Longitudinal Research on Music Education and Child Development: Contributions and Challenges

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Abstract
Based on a comprehensive analysis of 39 studies published in academic journals in the past decade (2010–2020), this article discusses the strengths of current research and the challenges that lie ahead for researchers interested in conducting longitudinal research on music education and child development. Among the strengths of the reviewed studies are multi-year projects, diverse study samples and programs, and a wide range of areas of interest—cognitive and neural to socioemotional and musical development. Challenges for future research are described in relation to three main perspectives. The methodological, the first perspective, tackles future challenges in terms of research approaches, population sampling, randomization, replication, and the lack of cross-cultural longitudinal research. The second perspective, the conceptual-philosophical, focuses on how children, music, and music education have been defined—in deliberate or tacit ways—in longitudinal works, and their implications for both research and practice. The third perspective, the political, focuses on the extent to which research on the effects of music education may be interpreted by some as promoting a neoliberal educational agenda. I conclude the article with suggestions for future research.

Keywords
Longitudinal research, child development, development in and through music, middle childhood, music education, learning transfer

Introduction
Longitudinal research offers unparalleled insights into child development in and through music. This type of research design is well aligned with two central tenets of education: the notion that learning is an interactive process that unfolds over the course of time, and that learning promotes changes to one’s knowledge, beliefs, and behaviors (Ambrose et al., 2010). Several longitudinal studies concerning children’s music learning have been published in the past decade. This is, therefore, a good time to reflect on their underlying overall approaches including research questions and methods, and to imagine future directions.

In this article, I examine longitudinal studies on music learning and child development that have been published in peer-review journals in the last 10 years, and discuss them from three methodological, conceptual-philosophical, and political perspectives. There are two main assumptions underlying this article. These are: (a) music learning and development occur across the lifespan with childhood being one important period; and (b) music education can have a positive role in children’s development in multiple ways. For the purpose of this article, the term music education refers to some form of deliberate music learning in groups of similar-age individuals and guided by a teacher or facilitator, with periodical (e.g., weekly) practice sessions in the form of lessons, classes, workshops, or rehearsals occurring in and out of schools. The term child development is understood to describe a multi-layered and
dynamic process that is affected by “all levels of a developing system, the molecular to the cultural” (Smith & Thelen, 2003, p. 258). Although they are intrinsically related, in this article, a distinction is made between development in music, or the development of music-related skills such as singing, improvising, performing, and rhythmic synchronization, and development through music, or the development of “extra-musical” skills like inhibition control, fine-motor skills, and empathizing. Development in and development through music can be connected, respectively, to the concepts of near and far transfer (for a discussion see Miendlarzewska & Trost, 2014). Longitudinal research, in this article, is work that charts children’s development—in and/or through music—for at least one entire school year (roughly 9–10 months), with systematic observations of same-age and matched groups of children.

Longitudinal Studies on Collective Music Education and Child Development (2010–2020): A Critical Review

To get a better sense of the strengths of current longitudinal research and the challenges that lie ahead, I conducted a critical review of studies on the effects of music education on child development that were published between January 2010 and January 2020. Advance online publications journals that make them available were also included. Given that educators tend to favor the term “music education” and that psychologists and scientists seem to employ the term “music training” in their work, these two terms were used in two searches that were conducted in 15 different databases. Search a included the terms “music training,” “children,” and “longitudinal,” and search b “music education,” “children,” and “longitudinal.” Each search revealed more than 3,000 entries, and was then narrowed down through the inclusion of the following additional search terms: English language, education, psychology, learning, peer-review journal, and available online. Using these terms, search a yielded 312 articles, while search b yielded 461. The next step was to generate a single, combined list of sources (a+b) through the elimination of repeated studies and unrelated papers. Abstracts were analyzed individually, resulting in a combined list of 244 sources. The combined list included reviews of literature and meta-analyses (e.g., Cooper, 2019; Dumont et al., 2017; Miendlarzewska, & Trost, 2014), population-level analyses (Guhn et al., 2019), and position papers (e.g., McCormke, 2014; Schellenberg, 2019; Tervaniemi et al., 2018). All 244 studies were then analyzed for their contents. Thirty-nine studies met the following criteria: (a) involved some form of collective music education led by an adult (a teacher or a facilitator); (b) followed a longitudinal design, with at least 9–10 months of music programming, which corresponds to a full school year in many countries; (c) included outcome measures of musical and/or “extra-musical” development; (d) focused on typically developing school-aged children (ages 3–16); (e) compared at least two different groups in at least two different time points; and (f) were published in a peer-reviewed journal between January 2010 and January 2020. A summary of all 39 studies is presented in Table 1, including the journals where they were published, their methods, funding sources, and the music education approaches (where available). Importantly, the aim of this critical review was to gain insights into the strengths and challenges of longitudinal music research involving children, by scrutinizing their approaches and methods.

General Characteristics and Strengths of the Literature

Between 2010 and 2020, several multi-year studies on the effects of music education have been published that suggests this field of research is alive and well. Studies ranged from 1 to 5 years in duration, with one school or calendar year being the most common. Three main types of design emerged:

(a) “pre- and post-test” design, in which two or more groups were tested at baseline (i.e., before induction into a program) and again at the end of a designated time (e.g., a school year or end of a program), with or without additional testing points in between (e.g., Rautenberg, 2015);
(b) “dosage-effect” design, in which children who had attended a music education program for a given amount of time were compared with children who had attended the same program for a smaller or larger amount of time (e.g., Holochwost et al., 2017); and
(c) “pre- and post-test design with follow up” design, or studies in which children were tested repeatedly, and then re-tested some time after their participation in the music program had ended (e.g., Chobert et al., 2014).

The latter type of design was less frequent, and more commonly seen in studies that were based on shorter musical interventions (e.g., Moreno et al., 2011; Neto et al., 2016).

As a collective, 34 out of 39 studies reviewed for this article added information to the body of knowledge on middle childhood—or the period when children are the ages of 6 and 14 (Eccles, 1999). Middle childhood is a time of rapid musical growth and development (see Ilari et al., 2016), and also a time when many children begin to learn musical instruments through private tuition or school music education (see Trainor & Hannon, 2013). Five studies focused on children younger than 5 who were learning music in play-based early childhood music programs (e.g., Brown et al., 2010; Herrera et al., 2011; Linnavalii et al., 2018;
| Author(s), year of publication, and country of origin | Journal | Study participants (number, age at baseline, and sex) | Duration of programs (intervention) and # of testing | Group assignment | Music program | Areas of assessment | Funding Sources |
|-----------------------------------------------------|---------|------------------------------------------------------|------------------------------------------------------|-----------------|---------------|-------------------|----------------|
| Alemán et al., 2017 (Venezuela) | Prevention Science | 2,914 Venezuelan children (age 6–14) at the beginning of the study, low SES | 1 year (2 testing time points) | 2 groups: (a) music early admission (b) music late admission | El Sistema program in 16 núcleos (music centers) | Executive functioning, self- and guardian-reported measures of broad prosocial behavior, difficulties and aggression, prosocial skills, cognitive abilities | Inter-U.S. Development Bank |
| Brown et al., 2010 (U.S.A) | Early Childhood Research Quarterly | Study 1: 194 U.S. children (109 girls, aged 3–5 years, mean age = 47 months, low SES); Study 2: 165 U.S. children and their caregivers (90 girls, aged 3–5 years, mean age = 49 months, low SES) | 1 academic year (2 testing time points) | Study 1: 2 groups: (a) children who attended the program for 1 year (b) children who attended the program for 2 years | Music was taught in conjunction with other arts as part of an integrated early childhood arts education program called “Kaleidoscope.” Children received instruction in music, creative movement, and visual arts through the development of thematic projects | Study 1: Early learning (language, motor skills, social-emotional skills, and self-help); music, creative movement, visual arts (teacher ratings) Study 2: Receptive vocabulary | No information |
| Chobert et al., 2014 (France) | Cerebral Cortex | 24 French children (7 girls, mean age = 8.25) | 2 years of study (3 testing time points) | 2 groups: (a) music, and (b) painting; children received 6 months of music or painting per year for 2 years | Children received 2 weekly music lessons (45 minutes each) on the first year, and once a week (45 min) in the second year; the curriculum was based on a combination of the Kodály and Orff approaches | EEG study: Pre-attentive speech perception | No information |
| Degé et al., 2011 (Germany) | European Journal of Developmental Psychology | 34 German school-aged children (22 girls, aged 9–11) | 2 years (2 testing time points) | Existing groups: (a) EMC, and (b) control (regular music program) | Extended music curriculum (EMC) at school; 3 weekly music lessons, and choir or orchestra | Visual memory, auditory memory, motivation to avoid work, musical aptitude | German Federal Ministry of Education |
| Degé & Schwarzer, 2018 (Germany) | Musicae Scientiae | 30 German children (19 girls, aged 9–11) | 1 year (2 testing time points) | 2 groups: (a) EMC, and (b) control (regular music program) | EMC at school; 3 weekly music lessons (one of which performing with peers), and choir or orchestra | Academic self-concept, organized nonmusical out-of-school activities, IQ, musical aptitude, and motivation | German Federal Ministry of Education |
| Author(s), year of publication, and country of origin | Journal | Study participants (number, age at baseline, and sex) | Duration of programs (intervention) and # of testing | Group assignment | Music program | Areas of assessment | Funding Sources |
|---------------------------------------------------|---------|-----------------------------------------------------|---------------------------------------------------|-----------------|---------------|-------------------|----------------|
| Frankenberg et al., 2016 (Germany)                | Psychology of Music | 159 children (aged 7–11 at the start) immigrant families residing in Germany (87 girls, mean age at first test = 7.84 years) | 1.5 years (2 testing time points) | 2 groups (a) JeKi; (b) choir | School-based music education called “Jedem Kind ein Instrument” (JeKi), beginning with introduction to instruments and small-group instrumental lessons (once a year and later on twice a year) | Frankfurt acculturation scale measuring children’s orientation towards culture of origin and new culture; emotional and social school experiences | German Federal Ministry of Education |
| Goldstein & Winner, 2012 (U.S.A.)                 | Journal of Cognition and Development | 53 U.S. high school students from a competitive performing arts high school* (36 girls, aged 13–16) | 10 months (2 testing time points) | 2 groups: (a) drama students; (b) control (music and visual arts) | In-school music education program at a performing arts high school (no other information) | Theory of mind, empathy, parental questionnaire about arts participation | No information |
| Habibi et al., 2016 (U.S.A.)                      | Developmental Cognitive Neuroscience | 37 U.S. children (12 girls, mean age at baseline = 6.9; low SES) | 2 years (3 testing time points) | 3 groups: (a) music, (b) sports—swim team and soccer; and (c) control | El Sistema-inspired program with 6–7 weekly hours of group instrumental lessons, music fundamentals, ensemble rehearsal, and homework tutoring | EEG study: Tonal perception (passive task), tonal and rhythmic discrimination (active task) | USC Brain & Creativity Research Fund |
| Habibi et al., 2017 (U.S.A.)                      | Cerebral Cortex | 56 U.S. children (23 girls, mean age at baseline = 6.9, low SES) | 2 years (2 testing time points) | 3 groups: (a) music, (b) sports—swim team and soccer; and (c) control | El Sistema-inspired program with 6–7 weekly hours of group instrumental lessons, music fundamentals, ensemble rehearsal, and homework tutoring | Anatomical T1 (MPRAGE), diffusion, and functional MR imaging | USC Brain & Creativity Research Fund |
| Hennessy et al., 2019                             | Frontiers in Neuroscience | 88 U.S. children (36 females, mean age at baseline = 6.81, low SES) | 4 years (5 testing time points) | 3 groups: (a) music, (b) sports—swim team and soccer; and (c) control | El Sistema-inspired program with 6–7 weekly hours of group instrumental lessons, music fundamentals, ensemble rehearsal, and homework tutoring | WASI-II (cognitive abilities), executive function (flanker, animal, and word-color stroop, delayed gratification), anatomical diffusion, and functional MR | USC Brain & Creativity Research Fund |
| Author(s), year of publication, and country of origin | Journal | Study participants (number, age at baseline, and sex) | Duration of programs (intervention) and # of testing | Group assignment | Music program | Areas of assessment | Funding Sources |
|----------------------------------------------------|---------|------------------------------------------------------|---------------------------------------------------|-----------------|---------------|-------------------|-----------------|
| Herrera et al., 2011 (Spain)                       | Psychology of Music | 97 Spanish or Tamazight-speaking preschoolers (44 girls, ages 4–5, low SES) | 2 years (3 testing time points) | 3 groups: (a) phonological awareness training based on words; (b) phonological awareness training based on songs and rhymes; and (c) control | Music program with emphasis on rhymes and songs, with attention to eight components of phonological awareness (e.g., identification of initial, ending, or middle sounds); music lessons were offered twice a week for 1 hour in groups of 15–17 children, at their local preschools | Phonological awareness, Verbal memory, Word naming speed | Ministry of Education and Science in Spain, Feder Funds (European Union), and Vice-Rectorate for Science Policy and Research at the University of Granada, Spain. |
| Holochwost et al., 2017 (U.S.A.)                   | Psychology of Aesthetics, Creativity and the Arts | 265 U.S. children (58% female, 86% African American, in grades 1-8, mean age = 10.2 years, low SES) | 1 year (3 testing time points) | 2 groups: (a) music, (b) control | 39-week El Sistema-inspired program, with 2 daily hours (40 minutes of instruction on an orchestral instrument in small groups, 40 minutes of ensemble rehearsal, plus 40 minutes including snack and transition) | Academic achievement, executive functioning, “dosage effect” of music program | No information |
| Ilari et al., 2016 (U.S.A.)                        | Frontiers in Psychology | 50 U.S. children (19 girls, aged 6–7 at the start of the study, mainly of Latino ethnicity, from low SES) | 1 year (2 testing time points) | 2 groups: (a) music; (b) control | El Sistema-inspired program with 6–7 weekly hours of group instrumental lessons, music fundamentals, ensemble rehearsal, and homework tutoring | Singing, auditory perception (rhythm and pitch), entrainment | USC Zumberge Interdisciplinary Award; USC Brain & Creativity Research Fund |
| Ilari et al., 2018a (U.S.A.)                       | Psychology of Music | 53 U.S. children (22 girls, aged 6–7 at the start of the study, mainly of Latino ethnicity, and from low SES) | 2 years (report based on 3 testing time points) | 3 groups: (a) music, (b) sports—swim team and soccer; and (c) control | El Sistema-inspired program with 6–7 weekly hours of group instrumental lessons, music fundamentals, ensemble rehearsal, and homework tutoring | Pitch-matching and vocal improvisation (creating an end to a given song) | USC Zumberge Interdisciplinary Award; USC Brain & Creativity Research Fund |
| Ilari et al., 2018b (U.S.A.)                       | Music & Science | 45 U.S. children (20 girls, aged 6–7 at the start of the study, mainly of Latino ethnicity, and from low SES) | 3 years (report based on 2 testing time points) | 3 groups: (a) music, (b) sports—swim team and soccer; and (c) control | El Sistema-inspired program with 6–7 weekly hours of group instrumental lessons, music fundamentals, ensemble rehearsal, and homework tutoring | Rhythmic entrainment, Prosocial behaviors, Theory of mind | USC Brain & Creativity Research Fund |

(continued)
| Author(s), year of publication, and country of origin | Journal | Study participants (number, age at baseline, and sex) | Duration of programs (intervention) and # of testing | Group assignment | Music program | Areas of assessment | Funding Sources |
|-----------------------------------------------------|---------|------------------------------------------------------|---------------------------------------------------|-----------------|--------------|-------------------|-----------------|
| Ilari et al., 2019 (U.S.A.)                         | International Journal of Community Music | 46 U.S. children (20 girls, aged 6–7 at the start of the study, mainly of Latino ethnicity, and from low SES) | 4 years (report based on 4 testing time points) | 3 groups: (a) music, (b) sports—swim team and soccer; and (c) control | El Sistema-inspired program with 6–7 weekly hours of group instrumental lessons, music fundamentals, ensemble rehearsal, and homework tutoring | Behavioral and Emotional Screening System— BACH-2-BESS (parents and children), TIPI, community violence measure, family history | USC Brain & Creativity Research Fund |
| Jaschke et al., 2018 (the Netherlands)               | Frontiers in Neuroscience | 147 Dutch children (mean age = 6.4) | 2 years (5 testing time points) | 4 groups: (a, b) music groups, (c) visual arts, and (d) control | In-school lessons on musical concepts, instruments on classical and popular music, followed by instrumental lessons; music program also included collective music making, singing, and improvisation | Executive functioning verbal IQ, academic performance | Horizon Grant of the Netherlands Organization for Scientific Research |
| Linnavalli, et al., 2018 (Finland)                   | Nature – Scientific Reports | 66 Finnish children (41 girls, mean age = 61 months) | 2 school years (4 testing time points) | 2 groups: (a) music; (b) dance | Music program provided in local schools or at music institutes; lessons (45 minutes, once a week) followed the Finnish music preschool tradition consisting of singing, games, rhythmic activities, listening, and moving to music | Phoneme processing, vocabulary, perceptual reasoning, and control inhibition | Graduate School of Humanities and Social Sciences (University of Helsinki), Finnish Cultural Foundation |
| Lorenzo et al., 2014 (Puerto Rico/Spain)            | Procedia-Social and Behavioral Sciences | 213 Puerto Rican children (108 girls, mean age = 42 months) | 2 years (6 testing time points) | 2 groups: (a) music; (b) control | In-school musical program that followed a Gordon-based program in Spanish; the program included singing, playing instruments, movement and improvisation; classes were 20-minutes long (3 times a week), and were taught by early childhood teachers (generalists), who received music training | Child initiative, social relations, creative representation, music and movement, language, and logical thinking | Spanish Ministry of Science and Innovation, Vice-Rector’s Office for Scientific Policy and Research of the University of Granada. |

(continued)
| Author(s), year of publication, and country of origin | Journal | Study participants (number, age at baseline, and sex) | Duration of programs (intervention) and # of testing | Group assignment | Music program | Areas of assessment | Funding Sources |
|--------------------------------------------------|---------|-----------------------------------------------------|--------------------------------------------------|-----------------|---------------|---------------------|-----------------|
| Martins, M. et al., 2018 (Portugal) | Frontiers in Psychology | 74 Portuguese children from low SES (41 girls, mean age = 8.3 years) | 8 months (2 testing time points) | 2 groups: (a) Orff; (b) basketball | In-school Orff music program—instrumental playing, singing, movement | Purdue pegboard test of manual dexterity and bimanual coordination | BIAL Foundation, Portuguese Foundation for Science and Technology, and Music program funded by municipality of Matosinhos |
| Moritz et al., 2013 (U.S.A.) | Reading and Writing Study 1: 30 U.S. preschoolers (13 girls, mean age = 5.6 years) | 1 academic year (2 testing time points) | 2 groups: (a) Kodály; (b) control (Silver-Burdett school music curriculum) | In-school music programs; children in the Kodály group worked on singing a cappella folk songs, rhymes, and singing-game songs; they also received lessons on rhythmic skills, including movement. The curriculum in the control school involved singing along with recorded music, movement, learning about instruments, and the development of musical concepts such as high/low, fast/soft, etc. | Vocabulary, cognitive abilities, and phonological awareness; tasks from the Music Aptitude Test (MAT) by K. Overy were also administered | APA/Institute of Education Sciences Postdoctoral Education Research Training Fellowship; European Project COST ISCH Action TD0904 Time in Mental Activity (TIMELY) |
| Nijs & Leman, 2014 (Belgium) | Computers & Education | 12 Belgian clarinet players (6 girls, aged 5–7) | 9 months (2 testing time points) | 2 groups: (a) clarinet lessons with the Music Paint Machine; (b) traditional clarinet lessons | Clarinet lessons with the use of a special technological device, the Music Paint Machine | Personality, musical aptitude, Self-regulation, Home musical environment, Home study, Classroom experience | Part of another project supported by the Flemish Government |
| Putkinen et al., 2014 (Finland) | Developmental Science | 131 Finnish children from middle or upper-class families (aged 7, 9, 11, 13) | Children participated in 1, 2 or 3 recordings (1–3 testing time points) | 2 groups: (a) music; (b) control | Children played a wide variety of instruments (all started before the age of 7) and attended a school that emphasized music education | No information | (continued) |
| Author(s), year of publication, and country of origin | Journal | Study participants (number, age at baseline, and sex) | Duration of programs (intervention) and # of testing | Group assignment | Music program | Areas of assessment | Funding Sources |
|------------------------------------------------------|---------|------------------------------------------------------|---------------------------------------------------|-----------------|---------------|-------------------|------------------|
| Putkinen et al., 2014b (Finland) | Neurobiology of Learning and Memory | 117 Finnish children from middle or upper class (aged 9, 11, 13) | Children participated in 1, 2 or 3 recordings (1–3 testing time points) | 2 groups: (a) music; (b) control | Children played a wide variety of instruments (all started before the age of 7) and attended a school that emphasized music education | Melodic multi-feature paradigm—Auditory event-related potential (ERP), response mismatch negativity (MMN) | No information |
| Rabinowitch et al., 2013 (UK) | Psychology of Music | 52 British children (28 girls, aged 8–11 years) | 1 academic year (2 testing time points) | 2 groups: (a) MGI; and (b) control | The Musical Group Interaction (MGI) program was based on pre-arranged musical games that encouraged the development of entrainment, imitation, and flexibility through self-other interactions | Emotional empathy (matched faces, Index of empathy, memory task), verbal ability | No information |
| Rautenberg, 2015 (Germany) | Journal of Research in Reading | 159 German children (80 girls, mean age = 7) | 9 months (2 testing time points) | 3 groups: (a) music, (b) visual arts, (c) control | Groups of children (8–12) participated in a music program based on Gordon’s Music Learning Theory; the focus of the program was the development of rhythmic skills, tonal/melodic skills, and auditory discrimination, with rhythm receiving special attention | Musical ability, Cognitive skills, SES, word reading (accuracy, speed, prosody) | No information |
| Rickard et al., 2010 (Australia) | Australian Journal of Music Education | 142 Australian children (78 girls, mean age 8.62–8.79) | 2 years (full sample); 3 years (subset); (3 testing points) | 2 groups: (a) music; (b) control | Classroom-based strings program based on the philosophies of P. Rolland and S. Nelson, incorporating improvisation and musical games, and musicianship; a subset of the control group received training in juggling | Demographics, Word pairs, Digit span, Visual retention, self-esteem | Australian Research Council |
| Author(s), year of publication, and country of origin | Journal | Study participants (number, age at baseline, and sex) | Duration of programs (intervention) and # of testing | Group assignment | Music program | Areas of assessment | Funding Sources |
|-----------------------------------------------------|---------|------------------------------------------------------|---------------------------------------------------|-----------------|---------------|-------------------|-----------------|
| Rickard et al., 2012 (Australia)                   | International Journal of Music Education | 359 Australian students from 9 schools (192 girls; younger cohort in first grade at baseline; older cohort in third grade at baseline) | 2 years (full sample); 3 years (subset); (3 testing points) | 2 groups: (a) music (young and older cohort) (b) control (young and older cohort) | Children in younger cohort received three 30-minute weekly classes based on the Kodaly approach (singing, solfège, hand signs) and children in the older cohort received 1 weekly hour of instrumental music education (strings), aside from their regular music classes; some children in the control group (one school) received 1 hour weekly classes of juggling on the second year | Self-esteem and social skills | Australian Research Council |
| Roden et al., 2012 (Germany)                       | Frontiers in Psychology | 73 German children (36 girls, mean age at baseline = 7.73 years) | 1.5 years (3 testing time points) | 3 groups: (a) music; (b) natural science; (c) control | 45 minutes of weekly instrumental groups lessons for up to 5 children in a group; children also took part in mandatory school music education programs involving through singing, rhythm, and ear training | Cognitive abilities, visual memory, verbal memory | German Federal Ministry of Education and Research |
| Roden et al., 2014 (Germany)                       | Psychology of Music | 50 German children (27 girls, aged 7-8) | 1.5 years (3 testing time points) | 2 groups: (a) music; (b) natural sciences | 45 minutes of weekly instrumental groups lessons in guitar, cello, violin, trumpet, flute, keyboard, or drums (up to 5 children in a group), through JeKi; children also learned music in schools through singing, rhythm, and ear training | Cognitive abilities, working memory, demographics | German Federal Ministry of Education and Research |
| Roden et al., 2016 (Germany)                       | Learning and Instruction | 34 German children (19 girls, mean age = 7.76 years) | 1.5 years (2 testing time points) | 2 groups: (a) music; (b) natural sciences | Children learned music through the JeKi (Jedem Kind ein Instrument) program | Aggression, physiological measures (systolic and diastolic blood pressure, heart rate, cortisol) | German Federal Ministry of Education and Research |
| Author(s), year of publication, and country of origin | Journal | Study participants (number, age at baseline, and sex) | Duration of programs (intervention) and # of testing | Group assignment | Music program | Areas of assessment | Funding Sources |
|---------------------------------------------------|---------|-------------------------------------------------------|----------------------------------------------------|-----------------|--------------|-------------------|-----------------|
| Rose, et al., 2019 (UK)                           | Psychology of Music | 38 British children (21 girls, age range 85–103 months; varied SES and regions in the UK) | 1 year (2 testing time points) | 2 groups: (a) music SSM; (b) music EMT | Children in the SSM received only statutory school music lessons, amounting to less than 1 hour per week; children in the EMT group participated in statutory school music programs and took lessons in keyboard, piano, guitar, trumpet, horn, drum kit, or multiple instruments | Tonal and rhythmic perception, Cognitive abilities, Movement, Visual-motor integration, Memory, Social-emotional behaviors | No funding |
| Santos-Luiz et al., 2016 (Portugal)               | Musicae Scientiae | 110 Portuguese adolescents (aged 11–14) | 3 years (2 testing time points) | 2 groups: (a) specialized education in music curriculum, and (b) general basic education curriculum | School-based music curriculum focusing on ear training, instrumental learning, and choir or orchestra; average of 7 weekly hours | School grades for 6 subjects commonly taught in Portuguese schools, SES, motivation, cognitive abilities | FCT - Portuguese National Funding Agency for Science, Research and Technology |
| Schellenberg et al., 2015 (Canada)                | PLoS ONE | 84 Canadian children (49 girls, average age = 8 years, 8 months) | 1 academic year (2 testing time points) | 2 groups: (a) ukulele; (b) control | 40 minutes of weekly in-school ukulele classes based on curriculum by J. Doane. Program included singing, Curwen hand signs, improvisation, solo and group ensemble performances, and exposure to a wide range of genres; program followed a peer-learning model | Vocabulary, Emotion comprehension, Prosocial Skills, Sympathy | Social Science and Humanities Research Council of Canada |
| Slater et al., 2013 (U.S.A.)                      | PLoS ONE | 60 U. S. children (36 girls, mean age 8.25 years, low SES) | 1 year (2 testing time points) | 2 groups: (a) music; (b) control | El Sistema-inspired after-school music program (orchestra); instrumental class and ensemble (4–5 weekly hours) | Rhythmic development through basic tapping | NAMM Foundation, Grammy Foundation, Knowles Hearing Foundation |
| Slater et al., 2014 (U.S.A.)                      | PLoS ONE | 42 U. S. children (26 girls, aged 6–9, low SES) | 1 year (2 testing time points) | 2 groups: (a) music; (b) control | El Sistema-inspired after-school music program (orchestra); instrumental class and ensemble (4–5 weekly hours) | Silent word reading fluency, oral reading speed, Vocabulary and matrix reasoning | NAMM Foundation, Grammy Foundation, Knowles Hearing Foundation |
| Author(s), year of publication, and country of origin | Journal | Study participants (number, age at baseline, and sex) | Duration of programs (intervention) and # of testing | Group assignment | Music program | Areas of assessment | Funding Sources |
|----------------------------------------------------------|---------|------------------------------------------------------|-------------------------------------------------|-----------------|--------------|-------------------|-----------------|
| Slater et al., 2015 (U.S.A.) | Behavioural Brain Research | 38 U.S. children (21 girls, mean age 97.2–100 months, low SES) | 2 years (3 testing time points) | 2 groups: (a) music group that had 2 years of music education at the final test; (b) music group that had 1 year of music education in the final test | El Sistema-inspired after-school music program (orchestra); instrumental class and ensemble (4-5 weekly hours) | Speech-in-noise hearing test | NAMM Foundation, Grammy Foundation, Knowles Hearing Foundation |
| Van de Vyer et al., 2019 | Applied Developmental Psychology | 216 British children (114 girls, ages 5–10 years; mean age 7.32) | Approximately 1 year | 2 groups: (a) participatory arts (including music); (b) control (regular, mandated school curriculum) | Participatory arts program with teaching artists visiting schools and working with students and staff on stories of kindness and ways to express them; modes of expression included songwriting, writing story books, art installations and community art boards | Empathy and interpersonal prosocial intentions | Economic and Social Research Council, Arts Council of England, University of Kent Vice Chancellor’s Scholarships |
| Yang et al., 2014 (China) | Nature – Scientific Reports | 250 Chinese children (122 girls, mean age 78 months) | Approximately 4 years (11 semesters, 3 testing time points) | 2 groups: (a) private lessons and in-school general music; and (b) in-school general music only | General, in school music classes (45 minutes, once a week); private lessons | Chinese language (L1) consisting of phonology and word knowledge; English language (L2); mathematics | National Science Funding of China, Chinese Ministry of Education Social Science Funding, National Educational Research Key Project. |
Lorenzo et al., 2014; Moritz et al., 2013), rather than instrumental training programs. There are at least two reasons why this is a strength. First, by focusing on general music programs (i.e., those with a focus on music listening, theory, appreciation, movement and/or creation), researchers are addressing an important music learning modality that remains understudied, despite its ubiquity and reach. Second, these studies are relevant because they shed some light on the experiences of preschool children. In many Western countries, preschool-aged children learn music through play-based approaches, which are more holistic and child-centered. These programs are also known to differ from most instrumental music education programs, which tend to be music-centered and teacher-centered (see Young, 2018).

Studying early years' music programs is also critical given how marginal the field of early childhood music education is (Young, 2018), and in spite of beliefs of the early years of life as foundational for child development.

Another strength of the reviewed research is the diversity of study samples. Participants include Tamazight-speaking children in Northern Africa (Herrera et al., 2011), preschoolers attending Head Start programs in the U.S. and in Puerto Rico (Brown et al., 2010; Lorenzo et al., 2014), immigrant children in Germany (Frankenberg et al., 2016), Chinese (Yang et al., 2014), and Venezuelan children and youth (Alemán et al., 2017). And although 34 studies centered on European and North American (mainly U.S.) children, 18 of these focused on children from low SES and/or ethnic minority groups (e.g., Habibi et al., 2017; Slater et al., 2013). The emergence of studies with children varied SES, racial, ethnic, and cultural groups represents a step towards combatting the pervasive criticism that has been aimed at psychological research—and music psychology research by extension—which is a focus on WEIRD populations (White, English speaking, from industrialized, rich and democratic societies) (Heinrich et al., 2010).

Many studies were based on music programs that took place in regular schools, rather than specialist music schools, and in many cases, public rather than private schools. Of the 39 reviewed studies, 24 were based on in-school music programs, 13 focused on after-school, community-based programs, one compared children who took part in compulsory school music education with children who participated in both school music education and private tuition (Rose et al., 2019), and only one was conducted in the context of private instruction (Nijs & Leman, 2014). Given that earlier studies have focused predominantly on private music tuition (e.g., Costa-Giomi, 1999; Schlaug et al., 2005), the focus on collective programs, especially those occurring in schools and centers located in underserved communities (i.e., those with members of minority groups, who experience health and wealth disparities) offers some important insights for music education and helps to partially counter the criticism associated with music education research for focusing primarily on middle-class and affluent children. Also of note was the concerted effort to understand music learning in a large range of music programs. Studied programs ranged from traditional offerings such as Kodály (Rickard et al., 2012), Gordon (Rautenberg, 2015), and a variety of instrumental approaches like El Sistema (Alemán et al., 2017) and El Sistema-inspired (Holochwost et al., 2017) approaches, to more progressive, play-based music education programs for young children (Linnavalli et al., 2018), arts-integrated programs (Brown et al., 2010; Van de Vyer et al., 2019), ukulele classes (Schellenberg et al., 2015), and technological approaches like the Music Paint Machine (Nijs & Leman, 2014). Some researchers have also offered comprehensive descriptions of the music programs and curricula in their studies (e.g., Schellenberg et al., 2015), which is central for the interpretation of research findings (see Lamont, 1998).

A final strength of current studies is the number and configuration of experimental and control groups. Two groups were compared in 26 of the reviewed studies, three groups were compared in nine studies, and four groups in one study (Jaschke et al., 2018). Additionally, 28 out of 39 studies have compared music groups with active control groups of children engaged in areas such as visual arts, drama, dance, sports, and natural sciences (e.g., Chobert et al., 2014; Roden et al., 2014). Within these studies, 12 compared groups of children who underwent a special music program with children who were following a statutory music education program (e.g., Frankenberg et al., 2016). Having active control groups is extremely valuable because participation in any activity may account for children's motivation when engaged with experimental tasks in a longitudinal study.

Challenges Ahead

These studies published in the last decade have provided us with more opportunities to learn about collective music programs (for a discussion on their importance, see Overy, 2012), and music education and child development during middle childhood—particularly in children from the United States and European countries. We are also learning more about the impact of music education in the lives of children from diverse racial, ethnic, linguistic, and cultural groups, who have been relatively absent in the English-language literature. Study designs are also becoming more sophisticated; multi-year data are emerging, and so is concurrent information on different aspects of child development—from brain and cognition to social-emotional and musical skills. But some challenges remain, as we continue to pursue questions about music education and child development. These challenges have been categorized in terms of three interrelated perspectives: the methodological, the conceptual-philosophical, and the political.
**The Methodological Perspective.** A first glance at the methodologies employed in the reviewed studies highlights the predominance of quantitative data, with little to no mentioning of qualitative data or mixed-methods approaches. While qualitative studies examining music and child development and learning were found to exist, these studies typically did not use a longitudinal design (Harkins et al., 2016), nor did they focus on formal music instruction (Persellin, 2016), and thus were not included in the current analysis. Only one study was found to use a mixed-methods approach (Ilari et al., 2018). However, there was a rich diversity of topics and research questions concerning child development, ranging cognitive and neurological to musical, social, emotional, and linguistic areas.

Some areas of study have received more attention from the scholarly community than others, often receiving the unofficial label of “hot topics.” Executive function is one of these areas. There were nine studies addressing this complex construct more directly (e.g., Hennessy et al., 2019; Holochwost et al., 2017; Jaschke et al., 2018). Even within studies on this topic, there were differences in terms of study designs and measures. Executive function involves many complex cognitive subskills such as cognitive flexibility, inhibition control, and working memory (Moriguchi et al., 2016). In one study, all three subskills were examined (e.g., Jaschke et al., 2018); in another only one (e.g., control exhibition, see Linnavalli et al., 2018). The rationale for focusing on one or more subskills varies across studies. Researchers often capitalize on an opportunity to study multiple skills at once, while there is an obvious limitation as to how much data can be collected from participants at a given time. In some cases, researchers may want to study a specific skill in detail, focusing on its subskills (e.g., Jaschke et al., 2018), whereas in others, they may be interested in taking a more “panoramic view” by focusing on multiple skills (Habibi et al., 2014). Both types of studies offer valuable insights into our understanding of potential transfer effects. But having a more similar design applied to different populations would be more likely to provide a clearer picture of the skill or area of interest. That is, while there is reason to celebrate the diversity of questions that are being asked and the multiplicity of methods that are being employed, there is also a clear need for designs where results from different studies can be directly compared, contrasted, and replicated. As we know, replication is fundamental to scientific inquiry (for a discussion, see Ferguson, 2015; Makel & Plucker, 2014), as “the results of one experiment, no matter how dramatic, are insufficient evidence for confirming any hypothesis” (Duke, 2000, p. 11).

Another methodological challenge that has been discussed in some research reports (e.g., Linnavalli et al., 2018) is the randomization of study participants. Random assignment in school settings continues to be a contentious topic in education circles. Nearly 20 years ago, Cook (2001) postulated that random assignment experiments in schools tend to be conducted by researchers from fields other than education, and this seems to be in line with the 25 out of 29 studies summarized in Table 1 (supplementary materials), which were predominantly undertaken within the fields of psychology and cognitive neuroscience. Cook contended that for many scholars in the field of education, random assignment is seen as the core of an inappropriate worldview that obscures each school’s uniqueness, that oversimplifies the complicated nature of cause and effect in a school setting, and that is naïve about the ways in which social science is used in policy debates (p. 64).

Random assignment in schools is also complicated by its many political, administrative, and ethical ramifications, particularly when a study involves some activity or intervention that will only benefit a few (Cook, 2001). Furthermore, random assignment does not account for student motivation to continue playing an instrument, for example, as both individual and environmental issues play important roles (see Cheever et al., 2018 Linnavalli et al., 2018). As Habibi and colleagues (2017) have stressed, keeping children motivated in a longitudinal study is in and of itself a challenge, with random assignment potentially contributing negatively to participant retention, since children are not given a choice in their type of musical engagement. Tervaniemi and colleagues (2018) further suggested that researchers “strongly promote the use of naturalistic real-life group allocations, without randomization” (p. 4). Still, random assignment is important for one to establish causation. How can we solve this dilemma? Can random assignment be applied in a way that honors the culture of schools (and other settings) while maintaining the integrity and rigor of research design? This is an essential issue that merits further discussions as we move forward with longitudinal work.

Aside random assignment, another challenge that researchers will probably continue to face when designing experimental longitudinal studies in music education is locating comparable interventions. How does one go about defining comparable interventions? If two matched groups spend the same amount of time on different activities, should we expect their activity-related development to be equivalent? Is spending 2 hours in a school marching band equivalent to spending the same amount of time in a school-based visual arts program or basketball practice? Or do some program modalities require more individual effort than others, demanding some adjustments to a study design on the part of the researcher? These are important questions to consider. Along the same lines, how do teacher characteristics, expertise, teaching style, and overall program quality impact findings from longitudinal studies? Could some positive findings be associated with strong programs or be a byproduct of the work of excellent teachers? Likewise, could some null findings be associated with less successful programs or less-skilled teachers? A well-known “mantra” in education is that good teachers make all
the difference. Yet, information about music teachers is almost always left out in longitudinal reports (perhaps due to space constraints). These are serious issues that merit future consideration. One way to partly mitigate the issue of program quality is to include measures of "near transfer," or musical learning in a longitudinal study. In this review, less than half of the studies (i.e., 15 out of 39) included measures of music learning. Descriptions of teachers were found in only two studies.

Another issue to consider is the diversity of study samples in longitudinal music research. By uncovering the experiences of children from diverse socioeconomic, cultural, linguistic, and ethnic groups, current research is beginning to paint a picture of "variation within" specific countries (e.g., Habibi et al., 2014). But there is still much more to uncover, including in terms of "variation between" different countries. A serious gap in the literature is the lack of cross-cultural longitudinal work on music education and child development. Longitudinal research is already time-consuming and costly (see Habibi et al., 2015); by adding a cross-cultural layer to these works, these and the previously mentioned methodological challenges are likely aggravated. Cross-cultural research also requires a high degree of flexibility on the part of the research teams, including an understanding of cultures and contexts, as well as how specific data-collection tools and their underlying epistemologies are culture-specific, and not always appropriate for all contexts (see Matsumoto & van de Vijer, 2010). Yet cross-cultural research is also valuable (see Stevens, 2012), especially when one wishes to understand development—in and through music—from a wider perspective. While this review focused on studies published in English, a concerted effort could be made by international scholars to produce reviews of work published in other languages, as well as original studies.

The Conceptual-Philosophical Perspective. Among the conceptual-philosophical challenges that lie ahead are definitions of terms such as "music," "music education," and "child." That is, a first challenge refers to the idea of "music education" as a "black-box" (see Bowmer et al., 2018; Lamont, 1998; Saarikallio, 2019). While some scholars still associate music education exclusively with school music programs (and in many cases, Western "art" music), the field has expanded considerably in the past decades, encompassing multiple settings and forms of music teaching and learning (e.g., choirs, brass bands, orchestras, mariachi groups, jazz ensembles), including through informal approaches (e.g., popular music bands). But "black-boxed thinking" persists in conceptualizations of "music education," and also of "music." The popular press could be partially blamed for spreading such views with their catchy and often contradictory headlines such as "Academic benefits of music 'a myth'" (Devlin, 2013) and "Could playing Tchaikovsky’s 'Nutcracker' and other music improve kids' brains?" (Shapiro, 2014). In these reports, music listening, music performance, and music education are conflated; although each refers to a different form of musical engagement. A well-known example occurred during the late-1990s when the idea of the "Mozart effect," and the claim "music makes you smarter" became widespread (Bangerter & Heath, 2004; Duke, 2000). Yet, this claim was actually based on findings that linked music listening (and not music learning or music making) to spatial abilities (and not general intelligence) (see Rauscher & Hinton, 2006). Researchers can help to combat these "black-boxed" views of music and music education by offering thorough descriptions of music programs, curricula, settings, and, of course, teachers, in their reports.

Another taken-for-granted issue is a conception of "child" that has dominated research, and consequently, the discourses surrounding transfer effects of music education. Many (if not most) of the studies reviewed for this article seemed to endorse the view of children as undergoing a "process of becoming" (James & Prout, 1997), or "an adult in the making" (Uprichard, 2008). An implicit assumption underlying studies based on this conception of child is that children are developing skills in and through music in somewhat predictable ways, with adult skills as end goals. Such an assumption may lead one to arrive at the idea of development as a unidirectional process, despite suggestions of development as a spiraling and recurring process (see Cohen et al., 2020). A contrasting view is that of children as "being," or the child as a social actor actively constructing childhood (Uprichard, 2008). Such view underlines studies of children’s musical engagement that are situated in time, space, and culture, like Gluschankof’s (2019) study on self-initiated musicking of Arabic-speaking children in an Israeli Kindergarten. Reports of children as "being" are often qualitative.

Views of children as "being" or "becoming" are also linked to conceptions of time. Bronfenbrenner and Morris (2006) conceived of time as a tripartite component, including the micro, the meso, and the macro-time. The micro-time refers to what is happening "in the moment." The meso-time relates to the consistency of activities, events, and interactions in one’s life. The macro-time is linked to the socio-historical time (Bronfenbrenner & Morris, 2006). According to Bronfenbrenner and Morris, all three components of time impact human development and should be taken into account in developmental studies. The view of children as "becoming" is usually centered on the meso-time and implies a consistency of activities, whereas the view of children as "being" is typically linked to the micro-time. These contrasting views of the child, and of time, offer different points of departure in research design, and accordingly, different insights and contributions. A challenge for researchers engaged in developmental music research (and not only longitudinal studies) is, therefore, to consider how children are being conceptualized in their research: "being," "becoming," or both. I suggest that the
view of children as undergoing processes of both “being” and “becoming” (for a discussion see Ilari et al., 2018b), will likely offer richer insights into child development, in and through music.

Two other educational issues that represent challenges for developmental longitudinal work in music are also worth mentioning. First, there are differences between formal and informal music learning (see Folkestad, 2006). Out of the 39 reviewed studies, 29 have focused on formal music learning, with instrumental music education (especially Western “art” music) receiving the most attention (e.g., Habibi et al., 2017). Yet, in the field of music education, informal learning has recently gained momentum (Wright, 2016), with much emphasis now being placed on the study of neglected practices like popular music (Green, 2006), community music (Higgins, 2012), and world music pedagogy (Campbell, 2016). Only one study in the critical review was found to center on instruments cultural traditions other than Western “art” music (e.g., the ukulele, see Schellenberg et al., 2015), along with two early childhood studies on play-based curricula (Brown et al., 2010; Limnavalli et al., 2018), and one program focused on songwriting (Van de Vyer et al., 2019). These studies are important as they utilize a more informal approach to music teaching and learning. The remaining programs (i.e., the majority) appeared to be quite formal and traditional (e.g., literacy-based programs; teacher-centered instruction; traditional ensembles such as orchestras) in their approaches to music curricula and repertoire. It follows then that aside from focusing on informal music programs, future research might also benefit from exploring programs that embrace different modes of instruction delivery as some have begun to do (see Putkinen et al., 2014a), as well as on repertoires other than Western “art” music, on music listening and appreciation offerings beyond the preschool years, and on songwriting programs.

Second, the idea of development in and through music relates to some philosophical questions that are often left untouched. What is the potential role of music education in a child’s life? What is the argument for including music as a compulsory subject in the school curriculum? It is noteworthy that 22 out of 39 studies reviewed here focused exclusively on far transfer, eight focused on near transfer (e.g., Ilari et al., 2018b; Putkinen et al., 2014b), and nine included measures on both (e.g., Ilari et al., 2018a). In a provocative essay, Philpott (2009) exposed what he termed “soft justifications for music in the curriculum,” and categorized these into instrumental, therapeutic, civilizing, emotional, rational, symbolic, and liberal justifications. According to Philpott, these justifications “are predicated on the assumption that, at worst, music is seen as servicing other areas of human understanding, and at best as a necessary counterpart to a ‘harder’ and more rational world” (p. 49). Although not always explicit, in many of the reviewed research reports, an underlying assumption was that music learning is eminently good for children, and thus produces “good effects” (for a discussion see Odendaal et al., 2018; Philpott, 2009).

Philpott’s perspective illustrates how an emphasis on far transfer can sometimes be met with suspicion by scholars in music education (see also Rauscher, 1998). Music educators have often preferred to focus their attention on issues of student participation (Krupp-Schleussner & Lehmann-Wermser, 2016), equity, and access to music education (Brasche & Thorn, 2018; Elpus, 2015) than on transfer of skills. Others have focused on issues of effort, sense of accomplishment, skill development, and personal expression (Duke, 2000). At a surface level, these different perceptions of what music education can “do” for students may appear to be framed by pragmatic and tangible issues, as well as different research interests. But on a closer inspection, they expose different underlying epistemologies that frame disciplines like education, psychology, and cognitive neuroscience. Such distinctions are further complicated when advocacy is added to the conversation. As Ferguson (2015) points out,

The difficulty is that advocacy and science are diametrically opposed in method and aim. On an idealistic level, science is dedicated to a search for “truth” theoretically even if that truth is undesired, inconvenient, unpalatable, or challenging to one’s personal or the public’s beliefs or goals. By contrast, advocacy is concerned with constructing a particular message in pursuit of a predetermined goal that benefits oneself or others (p. 533).

When conducting developmental longitudinal music research, it is vital to be attuned to these issues, given the implications of research in educational practice. As Ferguson (2015) suggests, advocacy often gains more attention than science. Thus, a challenge for future researchers is to consider these oppositions. Whereas Ferguson is possibly too pessimistic about a successful meeting of science and advocacy, perhaps one way to proceed, is to work in inter-disciplinary teams, as some have already begun to do. I return to this issue later on.

The Political Perspective

A final challenge relates to the political context that surrounds research on child development in and through music. As we know, childhood education is high on political agendas (Vandenbroeck et al., 2010). In times of neoliberalism, market forces are continuously shaping educational discourses (see Allsup, 2015) by promoting what has been known as the “economic” or “investment” argument in education (Moss, 2013; Vandenbroeck, 2017a). Early childhood education, for example, has often been recognized not so much for what it contributes to children’s lives “in the moment” (again, children in the process of “being”), but for its economic benefits, such as lower levels of incarceration later in life (i.e., children in
the process of “becoming”) (see Reynolds et al., 2011). Some have claimed that instead of focusing on the systemic and unfair distributive policies and consequently, the poverty that disadvantages children the start and on how to combat it, in the current neoliberal era, the logic that dominates is the one of the corporate world and the market (Vandenbroeck, 2017a).

Music education advocacy discourses currently:

- foster the idea that every child can do music and that music is a fundamental aspect of a child’s education—a strategic discursive move that attempts to secure the place of music in schools.
- However, when we deploy these discourses, we fail to recognize that music education is far neutral (Hess, 2017 p. 24).

In other words, music programs are often underpinned by political ideologies. El Sistema and El Sistema-inspired programs, for example, may at times embrace salvationist discourses (see Baker, 2016). Programs that cater to populations underserved communities, in turn, may run the risk of centering in models of deficit that do not contribute to changing the status quo (see Valencia, 2010). It follows, then, that the idea of introducing music (or any other activity) to the curriculum to help students “catch up” or to raise their test scores, might be perceived as a contribution to neoliberal educational agendas. Research on the effects of music education can be viewed in a similar light. As an example, Vandenbroeck (2017a), warns us about the neoliberal discourse that is often attached to neuroscientific and child development research, and consequently, the eminent risk of education being “narrowed down to issues of productivity” (p. 14). In his own words, “when education is instrumentalized as the road towards a predefined goal that lies beyond childhood, this inevitably raises the question about who is entitled to define this goal” (p. 15).

As someone interested in both music (e.g., values) and science (e.g., models of the world), I am obviously torn between the desire to understand how children develop in and through music, and the risk of having this work being interpreted and, moreover, used to promote a neoliberal educational agenda that I am not in agreement with. On the one hand, I believe that developmental studies in music can help us better understand the human experience from a theoretical stance (i.e., the science behind it), and from a more pragmatic viewpoint (i.e., by contributing to education). In other words, I recognize the value of studying transfer of learning in its many forms (see Lamont, 1998; Overy, 1998). On the other hand, I understand the reservations that many music educators have with research investigating learning transfer. At times, such research may come across as over-simplistic and too prescriptive (a criticism that I have heard from music education colleagues; which some view as a lack of comprehension of the many functions of music and music education in a child’s life (see also Rauscher, 1998). One of the problems here is a false dichotomy that emerges in conversations about development in and development through music. Such dichotomous thinking—music as a means versus music as an end—can create tensions between disciplines. An agreed definition of child development could potentially alleviate some of this tension. When development is understood as a complex and dynamic process (and not as linear) involving “being” and “becoming,” it might be easier to conceive of music both as a means and an end. These are central issues that must be taken into consideration, not only when designing and undertaking longitudinal developmental music research, but also when publishing reports.

Where Do We Go Here? Possible Ways Forward

My goal with this article was to review and problematize developmental research studies in music that use a longitudinal design conducted in the last 10 years. It is important to stress that I did not aim to scrutinize the results of each study nor to discuss which musical interventions or study designs were potentially more effective in promoting learning transfer. Future meta-analyses and empirical studies can address these important issues. This report focused specially on a critical analysis of current strengths and challenges of longitudinal research design.

As we have seen, longitudinal musical research is alive and well, although it is not without critics. As noted earlier, I believe that such research may add to our understanding of child development. Yet this review suggests that the voice of music educators may be missing from longitudinal developmental music research, at least in terms of published works. As seen in Table 1 (supplementary materials), most reviewed studies were published in psychology and neuroscience journals, rather than education journals. Out of the 39 reviewed studies, five were published in education journals, and only two in music education journals (Rickard et al., 2010; 2012). Although some research teams were interdisciplinary in nature, only a handful of authors of the 39 reviewed studies were affiliated with music education programs. This is problematic, particularly when studies attempt to draw implications for music education practice. But how can we circumvent this problem? How can music educators become more involved in this conversation?

First and foremost, it would be valuable for graduate programs in music education to encourage students to study and perhaps get involved as research assistants or consultants in longitudinal designs, when possible. Longitudinal designs are, as we know, time-consuming and expensive. They also require a degree of patience on the part of researchers, due to the time that it takes to collect and analyze data, as well as participant retention issues (see Habibi et al., 2015). Additionally, some researchers may be discouraged by the fact that longitudinal research needs to take into account child development over time, and thus effect sizes tend to be small (see Sala & Gobet, 2017). Yet this type of research is important for the field of music.
education. Through effective engagement in longitudinal studies—from study design to preparation of final reports—music educators can make contributions to both research and practice.

Echoing the voices of colleagues from several disciplines, I recognize that developmental music research, longitudinal or cross-sectional, has much to gain from interdisciplinary and intercultural collaborations between music educators, psychologists, neuroscientists, and others (see Cheever et al., 2018). Aside from addressing some of the methodological and conceptual-philosophical challenges that were outlined earlier, interdisciplinary collaborations may also contribute to the political debate associated with research on near and far transfer in music, making a stronger contribution. Such collaborations may be more likely to consider mixed-methods designs. As Yoshiwakawa and colleagues (2008) suggest, mixed-methods designs "are vital to understanding development as a dynamic, transactional process" (p. 344). Interdisciplinary (and “intercultural”) research is not without its challenges, of course. But as Gauvain (2018) suggested, “it helps to remember that the focus is on the problem and not the disciplines, that each participant has a role to play, and that team members need to share knowledge and build on each other’s strengths” (p. 48).

Along with interdisciplinary and intercultural perspectives on longitudinal work lies the need to shift our views in terms of how children and childhood are conceptualized in our research. Once again, mixed-methods designs may help research teams do exactly this: document children’s experiences in and through music as they undergo both processes of being and becoming. Similarly, it is important that researchers avoid the “black-boxed” view of music and music education, by offering thorough descriptions of learners, programs, and the settings where they take place. Because teachers (and facilitators) are known to make a huge difference in the enactment of curricula within different programs; it is important to not only acknowledge this human factor when designing studies, but also to describe teachers and their approaches in full. Inclusion of such information in manuscripts will not only help to eliminate the “black-boxed” view of music and music education, but may potentially curb some of the problems associated with the translation of research into common parlance, as occurred with the “Mozart effect.” The issue of media coverage is afforded by both the rules and constraints of the English language, which is hegemonic in the research world (see Van der Veldenbroeck, 2017b).

Finally, as we design our studies and write our reports, we need to question the extent to which our work may be leading to a prescriptive view of music and music education; where music education may be reduced to a path towards a very specific goal. How we design, conduct, and portray longitudinal studies and the implications that are derived from our findings are part of a political act; one with clear implications for education. To conclude, music education is more than learning notes or developing “extra-musical” skills. Music (and music education by extension) are about ways of being in the world in the past and in the present; in good and in bad ways (Philpott, 2009), in the presence or absence of others, in different educational settings like the school and the home, and across the lifespan (see Pitts, 2012). Future research will benefit from considering these perspectives.

Acknowledgements

I would like to thank Robert Duke for our animated conversations on music as a “black-box,” and Peter Webster for his insights on the possible reasons as to why music educators have not engaged much with longitudinal research designs. I am also grateful to the reviewers and to Katie Overy for their insightful comments on earlier versions of this manuscript.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

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One anonymous reviewer.

Notes

1. A preliminary version of this article was presented at the “Music, Selves and Societies” workshop in June 2018, at the University of Cambridge.

2. Although my definition of music education includes both individual and group experiences, in this review article I purposefully focus on the analysis of collective music education programs.

3. I recognize the likelihood that a body of longitudinal works probably exists in languages other than English. Therefore, I am aware that the studies discussed in this article represent one way of thinking about and reporting research findings; one that is afforded by both the rules and constraints of the English language, which is hegemonic in the research world (see Vandenbroeck, 2017b).

4. Using a search-engine available through the library system of the University of Southern California, the following databases were accessed simultaneously in January 2020: Scopus, ERIC,
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