.uk/government/publications/the-importance-of-music-a-national-plan-for-music-education), Department for Education, November 2011.
7. 'The importance of music: a national plan for music education' (https://www.gov.uk/government/publications/the-importance-of-music-a-national-plan-for-music-education), Department for Education, November 2011.
8. 'Music education: state of the nation', All-Party Parliamentary Group for Music Education, University of Sussex and Incorporated Society of Musicians, February 2019; N Bath, A Daubney, D Mackrill and G Spruce, 'The declining place of music education in schools in England', in 'Children & Society', Volume 34, Issue 5, 2020, pages 443 to 457.
9. A Daubney and D Mackrill, 'Changes in secondary music curriculum provision over time 2012–16: summary of the research', University of Sussex, 2017.
10. G Folkestad, 'Formal and informal learning situations or practices vs formal and informal ways of learning', in 'British Journal of Music Education', Volume 23, Issue 2, 2006, pages 135 to 145; JA Sloboda, JW Davidson, MJA Howe and DG Moore, 'The role of practice in the development of performing musicians', in 'British Journal of Psychology', Volume 87, Issue 2, 1996, pages 287 to 309.
11. A Daubney and D Mackrill, 'Changes in secondary music curriculum provision over time 2012–16: summary of the research', University of Sussex, 2017.
12. 'Key stage 4 performance 2019 (revised)' (https://www.gov.uk/government/statistics/key-stage-4-performance-2019-revised), Department for Education, February 2020.
13. 'A level and other 16 to 18 results: 2018 to 2019 (revised)' (https://www.gov.uk/government/statistics/a-level-and-other-16-to-18-results-2018-to-2019-revised), Department for Education, January 2020.
14. S Hallam, 'The power of music: its impact on the intellectual, social and personal development of children and young people', in 'International Journal of Music Education', Volume 28, Issue 3, 2010, pages 269 to 289; S Hallam, 'The power of music: a research synthesis of the impact of actively making music on the intellectual, social and personal development of children and young people', International Music Education Research Centre, 2015; G Welch, S Hallam, A Lamont, K Swanwick, L Green, S Hennessy, G Cox, S O'Neill and G Farrell, 'Mapping music education research in the UK', in 'Psychology of Music', Volume 32, Issue 3, 2004, pages 239 to 290.
15. S Dehaene, 'How we learn: the new science of education and the brain', Penguin Publishing Group, 2020; JR Lucas and J Gromko, 'The relationship of musical pattern discrimination skill and phonemic awareness in beginning readers', in 'Contributions to Music Education', Volume 34, 2007, pages 9 to 17; RL Gordon, HM Fehd and BD McCandliss, 'Does music training enhance literacy skills? A meta-analysis', in 'Frontiers in Psychology', Volume 6, Issue 1777, 2015, pages 1 to 16; EM George and D Coch, 'Music training and working memory: an ERP study', in 'Neuropsychologia', Volume 49, Issue 5, 2011, pages 1083 to 1094; S Bergman Nutley, F Darki and T Klingberg, 'Music practice is associated with development of working memory during childhood and adolescence', in 'Frontiers in Human Neuroscience', Volume 7, Issue 926, 2013, pages 1 to 9; T Gill, 'The relationship between taking a formal music qualification and overall attainment at key stage 4', Cambridge Assessment, 2020; S Hallam and K Rogers, 'The impact of instrumental music learning on attainment at age 16: a pilot study', in 'British Journal of Music Education', Volume 33, Issue 3, 2016, pages 247 to 261.

16. HR Keene, ‘The arts as handmaiden’, in ‘Debates in primary education’, Routledge, 2020, pages 107 to 124.
17. G Sala and F Gobet, ‘Cognitive and academic benefits of music training with children: a multilevel meta-analysis’, in ‘Memory and Cognition’, Volume 48, Issue 8, 2020, pages 1429 to 1441.
18. M Boccia, L Piccardi, L Palermo, R Nori and M Palmiero, ‘Where do bright ideas occur in our brain? Meta-analytic evidence from neuroimaging studies of domain-specific creativity’, in ‘Frontiers in Psychology’, Volume 6, Issue 1195, 2015, pages 1 to 12; J Baer, ‘Is creativity domain specific?’, in ‘The Cambridge handbook of creativity’, edited by JC Kaufman and RJ Sternberg, Cambridge University Press, 2010, pages 321 to 341.DK Detterman, ‘The case for the prosecution: transfer as an epiphenomenon’, in ‘Transfer on trial: intelligence, cognition, and instruction’, edited by DK Detterman and RJ Sternberg, Ablex Publishing, 1993, pages 1 to 24; G Sala and F Gobet, ‘Does far transfer exist? Negative evidence from chess, music, and working memory training’ (http://journals.sagepub.com/doi/10.1177/0963721417712760), in ‘Current Directions in Psychological Science’, Volume 26, Issue 6, 2017, pages 515 to 520; B Caplan, ‘The case against education’, Princeton University Press, 2018.
19. KN Dunbar, ‘How scientists really reason: scientific reasoning in real-world laboratories’, in ‘The nature of insight’, edited by RJ Sternberg and JE Davidson, MIT Press, 1995, pages 365 to 395.
20. KA Ericsson, N Charness, P Feltovich and R Hoffmann, ‘The Cambridge handbook of expertise and expert performance’, Cambridge University Press, 2006, quote on page 821.
21. WG Chase and HA Simon, ‘Perception in chess’, in ‘Cognitive Psychology’, Volume 4, Issue 1, 1973, pages 55 to 81.
22. PJ Feltovich, MJ Prietula and KA Ericsson, ‘Studies of expertise from psychological perspectives’, in ‘The Cambridge handbook of expertise and expert performance’, edited by KA Ericsson, N Charness, PJ Feltovich and RR Hoffman, Cambridge University Press, 2006, pages 41 to 68.
23. AC Lehmann and KA Ericsson, ‘Research on expert performance and deliberate practice: implications for the education of amateur musicians and music students’, in ‘Psychomusicology: A Journal of Research in Music Cognition’, Volume 16, Issue 1 to 2, 1997, pages 40 to 58; AC Lehmann, ‘The acquisition of expertise in music: efficiency of deliberate practice as a moderating variable in accounting for sub-expert performance’, in ‘Perception and cognition of music’, edited by I Deliege and JA Sloboda, Psychology Press, 1997, pages 161 to 187; F Platz, R Kopiez, AC Lehmann and A Wolf, ‘The influence of deliberate practice on musical achievement: a meta-analysis’, in ‘Frontiers in Psychology’, Volume 5, Issue 646, 2014, pages 1 to 13; D Hargreaves, AC Cork and T Setton, ‘Cognitive strategies in jazz improvisation: an exploratory study’, in ‘Canadian Journal of Research in Music Education’, Volume 33, 1991, pages 47 to 54.
24. S Dehaene, ‘Conciousness and the brain: deciphering how the brain codes our thoughts’, Viking, 2014; D Kahneman, ‘Thinking, fast and slow’, Penguin, 2012; DT Willingham, ‘Why don’t students like school?’, John Wiley & Sons Inc., 2009.
25. ‘Education inspection framework – overview of research’ (https://www.gov.uk/government/publications/education-inspection-framework-overview-of-research), Ofsted, January 2019.
26. JMJ Murre and J Dros, ‘Replication and analysis of Ebbinghaus’ forgetting curve’ (https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0120644), in ‘PLoS ONE’, Volume 10, Issue 7, 2015, pages 1 to 23; GA Miller, ‘The magical number seven, plus or minus two: some limits on our capacity for processing information’, in ‘Psychological Review’, Volume 63, Issue 2, 1956, pages 81 to 97.
27. PA Kirschner, J Sweller and RE Clark, ‘Why minimal guidance during instruction does not work: an analysis of the failure of constructivist, discovery, problem-based, experiential, and inquiry-based teaching’, in ‘Educational Psychologist’, Volume 41, Issue 2, 2006, pages 75 to 86; JAC Hattie and GM Donoghue, ‘Learning strategies: a synthesis and conceptual model’ (https://www.nature.com/articles/npjscilearn201613), in ‘Nature Partner Journals: Science of Learning’, Volume 1, Issue 16013, 2016, pages 1 to 13.
28. SJ Morrison, SM Demorest and LA Stambaugh, ‘Enculturation effects in music cognition’, in ‘Journal of Research in Music Education’, Volume 56, Issue 2, 2008, pages 118 to 129; M Polanyi, ‘The tacit dimension’, Doubleday & Company, 1966; M Polanyi, ‘Personal knowledge: towards a post-critical philosophy’, University of Chicago Press, 1958; B Tillmann, JJ Bharucha and E Bigand, ‘Implicit learning of tonality: a self-organizing approach’, in ‘Psychological Review’, Volume 107, Issue 4, 2000, pages 885 to 913; EE Hannon and SE Trehub, ‘Tuning in to musical rhythms: infants learn more readily than adults’, in ‘Proceedings of the National Academy of Sciences’, Volume 102, Issue 35, 2005, pages 12639 to 12643; G Soley and EE Hannon, ‘Infants prefer the musical meter of their own culture: a cross-cultural comparison’, in ‘Developmental Psychology’, Volume 46, Issue 1, 2010, pages 286 to 292.
29. M Polanyi, ‘The tacit dimension’, Doubleday & Company, 1966.
30. EJ Gibson and AD Pick, ‘An ecological approach to perceptual learning and development’, Oxford University Press, 2000, quote on page 187.
31. J Sloboda, ‘Exploring the musical mind: cognition, emotion, ability, function’, Oxford University Press, 2005, quote on page 248.
32. S Hallam and A Bautista, ‘Processes of instrumental learning: the development of musical expertise’, in ‘Vocal, instrumental, and ensemble learning and teaching: an Oxford handbook of music education’, edited by GE McPherson and GF Welch, Oxford University Press, 2018, pages 108 to 125.
33. M Fayol, ‘From declarative and procedural knowledge to the management of declarative and procedural knowledge’, in ‘European Journal of Psychology of Education’, Volume 9, Issue 3, 1994, pages 179 to 190; J Sweller and P Chandler, ‘Why some material is difficult to learn’, in ‘Cognition and Instruction’, Volume 12, Issue 3, 1994, pages 185 to 233; P Owens and J Sweller, ‘Cognitive load theory and music instruction’, in ‘Educational Psychology’, Volume 28, Issue 1, 2008, pages 29 to 45; T de Jong, ‘Cognitive load theory, educational research, and instructional design: some food for thought’, in ‘Instructional Science’, Volume 38, Issue 2, 2010, pages 105 to 134; F Paas and JJG van Merriënboer, ‘Cognitive-load theory: methods to manage working memory load in the learning of complex tasks’, in ‘Current Directions in Psychological Science’, Volume 29, Issue 4, 2020, pages 394 to 398.
34. GA Miller, ‘The magical number seven, plus or minus two: some limits on our capacity for processing information’, in ‘Psychological Review’, Volume 63, Issue 2, 1956, pages 81 to 97; N Cowan, ‘The magical number 4 in short-term memory: a reconsideration of mental storage capacity’, in ‘Behavioral and Brain Sciences’, Volume 24, Issue 1, 2001, pages 87 to 114.
35. J Sweller and P Chandler, ‘Why some material is difficult to learn’, in ‘Cognition and Instruction’, Volume 12, Issue 3, 1994, pages 185 to 233.

36. C Kidd, ST Piantadosi and RN Aslin, 'The Goldilocks effect: human infants allocate attention to visual sequences that are neither too simple nor too complex' (https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0036399), in 'PLoS ONE', Volume 7, Issue 5, 2012, pages 1 to 8.
37. EL Bjork and RA Bjork, 'Making things hard on yourself, but in a good way: creating desirable difficulties to enhance learning', in 'Psychology and the real world: essays illustrating fundamental contributions to society', edited by MA Gernsbacher, RW Pew, LM Hough and JR Pomerantz, Worth Publishers, 2011, pages 56 to 64; D Christodoulou, 'Making good progress? The future of assessment for learning', Oxford University Press, 2017; D Wiliam, 'Embedded formative assessment', Solution Tree Press, 2011; J Sweller, JJG van Merriënboer and F Paas, 'Cognitive architecture and instructional design: 20 years later', in 'Educational Psychology Review', Volume 31, Issue 2, 2019, pages 261 to 292; E Pollock, P Chandler and J Sweller, 'Assimilating complex information', in 'Learning and Instruction', Volume 12, Issue 1, 2002, pages 61 to 86; JAC Hattie and GM Donoghue, 'Learning strategies: a synthesis and conceptual model' (https://www.nature.com/articles/npjscilearn201613), in 'Nature Partner Journals: Science of Learning', Volume 1, Issue 16013, 2016, pages 1 to 13; D Rohrer and K Taylor, 'The effects of overlearning and distributed practice on the retention of mathematics knowledge', in 'Applied Cognitive Psychology', Volume 20, Issue 9, 2006, pages 1209 to 1224.
38. G Claxton, 'The future of teaching', Routledge, 2021.
39. RA Duke, AL Simmons and CD Cash, 'It's not how much; it's how: characteristics of practice behavior and retention of performance skills', in 'Journal of Research in Music Education', Volume 56, Issue 4, 2009, pages 310 to 321; AL Simmons, 'Distributed practice and procedural memory consolidation in musicians' skill learning', in 'Journal of Research in Music Education', Volume 59, Issue 4, 2012, pages 357 to 368.
40. JA Groeger and S Brady, 'Differential effects of formal and informal driver training', Department for Transport, 2004.
41. JA Sloboda, JW Davidson, MJA Howe and DG Moore, 'The role of practice in the development of performing musicians', in 'British Journal of Psychology', Volume 87, Issue 2, 1996, pages 287 to 309; H Jørgensen and S Hallam, 'Practising', in 'Oxford handbook of music psychology', edited by S Hallam, I Cross, and M Thaut, 2nd edition, Oxford University Press, 2016.
42. KA Ericsson, RT Krampe and C Tesch-Römer, 'The role of deliberate practice in the acquisition of expert performance', in 'Psychological Review', Volume 100, Issue 3, 1993, pages 363 to 406.
43. A Lehmann, 'Effort and enjoyment in deliberate practice: a research note', in 'Research in and for higher music education', edited by IM Hanken and SG Nielsen, Norwegian Academy of Music, 2002, pages 55 to 68; R Hyllegard and T Bories, 'Deliberate practice theory: relevance, effort and inherent enjoyment of music practice', in 'Perceptual and Motor Skills', Volume 107, Issue 2, 2008, pages 439 to 448.
44. S Engelmann, 'War against the schools' academic child abuse', Halcyon House, 1992; PJ Hinds, 'The curse of expertise: the effects of expertise and debiasing methods on prediction of novice performance', in 'Journal of Experimental Psychology: Applied', Volume 5, Issue 2, 1999, pages 205 to 221.
45. GE McPherson, 'From child to musician: skill development during the beginning stages of learning an instrument', in 'Psychology of Music', Volume 33, Issue 1, 2005, pages 5 to 35; RA Duke, AL Simmons and CD Cash, 'It's not how much; it's how: characteristics of practice behavior and retention of performance skills', in 'Journal of Research in Music Education', Volume 56, Issue 4, 2009, pages 310 to 321.
46. GE McPherson and JM Renwick, 'A longitudinal study of self-regulation in children's musical practice', in 'Music Education Research', Volume 3, Issue 2, 2001, pages 169 to 186; FM Zaromb, JD Karpicke and HL Roediger, 'Comprehension as a basis for metacognitive judgments: effects of effort after meaning on recall and metacognition', in 'Journal of Experimental Psychology: Learning, Memory, and Cognition', Volume 36, Issue 2, 2010, pages 552 to 557; S Hallam, 'The development of metacognition in musicians: implications for education', in 'British Journal of Music Education', Volume 18, Issue 1, 2001, pages 27 to 39; S Hallam, 'The development of expertise in young musicians: strategy use, knowledge acquisition and individual diversity', in 'Music Education Research', Volume 3, Issue 1, 2001, pages 7 to 23.
47. F Platz, R Kopiez, AC Lehmann and A Wolf, 'The influence of deliberate practice on musical achievement: a meta-analysis', in 'Frontiers in Psychology', Volume 5, Issue 646, 2014, pages 1 to 13.
48. AM Haith and JW Krakauer, 'The multiple effects of practice: skill, habit and reduced cognitive load', in 'Current Opinion in Behavioral Sciences', Volume 20, 2018, pages 196 to 201.
49. G McPhail, 'The search for deep learning: a curriculum coherence model', in 'Journal of Curriculum Studies', 2020, pages 1 to 15.
50. KA Ericsson and W Kintsch, 'Long-term working memory', in 'Psychological Review', Volume 102, Issue 2, 1995, pages 211 to 245.
51. B Oakley and T Sejnowski, 'Learning how to learn', Penguin Random House, 2018.
52. RV Lindsey , JD Shroyer, H Pashler and MC Mozer, 'Improving students' long-term knowledge retention through personalized review', in 'Psychological Science', Volume 25, Issue 3, 2014, pages 639 to 647.
53. M Carrier and H Pashler, 'The influence of retrieval on retention', in 'Memory & Cognition', Volume 20, Issue 6, 1992, pages 633 to 642.
54. B Oakley and T Sejnowski, 'Learning how to learn', Penguin Random House, 2018.
55. M Young, D Lambert, C Roberts and M Roberts, 'Knowledge and the future school: curriculum and social justice', Bloomsbury Academic, 2014.
56. R Smith, D Sims, A Rabiasz and J Tattersall, 'NFER teacher voice omnibus' (https://www.nfer.ac.uk/nfer-teacher-voice-omnibus-may-to-july-2016-survey-dfe-questions/), The National Foundation for Educational Research, January 2017; A Daubney and D Mackrill, 'Changes in secondary music curriculum provision over time 2012–16: summary of the research', University of Sussex, 2017.
57. 'Music in schools – wider still, and wider' (https://www.gov.uk/government/publications/music-in-schools), Ofsted, March 2012.
58. WH Schmidt, HC Wang and CC McKnight, 'Curriculum coherence: an examination of US mathematics and science content standards from an international perspective', in 'Journal of Curriculum Studies', Volume 37, Issue 5, 2005, pages 525 to 559.
59. M Fautley and A Daubney, 'Some thoughts on curriculum in music education', in 'British Journal of Music Education', Volume 36, Issue 1, 2019, pages 1 to 4.

60. DT Willingham, ‘Why don’t students like school?’, John Wiley & Sons Inc., 2009.
61. H Stobart and I Cross, ‘The Andean Anacrusis? Rhythmic structure and perception in Easter songs of Northern Potosí, Bolivia’, in ‘British Journal of Ethnomusicology’, Volume 9, Issue 2, 2000, pages 63 to 92; P Toiviainen and T Eerola, ‘Where is the beat? Comparison of Finnish and South African listeners’, in ‘Proceedings of the 5th Triennial Escom Conference’, 2003, pages 501 to 504.
62. G Buzsáki, ‘The brain from inside out’, Oxford University Press, 2019.
63. J Becker, ‘Time and tune in Java’, in ‘The imagination of reality: essays in Southeast Asian coherence systems’, edited by AL Becker and AA Yengoyan Norwood, 1979, pages 197 to 210; K Berger, ‘Bach’s cycle, Mozart’s arrow’, University of California Press, 2007.
64. S Dehaene, ‘How we learn: the new science of education and the brain’, Penguin, 2020.
65. S Dehaene, ‘How we learn: the new science of education and the brain’, Penguin, 2020.
66. A Baddeley, ‘Working memory’, Oxford University Press, 1986; J Sweller, ‘Working memory, long-term memory, and instructional design’, in ‘Journal of Applied Research in Memory and Cognition’, Volume 5, Issue 4, 2016, pages 360 to 367; J Sweller, PL Ayres and S Kalyuga, ‘Cognitive load theory’, Springer, 2011.
67. S Kalyuga, ‘Effects of learner prior knowledge and working memory limitations on multimedia learning’, in ‘Procedia – Social and Behavioral Sciences’, Volume 83, 2013, pages 25 to 29, quote on page 28.
68. B Oakley and T Sejnowski, ‘Learning how to learn’, Penguin Random House, 2018; G Claxton, ‘The future of teaching’, Routledge, 2021.
69. KA Ericsson and W Kintsch, ‘Long-term working memory’, in ‘Psychological Review’, Volume 102, Issue 2, 1995, pages 211 to 245; S Dehaene, ‘How we learn: the new science of education and the brain’, Penguin, 2020; JA Sloboda, B Hermelin and N O’Connor, ‘An exceptional musical memory’, in ‘Music Perception’, Volume 3, Issue 2, 1985, pages 155 to 169.
70. J Stockard, TW Wood, C Coughlin and CR Khoury, ‘The effectiveness of direct instruction curricula: a meta-analysis of a half century of research’, in ‘Review of Educational Research’, Volume 88, Issue 4, 2018, pages 479 to 507; T Oates, ‘Could do better: using international comparisons to refine the national curriculum in england’, in ‘The Curriculum Journal’, Volume 22, Issue 2, 2011, pages 121 to 150.
71. RE Mayer, ‘Should there be a three-strikes rule against pure discovery learning?’, in ‘American Psychologist’, Volume 59, Issue 1, 2004, pages 14 to 19.
72. IG Andersen and SC Andersen, ‘Student-centered instruction and academic achievement: linking mechanisms of educational inequality to schools’ instructional strategy’, in ‘British Journal of Sociology of Education’, Volume 38, Issue 4, 2017, pages 533 to 550; PA Kirschner, J Sweller and RE Clark, ‘Why minimal guidance during instruction does not work: an analysis of the failure of constructivist, discovery, problem-based, experiential, and inquiry-based teaching’, in ‘Educational Psychologist’, Volume 41, Issue 2, 2006, pages 75 to 86.
73. PA Kirschner and C Hendrick, ‘How learning happens: seminal works in educational psychology and what they mean in practice’, Routledge, 2020, quote on page 277.
74. L Vaquero, K Hartmann, P Ripollés, N Rojo, J Sierpowska, C François, E Càmara, F Tijmen van Vugt, B Mohammadi, A Samii, TF Münte, A Rodríguez-Fornells and E Altenmüller 13, ‘Structural neuroplasticity in expert pianists depends on the age of musical training onset’, in ‘Neuroimage’, Volume 126, 2016, pages 106 to 119.
75. J Sloboda, ‘Music as a language’, in ‘Exploring the musical mind: cognition, emotion, ability, function’, Oxford University Press, 2005; AC Lehmann and KA Ericsson, ‘Research on expert performance and deliberate practice: implications for the education of amateur musicians and music students’, in ‘Psychomusicology: A Journal of Research in Music Cognition’, Volume 16, Issue 1 to 2, 1997, pages 40 to 58; E Altenmüller and S Furuya, ‘Planning and performance’, edited by S Hallam, I Cross and M Thaut, in ‘Oxford handbook of music psychology’, 2nd edition, Oxford University Press, 2016.
76. E Altenmüller and S Furuya, ‘Planning and performance’, edited by S Hallam, I Cross, and M Thaut, in ‘Oxford Handbook of Music Psychology’, 2nd edn, Oxford University Press, 2016.
77. J Sloboda, ‘Exploring the musical mind: cognition, emotion, ability, function’, Oxford University Press, 2005, quote on page 290.
78. S Hallam and A Bautista, ‘Processes of instrumental learning: the development of musical expertise’, in ‘Vocal, instrumental, and ensemble learning and teaching: an Oxford handbook of music education’, edited by GE McPherson and GF Welch, Oxford University Press, 2018, quote on page 110.
79. AC Lehmann and KA Ericsson, ‘Research on expert performance and deliberate practice: implications for the education of amateur musicians and music students’, in ‘Psychomusicology: A Journal of Research in Music Cognition’, Volume 16, Issue 1 to 2, 1997, pages 40 to 58; EF Clarke, ‘Generative principles in music performance’, in ‘Generative processes in music: the psychology of performance, improvisation, and composition’, edited by JA Sloboda, Oxford University Press, 2001.
80. M Bangert and G Schlaug, ‘Specialization of the specialized in features of external human brain morphology’, in ‘European Journal of Neuroscience’, Volume 24, Issue 6, 2006, pages 1832 to 1834; T Elbert, C Pantev, C Wienbruch, B Rockstroh and E Taub, ‘Increased cortical representation of the fingers of the left hand in string players’, in ‘Science’, Volume 270, Issue 5234, 1995, pages 305 to 307; B Gebel, C Braun, E Kaza, E Altenmüller and M Lotze, ‘Instrument specific brain activation in sensorimotor and auditory representation in musicians’, in ‘Neuroimage’, Volume 74, 2013, pages 37 to 44; P Ragert, A Schmidt, E Altenmüller and HR Dinse, ‘Superior tactile performance and learning in professional pianists: evidence for meta-plasticity in musicians’, in ‘European Journal of Neuroscience’, Volume 19, Issue 2, 2004, pages 473 to 478; LH Shaffer, ‘Performances of Chopin, Bach, and Bartok: studies in motor programming’, in ‘Cognitive Psychology’, Volume 13, Issue 3, 1981, pages 326 to 376; J Sloboda, ‘The communication of musical metre in piano performance’, in ‘The Quarterly Journal of Experimental Psychology Section A’, Volume 35, Issue 2, 1983, pages 377 to 396.
81. A Shahin, LE Roberts and LJ Trainor, ‘Enhancement of auditory cortical development by musical experience in children’, in ‘Neuroreport’, Volume 15, Issue 12, 2004, pages 1917 to 1921; C Gaser and G Schlaug, ‘Brain structures differ between musicians and non-musicians’, in ‘The Journal of Neuroscience’, Volume 23, Issue 27, 2003, pages 9240 to 9245; KL Hyde, J Lerch, A Norton, M Forgeard, E Winner, AC Evans and G Schlaug, ‘Musical training shapes structural brain development’, in ‘Journal of Neuroscience’, Volume 29, Issue 10, 2009, pages 3019 to 3025.

82. A Lehmann, H Gruber and R Kopiez, 'Expertise in music', in 'The Cambridge handbook of expertise and expert performance', edited by KA Ericsson, N Charness, PJ Feltovich and RR Hoffman, 2nd edition, Cambridge University Press, 2018, quote on page 543.
83. M Bangert, U Jürgens, U Häusler and E Altenmüller, 'Classical conditioned responses to absent tones' (https://bmcneurosci.biomedcentral.com/articles/10.1186/1471-2202-7-60), in 'BMC Neuroscience', Volume 7, Issue 60, 2006, pages 1 to 13.
84. B Haslinger, P Erhard, E Altenmüller, U Schroeder, H Boecker and AO Ceballos-Baumann, 'Transmodal sensorimotor networks during action observation in professional pianists', in 'Journal of Cognitive Neuroscience', Volume 17, Issue 2, 2005, pages 282 to 293.
85. TF Münte, C Kohlmetz, W Nager and E Altenmüller, 'Superior auditory spatial tuning in conductors', in 'Nature', Volume 409, Issue 6820, 2001, page 580.
86. Y Hirata, S Kuriki and C Pantev, 'Musicians with absolute pitch show distinct neural activities in the auditory cortex', in 'Neuroreport', Volume 10, Issue 5, 1999, pages 999 to 1002.
87. K Swanwick and D Taylor, 'Discovering music: developing the music curriculum in secondary schools', Batsford Educational, 1982.
88. 'National curriculum in England: music programmes of study' (https://www.gov.uk/government/publications/national-curriculum-in-england-music-programmes-of-study), Department for Education, September 2013.
89. C-I Lu, ML Greenwald, Y-Y Lin and SM Bowyer, 'Reading musical notation versus English letters: mapping brain activation with MEG', in 'Psychology of Music', Volume 47, Issue 2, 2019, pages 255 to 269; AC Lehmann and R Kopiez, 'Sight-reading', in 'Oxford handbook of music psychology', edited by S Hallam, I Cross, and M Thaut, 2nd edition, Oxford University Press, 2016.
90. A Castles, K Rastle and K Nation, 'Ending the reading wars: reading acquisition from novice to expert', in 'Psychological Science in the Public Interest', Volume 19, Issue 1, 2018, pages 5 to 51; LC Ehri, SR Nunes, SA Stahl and DM Willows, 'Systematic phonics instruction helps students learn to read: evidence from the National Reading Panel's meta-analysis', in 'Review of Educational Research', Volume 71, Issue 3, 2001, pages 393 to 447; 'Teaching children to read: an evidence-based assessment of the scientific research literature on reading and its implications for reading instruction', National Reading Panel, 2000; YN Yoncheva, VC Blau, U Maurer and BD McCandliss, 'Attentional focus during learning impacts N170 ERP responses to an artificial script', in 'Developmental Neuropsychology', Volume 35, Issue 4, 2010, pages 423 to 445.
91. J Mills and GE McPherson, 'Musical literacy: reading traditional clef notation', in 'The child as musician: a handbook of musical development', edited by GE McPherson, 2nd edition, Oxford University Press, 2015, pages 192 to 207; GE McPherson and A Gabrielsson, 'From sound to sign', in 'The science and psychology of music performance: creative strategies for teaching and learning', edited by R Parncutt and GE McPherson, Oxford University Press, 2002, pages 99 to 116.
92. HR Gudmundsdottir, 'Advances in music-reading research', in 'Music Education Research', Volume 12, Issue 4, 2010, pages 331 to 338.
93. ED Hirsch, 'Why knowledge matters: rescuing our children from failed educational theories', Harvard Education Press, 2016; D Recht and L Leslie, 'Effect of prior knowledge on good and poor readers' memory of text', in 'Journal of Educational Psychology', Volume 80, Issue 1, 1988, pages 16 to 20.
94. AC Lehmann and KA Ericsson, 'Sight-reading ability of expert pianists in the context of piano accompanying', in 'Psychomusicology: A Journal of Research in Music Cognition', Volume 12, Issue 2, 1993, pages 182 to 195.
95. TM Centanni, DM Anchan, M Beard, R Brooks, LA Thompson and SA Petrill, 'Genetic and environmental influences on decoding skills – implications for music and reading' (https://www.frontiersin.org/articles/10.3389/fpsyg.2019.02604/full), in 'Frontiers in Psychology', Volume 10, Issue 2604, 2019, pages 1 to 9; TW Goolsby, 'Profiles of processing: eye movements during sightreading', in 'Music Perception', Volume 12, Issue 1, 1994, pages 97 to 123; JA Sloboda, 'The effect of item position on the likelihood of identification by inference in prose reading and music reading', in 'Canadian Journal of Psychology/Revue Canadienne de Psychologie', Volume 30, Issue 4, 1976, pages 228 to 237; P Fine, A Berry and B Rosner, 'The effect of pattern recognition and tonal predictability on sight-singing ability', in 'Psychology of Music', Volume 34, Issue 4, 2006, pages 431 to 447.
96. M Riess Jones, 'Musical time', in 'Oxford handbook of music psychology', edited by S Hallam, I Cross and M Thaut, 2nd edition, Oxford University Press, 2016, quote on page 125.
97. S Dehaene, 'How we learn: the new science of education and the brain', Penguin, 2020; G Buzsáki, 'The brain from inside out', Oxford University Press, 2019.
98. M Amalric, I Denghien and S Dehaene, 'On the role of visual experience in mathematical development: evidence from blind mathematicians', in 'Developmental Cognitive Neuroscience', Volume 30, 2018, pages 314 to 323.
99. JMP Wilbiks and S Hutchins, 'Musical training improves memory for instrumental music, but not vocal music or words', in 'Psychology of Music', Volume 48, Issue 1, 2020, pages 150 to 159.
100. SC Herholz and RJ Zatorre, 'Musical training as a framework for brain plasticity: behavior, function, and structure', in 'Neuron', Volume 76, Issue 3, 2012, pages 486 to 502; EMM Jonaitis and JR Saffran, 'Learning harmony: the role of serial statistics', in 'Cognitive Science', Volume 33, Issue 5, 2009, pages 951 to 968; D Müllensiefen, B Gingras, J Musil and L Stewart, 'The musicality of non-musicians: an index for assessing musical sophistication in the general population' (https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0089642), in 'PLoS ONE', Volume 9, Issue 2, 2014, pages 1 to 23.
101. S Engelmann and D Carnine, 'Theory of instruction: principles and application', 3rd edition, NIFDI Press, 2016, quote on page 4.
102. S Engelmann and D Carnine, 'Theory of instruction: principles and application', 3rd edition, NIFDI Press, 2016.
103. M Pearce and GA Wiggins, 'Aspects of a cognitive theory of creativity in musical composition', Proceedings of the ECAI02 Workshop on Creative Systems, 2004, pages 17 to 24.
104. A Ockelford, 'Beyond music psychology', in 'Oxford handbook of music psychology', edited by S Hallam, I Cross and M Thaut, 2nd edition, Oxford University Press, 2016, quote on page 883.
105. I Stravinsky, 'Poetics of music in the form of six lessons', Harvard University Press, 1970, quote on page 65.

106. D Christodoulou, ‘Making good progress? The future of assessment for learning’, Oxford University Press, 2017; D Wiliam, ‘Embedded formative assessment’, Solution Tree Press, 2011; J Sweller, JJG van Merriënboer and F Paas, ‘Cognitive architecture and instructional design: 20 years later’, in ‘Educational Psychology Review’, Volume 31, Issue 2, 2019, pages 261 to 292.
107. C Counsell, ‘The very acts of deciding what a component is, of how it might work in complex interplay with other[…]’ (https://twitter.com/Counsell_C/status/1406218980155604992), Twitter, June 2021.
108. JA Plucker, MA Runco and CB Hegarty, ‘Enhancement of creativity’, in ‘Encyclopedia of creativity’, Elsevier, 2011, pages 456 to 460; J Baer, ‘The importance of domain-specific expertise in creativity’, in ‘Roeper Review’, Volume 37, Issue 3, 2015, pages 165 to 178.
109. D Sudnow, ‘Ways of the hand: the organization of improvised conduct’, MIT Press, 1993.
110. RW Weisberg, ‘Expertise and structured imagination in creative thinking: reconsideration of an old question’, in ‘The Cambridge handbook of expertise and expert performance’, edited by KA Ericsson, N Charness, PJ Feltovich and RR Hoffman, Cambridge University Press, 2018, pages 812 to 834; RW Weisberg, ‘On “out-of-the-box” thinking in creativity’, in ‘Tools for innovation’, edited by A Markman and K Wood, Oxford University Press, 2009; RW Weisberg, ‘Creativity: understanding innovation in problem solving, science, invention, and the arts’, John Wiley & Sons Inc., 2006; J Baer, ‘Is creativity domain specific?’, in ‘The Cambridge handbook of creativity’, edited by JC Kaufman and RJ Sternberg, Cambridge University Press, 2010, pages 321 to 341; J Baer, ‘Creativity and divergent thinking: a task-specific approach’, Lawrence Erlbaum Associates, 1993.
111. B Tillmann, JJ Bharucha and E Bigand, ‘Implicit learning of tonality: a self-organizing approach’, in ‘Psychological Review’, Volume 107, Issue 4, 2000, pages 885 to 913; D Huron, ‘Sweet anticipation: music and the psychology of expectation’, MIT Press, 2006; J Sloboda, ‘Exploring the musical mind: cognition, emotion, ability, function’, Oxford University Press, 2005; I Jimenez and T Kuusi, ‘What helps jazz musicians name tunes from harmony? The relationship between work with harmony and the ability to identify well-known jazz standards from chord progressions’, in ‘Psychology of Music’, Volume 48, Issue 2, 2020, pages 215 to 231.
112. J Sloboda, ‘The acquisition of musical performance expertise: deconstructing the “talent” account of individual differences in musical expressivity’, in ‘Exploring the musical mindcognition, emotion, ability, function’, Oxford University Press, 2004, pages 274 to 296; AC Lehmann and KA Ericsson, ‘Research on expert performance and deliberate practice: implications for the education of amateur musicians and music students’, in ‘Psychomusicology: A Journal of Research in Music Cognition’, Volume 16, Issue 1 to 2, 1997, pages 40 to 58; KA Ericsson, ‘The road to excellence: the acquisition of expert performance in the arts and sciences, sports, and games’, Lawrence Erlbaum Associates, 1996; E Altenmüller and S Furuya, ‘Planning and performance’, edited by S Hallam, I Cross and M Thaut, in ‘Oxford Handbook of Music Psychology’, 2nd edition, Oxford University Press, 2016; RM Brown, RJ Zatorre and VB Penhune, ‘Expert music performance: cognitive, neural, and developmental bases’, in ‘Progress in Brain Research’, Volume 217, 2015, pages 57 to 86.
113. R Chaffin and G Imreh, ‘Practicing perfection: piano performance as expert memory’, in ‘Psychological Science’, Volume 13, Issue 4, 2002, pages 342 to 349; A Reid, ‘Variation in the ways that instrumental and vocal students experience learning music’, in ‘Music Education Research’, Volume 3, Issue 1, 2001, pages 25 to 40; EE Hannon and LJ Trainor, ‘Music acquisition: effects of enculturation and formal training on development’, in ‘Trends in Cognitive Sciences’, Volume 11, Issue 11, 2007; RH Woody, ‘Explaining expressive performance: component cognitive skills in an aural modeling task’, in ‘Journal of Research in Music Education’, Volume 51, Issue 1, 2003, pages 51 to 63; A Bautista, M del Puy Pérez Echeverría, J Pozo and BM Brizuela, ‘Piano students’ conceptions of musical scores as external representations: a cross-sectional study’, in ‘Journal of Research in Music Education’, Volume 57, Issue 3, 2009, pages 181 to 202.
114. P Loui, DL Wessel and CL Hudson Kam, ‘Humans rapidly learn grammatical structure in a new musical scale’, in ‘Music Perception’, Volume 27, Issue 5, 2010, pages 377 to 388.
115. EF Clarke, ‘Generative principles in music performance’, in ‘Generative processes in music: the psychology of performance, improvisation, and composition’, edited by JA Sloboda, Oxford University Press, 2001; LH Shaffer, ‘Performances of Chopin, Bach, and Bartok: studies in motor programming’, in ‘Cognitive Psychology’, Volume 13, Issue 3, 1981, pages 326 to 376; J Sloboda, ‘The communication of musical metre in piano performance’, in ‘The Quarterly Journal of Experimental Psychology Section A’, Volume 35, Issue 2, 1983, pages 377 to 396; J Sloboda, ‘The acquisition of musical performance expertise: deconstructing the “talent” account of individual differences in musical expressivity’, in ‘Exploring the musical mindcognition, emotion, ability, function’, Oxford University Press, 2004, pages 274 to 296.
116. LJ Trainor and RJ Zatorre, ‘The neurobiological basis of musical expectations’, in ‘Oxford handbook of music psychology’, edited by S Hallam, I Cross and M Thaut, 1st edition, Oxford University Press, 2008.
117. VN Salimpoor, DH Zald, RJ Zatorre, A Dagher and AR McIntosh, ‘Predictions and the brain: how musical sounds become rewarding’, in ‘Trends in Cognitive Sciences’, Volume 19, Issue 2, 2015, pages 86 to 91; D Huron, ‘Sweet anticipation: music and the psychology of expectation’, MIT Press, 2006.
118. ‘Apollonian and dionysian’ (https://en.wikipedia.org/wiki/Apollonian_and_Dionysian), Wikipedia.
119. G Buzsáki, ‘The brain from inside out’, Oxford University Press, 2019.
120. A Bertinetto, ‘“Do not fear mistakes – there are none” – the mistake as surprising experience of creativity in jazz’, in ‘Education as jazz’, edited by E Zorzi and M Santi, Cambridge Scholars Publishing, 2016.
121. P Sims, ‘The no. 1 enemy of creativity: fear of failure’, in ‘Harvard Business Review’, 2012.
122. V Kinsella and M Fautley, ‘Giving value to musical creativity’, in ‘Creative and critical projects in classroom music: fifty years of sound and silence’, edited by J Finney, C Philpott and G Spruce, Routledge, 2021, pages 65 to 76, quote on page 66.
123. L Green, ‘Music, Informal Learning and the School: A New Classroom Pedagogy’, Ashgate, 2008
124. TM Amabile, ‘Within you, without you: the social psychology of creativity, and beyond’, in ‘Theories of creativity’, edited by MA Runco and RS Albert, Sage, 1990.
125. PA Kirschner, J Sweller and RE Clark, ‘Why minimal guidance during instruction does not work: an analysis of the failure of constructivist, discovery, problem-based, experiential, and inquiry-based teaching’, in ‘Educational Psychologist’, Volume 41, Issue 2, 2006, pages 75 to 86; M Kaschub and J Smith, ‘Minds on music: composition for creative and critical thinking’, Rowman & Littlefield, 2009.

126. 'National curriculum in England: music programmes of study' (https://www.gov.uk/government/publications/national-curriculum-in-england-music-programmes-of-study), Department for Education, September 2013.
127. D Raffman, 'Language, music and mind', MIT Press, 1993; I Cross and E Tolbert, 'Music and meaning', in 'Oxford handbook of music psychology', edited by S Hallam, I Cross and M Thaut, 2nd edition, Oxford University Press, 2016; M Clayton, 'The social and personal functions of music in cross-cultural perspective', in 'Oxford handbook of music psychology', edited by S Hallam, I Cross and M Thaut, 2nd edition, Oxford University Press, 2016; C Koopman and S Davies, 'Musical meaning in a broader perspective', in 'Journal of Aesthetics and Art Criticism', Volume 59, Issue 3, 2001, pages 261 to 273; K Jakubowski and A Ghosh, 'Music-evoked autobiographical memories in everyday life' (https://journals.sagepub.com/doi/full/10.1177/0305735619888803), in 'Psychology of Music', Volume 49, Issue 3, 2021; P Janata, ST Tomic and SK Rakowski, 'Characterisation of music-evoked autobiographical memories', in 'Memory', Volume 15, Issue 8, 2007, pages 845 to 860; LL Cuddy, R Sikka and A Vanstone, 'Preservation of musical memory and engagement in healthy aging and Alzheimer's disease', in 'Annals of the New York Academy of Sciences', Volume 1337, Issue 1, 2015, pages 223 to 231; A Baird, R Gelding, O Brancatisano and W Forde Thompson, 'A preliminary exploration of the stability of music- and photo-evoked autobiographical memories in people with Alzheimer's and Behavioral Variant Frontotemporal Dementia', in 'Music & Science', Volume 3, 2020, pages 1 to 15; L Green, 'Musical meaning and social reproduction: a case for retrieving autonomy', in 'Educational Philosophy and Theory', Volume 37, Issue 1, 2005, pages 77 to 92; AE Krause, S Maurer and JW Davidson, 'Characteristics of self-reported favorite musical experiences', in 'Music & Science', Volume 3, 2020; S Hallam, 'Music psychology in education', Institute of Education, 2006.
128. J Paynter, 'Music in the secondary school curriculum', Cambridge University Press, 1982.
129. DT Willingham, 'Why don't students like school?', John Wiley & Sons Inc., 2009.
130. RJ Dolan, 'Emotion, cognition, and behavior', in 'Science', Volume 298, Issue 5596, 2002, pages 1191 to 1194.
131. RV Lindsey , JD Shroyer, H Pashler and MC Mozer, 'Improving students' long-term knowledge retention through personalized review', in 'Psychological Science', Volume 25, Issue 3, 2014, pages 639 to 647; HL Roediger and JD Karpicke, 'The power of testing memory: basic research and implications for educational practice', in 'Perspectives on Psychological Science', Volume 1, Issue 3, 2006; M Carrier and H Pashler, 'The influence of retrieval on retention', in 'Memory & Cognition', Volume 20, Issue 6, 1992, pages 633 to 642; LA Stambaugh, 'When repetition isn't the best practice strategy: effects of blocked and random practice schedules', in 'Journal of Research in Music Education', Volume 58, Issue 4, 2011, pages 368 to 383; AL Simmons, SE Allen, C Davis Cash and RA Duke, 'Effects of early break intervals on musicians' and nonmusicians' skill learning' (http://journals.sagepub.com/doi/10.1177/0305735617735373), in 'Psychology of Music', Volume 47, Issue 1, 2019, pages 83 to 95.
132. JB Hale, CA Fiorello, R Dumont, JO Willis, C Rackley and C Elliott, 'Differential ability scales – second edition (neuro)psychological predictors of math performance for typical children and children with math disabilities', in 'Psychology in the Schools', Volume 45, Issue 9, 2008, pages 838 to 858; SP Miller and PJ Hudson, 'Using evidence-based practices to build mathematics competence related to conceptual, procedural, and declarative knowledge', in 'Learning Disabilities Research & Practice', Volume 22, Issue 1, 2007, pages 47 to 57.
133. A Ockelford, 'Music, language and autism: exceptional strategies for exceptional minds', Jessica Kingsley Publishers, 2013; V Dormal, V Crollen, C Baumans, F Lepore and O Collignon, 'Early but not late blindness leads to enhanced arithmetic and working memory abilities', in 'Cortex', Volume 83, 2016, pages 212 to 221.
134. K Marshall, 'Making music accessible: teaching students with dyslexia', Associated Board of the Royal Schools of Music, 2019; JW Cassidy, 'Managing the mainstreamed classroom', in 'Music Educators Journal', Volume 76, Issue 8, 1990, pages 40 to 43; 'Music and inclusive teaching: information from B.D.A music' (https://www.bdadyslexia.org.uk/advice/adults/music-and-dyslexia-1), British Dyslexia Association; 'Including pupils with sen and/or disabilities in primary music', Teacher Development Agency; L Ganschow, J Lloyd-Jones and TR Miles, 'Dyslexia and musical notation', in 'Annals of Dyslexia', Volume 44, 1994, pages 185 to 202; EA Draper, 'Teaching students with autism spectrum disorder: strategies for the music classroom', in 'General Music Today', Volume 33, Issue 2, 2020, pages 87 to 89; SL Standerfer, 'Differentiation in the music classroom', in 'Music Educators Journal', Volume 97, Issue 4, 2011; P Owens and J Sweller, 'Cognitive load theory and music instruction', in 'Educational Psychology', Volume 28, Issue 1, 2008, pages 29 to 45.
135. 'Music in schools – wider still, and wider' (https://www.gov.uk/government/publications/music-in-schools), Ofsted, March 2012.
136. JAC Hattie, 'Visible learning: a synthesis of over 800 meta-analyses relating to achievement', Routledge, 2009; A Creech and S Hallam, 'Learning a musical instrument: the influence of interpersonal interaction on outcomes for school-aged pupils', in 'Psychology of Music', Volume 39, Issue 1, 2011, pages 102 to 122; M Manturzewska, 'A biographical study of the life-span development of professional musicians', in 'Psychology of Music', Volume 18, Issue 2, 1990, pages 112 to 139; G McPhail, 'The search for deep learning: a curriculum coherence model', in 'Journal of Curriculum Studies', 2020, pages 1 to 15.
137. T Kane and D Staiger, 'Gathering feedback for teaching combining high-quality observations with student surveys and achievement gains', MET Project Policy and Practice Brief, 2012.
138. JW Stigler and KF Miller, 'Expertise and expert performance in teaching', in 'The Cambridge handbook of expertise and expert performance', edited by KA Ericsson, N Charness, PJ Feltovich and RR Hoffman, 2nd edition, Cambridge University Press, 2018, pages 431 to 452, quote on page 438.
139. EL Bjork and RA Bjork, 'Making things hard on yourself, but in a good way: creating desirable difficulties to enhance learning', in 'Psychology and the real world: essays illustrating fundamental contributions to society', Worth Publishers, 2011, pages 56 to 64.
140. M Csikszentmihalyi, 'Flow: the psychology of optimal experience', 1990.
141. S Dehaene, 'How we learn: the new science of education and the brain', Penguin, 2020.
142. S Dehaene, 'How we learn: the new science of education and the brain', Penguin, 2020, quote on page 179.
143. RT Krampe and KA Ericsson, 'Maintaining excellence: deliberate practice and elite performance in young and older pianists', in 'Journal of Experimental Psychology', Volume 125, Issue 4, 1996, pages 331 to 359; J Hattie and H Timperley, 'The power of feedback', in 'Review of Educational Research', Volume 77, Issue 1, 2007, pages 81 to 112.
144. A Daubney and D Mackrill, 'Planning music in the national curriculum', in 'Planning the primary national curriculum: a complete guide for trainees and teachers', edited by K Sewell, 2nd edition, SAGE, 2018, quote on page 256.

145. J Hattie and H Timperley, 'The power of feedback', in 'Review of Educational Research', Volume 77, Issue 1, 2007, pages 81 to 112; B Wisniewski, K Zierer and J Hattie, 'The power of feedback revisited: a meta-analysis of educational feedback research', in 'Frontiers in Psychology', Volume 10, Issue 3087, 2020, pages 1 to 14.
146. D Wiliam and P Black, 'Meanings and consequences: a basis for distinguishing formative and summative functions of assessment?', in 'British Educational Research Journal', Volume 22, Issue 5, 1996, pages 537 to 548; B Wisniewski, K Zierer and J Hattie, 'The power of feedback revisited: a meta-analysis of educational feedback research', in 'Frontiers in Psychology', Volume 10, Issue 3087, 2020, pages 1 to 14; VW Davis, 'Error reflection: embracing growth mindset in the general music classroom', in 'General Music Today', Volume 30, Issue 2, 2017, pages 11 to 17.
147. D Christodoulou, 'Making good progress? The future of assessment for learning', Oxford University Press, 2017; D Wiliam, 'Embedded formative assessment', Solution Tree Press, 2011.
148. M Fautley and R Colwell, 'Assessment in the secondary music classroom', in 'Music learning and teaching in infancy, childhood, and adolescence: an Oxford handbook of music education', edited by G McPherson and G Welch, Oxford University Press, 2018, pages 257 to 276, quote on page 265.
149. D Christodoulou, 'Making good progress? The future of assessment for learning', Oxford University Press, 2017, quote on page 96.
150. GE McPherson and JM Renwick, 'A longitudinal study of self-regulation in children's musical practice', in 'Music Education Research', Volume 3, Issue 2, 2001, pages 169 to 186; S Hallam, 'The development of metacognition in musicians: implications for education', in 'British Journal of Music Education', Volume 18, Issue 1, 2001, pages 27 to 39.
151. KA Ericsson, RT Krampe and C Tesch-Römer, 'The role of deliberate practice in the acquisition of expert performance', in 'Psychological Review', Volume 100, Issue 3, 1993, pages 363 to 406.
152. S Kalyuga, 'Effects of learner prior knowledge and working memory limitations on multimedia learning', in 'Procedia – Social and Behavioral Sciences', Volume 83, 2013, pages 25 to 29.
153. C Keysers, B Wicker, V Gazzola, J-L Anton, L Fogassi and V Gallese, 'A touching sight: SII/PV activation during the observation and experience of touch' (http://www.neuron.org/cgi/content/full/42/2/335/DC1), in 'Neuron', Volume 42, 2004, pages 335 to 346; RH Woody, 'Explaining expressive performance: component cognitive skills in an aural modeling task', in 'Journal of Research in Music Education', Volume 51, Issue 1, 2003, pages 51 to 63; F Linklater, 'Effects of audio- and videotape models on performance achievement of beginning clarinetists', in 'Journal of Research in Music Education', Volume 45, Issue 3, 1997, pages 402 to 414.
154. M Feeley, 'Screen time survey reveals consumers spend 50 days a year on smartphones' (https://www.thedrum.com/news/2019/05/02/screen-time-survey-reveals-consumers-spend-50-days-year-smartphones), The Drum, 2 May 2019.
155. MM Chun and R Marois, 'The dark side of visual attention', in 'Current Opinion in Neurobiology', Volume 12, Issue 2, 2002, pages 184 to 189; M Sigman and S Dehaene, 'Brain mechanisms of serial and parallel processing during dual-task performance', in 'Journal of Neuroscience', Volume 28, Issue 30, 2008, pages 7585 to 7598; S Marti, JR King and S Dehaene, 'Time-resolved decoding of two processing chains during dual-task interference', in 'Neuron', Volume 88, Issue 6, 2015, pages 1297 to 1307.
156. S Dehaene, 'How we learn: the new science of education and the brain', Penguin, 2020, quote on pages 161 to 162.
157. T Seufert, 'The interplay between self-regulation in learning and cognitive load' (https://linkinghub.elsevier.com/retrieve/pii/S1747938X18301702), in 'Educational Research Review', Volume 24, 2018, pages 116 to 129.
158. GE McPherson and JM Renwick, 'A longitudinal study of self-regulation in children's musical practice', in 'Music Education Research', Volume 3, Issue 2, 2001, pages 169 to 186.
159. JJG van Merrienboer, PA Kirschner and L Kester, 'Taking the load off a learner's mind: instructional design for complex learning', in 'Educational Psychologist', Volume 38, Issue 1, 2003, pages 5 to 13.
160. G Guerra, J Tijms, A Vaessen, A Tierney, F Dick and M Bonte, 'Loudness and intelligibility of irrelevant background speech differentially hinder children's short story reading', in 'Mind, Brain, and Education', Volume 15, Issue 1, 2021, pages 77 to 87.
161. AL Glass and M Kang, 'Dividing attention in the classroom reduces exam performance', in 'Educational Psychology', Volume 39, Issue 3, 2019, pages 395 to 408.
162. C Newport, 'Digital minimalism: choosing a focused life in a noisy world', Penguin Random House, 2019.
163. S Dehaene, 'Conciousness and the brain: deciphering how the brain codes our thoughts', Viking, 2014.
164. S Kirschner and M Tomasello, 'Joint music making promotes prosocial behavior in 4-year-old children', in 'Evolution and Human Behavior', Volume 31, Issue 5, 2010, pages 354 to 364; D Gerry, A Unrau and LJ Trainor, 'Active music classes in infancy enhance musical, communicative and social development', in 'Developmental Science', Volume 15, Issue 3, 2012, pages 398 to 407.
165. D Rigney, 'The Matthew effect: how advantage begets further advantage', Columbia University Press, 2010.
166. T Bennett, 'Creating a culture: a review of behaviour management in schools' (https://www.gov.uk/government/publications/behaviour-in-schools), Department for Education, March 2017.
167. P McCrea, 'Motivated teaching: harnessing the science of motivation to boost attention and effort in the classroom', CreateSpace Independent Publishing Platform, 2020, quote on page 7.
168. G Garon-Carrier, M Boivin, F Guay, Y Kovas, G Dionne, J-P Lemelin, JR Séguin, F Vitaro and RE Tremblay, 'Intrinsic motivation and achievement in mathematics in elementary school: a longitudinal investigation of their association', in 'Child Development', Volume 87, Issue 1, 2016, pages 165 to 175; A Woods-McConney, MC Oliver, A McConney, R Schibeci and D Maor, 'Science engagement and literacy: a retrospective analysis for students in Canada and Australia', in 'International Journal of Science Education', Volume 36, Issue 10, 2014, pages 1588 to 1608; P Evans, GE McPherson and JW Davidson, 'The role of psychological needs in ceasing music and music learning activities', in 'Psychology of Music', Volume 41, Issue 5, 2013, pages 600 to 619; HW Marsh and A O'Mara, 'Reciprocal effects between academic self-concept, self-esteem, achievement, and attainment over seven adolescent years: unidimensional and multidimensional perspectives of self-concept', in 'Personality and Social Psychology Bulletin', Volume 34, Issue 4, 2008, pages 542 to 552.
169. S Dehaene, 'How we learn: the new science of education and the brain', Penguin, 2020.

170. SF Zdzinski, ‘Parental involvement, selected student attributes, and learning outcomes in instrumental music’, in ‘Journal of Research in Music Education’, Volume 44, Issue 1, 1996, pages 34 to 48; JW Davidson, MJA Howe, DG Moore and JA Sloboda, ‘The role of parental influences in the development of musical performance’, in ‘British Journal of Developmental Psychology’, Volume 14, Issue 4, 1996, pages 399 to 412; JA Sloboda, MJA Howe and JW Davidson, ‘Formal practice as a predictor of success or failure in instrumental learning’, in ‘Proceedings of the Third International Conference for Music Perception and Cognition’, University of Liege, 1994; DG Moore, K Burland and JW Davidson, ‘The social context of musical success: a developmental account’, in ‘British Journal of Psychology’, Volume 94, 2003, pages 529 to 549.
171. L Green, ‘Group cooperation, inclusion and disaffected pupils: some responses to informal learning in the music classroom. Presented at the RIME Conference 2007, Exeter, UK’, in ‘Music Education Research’, Volume 10, Issue 2, 2008, pages 177 to 192.
172. L Green, ‘How popular musicians learn: a way ahead for music education’, Ashgate Press, 2002; T Bennett, ‘Teacher proof’, Routledge, 2013.
173. JM Renwick and GE McPherson, ‘Interest and choice: student-selected repertoire and its effect on practising behaviour’, in ‘British Journal of Music Education’, Volume 19, Issue 2, 2002, pages 173 to 188; L Green, ‘Group cooperation , inclusion and disaffected pupils: some responses to informal learning in the music classroom. Presented at the RIME Conference 2007, Exeter, UK’, in ‘Music Education Research’, Volume 10, Issue 2, 2008, pages 177 to 192; N Jeanneret and GM DeGraffenreid, ‘Music education in the generalist classroom’, in ‘The Oxford handbook of music education’, edited by GE McPherson and GF Welch, Oxford University Press, 2012, pages 399 to 416.
174. E Georgii-Hemming and M Westvall, ‘Music education: a personal matter?’, in ‘British Journal of Music Education’, Volume 27, Issue 1, 2010, pages 21 to 33.
175. E Georgii-Hemming and M Westvall, ‘Music education – a personal matter? Examining the current discourses of music education in Sweden’, in ‘British Journal of Music Education’, Volume 27, Issue 1, 2010, pages 21 to 33.
176. I Katz and A Assor, ‘When choice motivates and when it does not’, in ‘Educational Psychology Review’, Volume 19, Issue 4, 2007, pages 429 to 442.
177. L Kvavilashvili, J Mirani, S Schlagman and DE Kornbrot, ‘Comparing flashbulb memories of September 11 and the death of Princess Diana: effects of time delays and nationality’, in ‘Applied Cognitive Psychology’, Volume 17, Issue 9, 2003, pages 1017 to 1031.
178. CY Wan and G Schlaug, ‘Music making as a tool for promoting brain plasticity across the life span’, in ‘Neuroscientist’, Volume 16, Issue 5, 2010, pages 566 to 577; G Schlaug, ‘Music, musicians, and brain plasticity’, in ‘Oxford handbook of music psychology’, edited by S Hallam, I Cross and M Thaut, 2nd edition, Oxford University Press, 2016; FL Roehmann and FR Wilson, ‘Music and child development: the biology of music making: proceedings of the 1987 Denver conference’, 1990; RJ Dolan, ‘Emotion, cognition, and behavior’, in ‘Science’, Volume 298, Issue 5596, 2002, pages 1191 to 1194.
179. M Fautley, ‘Assessment in music education’, Oxford University Press, 2010.
180. S Hallam, ‘The psychology of music’, Routledge, 2018.
181. A Lamont, ‘Musical development from the early years onwards’, in ‘Oxford handbook of music psychology’, edited by S Hallam, I Cross and M Thaut, 2nd edition, Oxford University Press, 2016, pages 399 to 414, quote on page 406.
182. DJ Elliott, M Silverman and GE McPherson, ‘Philosophical and qualitative perspectives on assessment in music education’, in ‘The Oxford handbook of philosophical and qualitative assessment in music education’, edited by DJ Elliott, M Silverman and GE McPherson, Oxford University Press, 2019, quote on page 4.
183. P Burnard and BA Younker, ‘Problem-solving and creativity: insights from students’ individual composing pathways’, in ‘International Journal of Music Education’, Volume 22, Issue 1, 2004, pages 59 to 76.
184. M Fautley and A Daubney, ‘Curriculum and assessment in music education – the research context: an explanation of the process underpinning the production of the ISM materials’, Incorporated Society of Musicians, 2019.
185. ‘Teaching music in schools’ (https://www.gov.uk/government/publications/teaching-music-in-schools), Department for Education, March 2021.
186. ‘Music in schools – wider still, and wider’ (https://www.gov.uk/government/publications/music-in-schools), Ofsted, March 2012.
187. Simon Toyne, ‘Music’ (http://www.jstor.org/stable/10.2307/j.ctv14t475s.13), in ‘What should schools teach?’, UCL Press, 2021, pages 103 to 121.
188. S Hennessy, ‘Overcoming the red-feeling: the development of confidence to teach music in primary school amongst student teachers’, in ‘British Journal of Music Education’, Volume 17, Issue 2, 2000, pages 183 to 196; F Seddon and M Biasutti, ‘Non-music specialist trainee primary school teachers’ confidence in teaching music in the classroom’, in ‘Music Education Research’, Volume 10, Issue 3, 2008, pages 403 to 421.
189. F Seddon and M Biasutti, ‘Non-music specialist trainee primary school teachers’ confidence in teaching music in the classroom’, in ‘Music Education Research’, Volume 10, Issue 3, 2008, pages 403 to 421.
190. R Descartes, ‘Meditations on first philosophy’, 1641.