Learning Theories as Roots of Current Musical Practice and Research

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Numerous theories ground research and practice in the broad domain of music. Theories of psychoacoustics guide the construction of a concert hall, theories of information and expectancy suggest to composers a listener's capacity for music appreciation, theories of musical preference affect a concert programmer's decision making, and theories of measurement influence the construction of a musical aptitude test.

In music education, theories of learning have contributed to an understanding of how the learner processes information and, through corresponding instructional theories, have caused change in instructional practice. Theories of motivation and recent theories of intelligence (Dweck, 1997) assist teachers in eliciting student productivity. Theories of child development govern the construction of age-appropriate subject matter. As both instructional and motivation theories are addressed elsewhere in this part of the Handbook, they have been excluded from the discussion in this chapter.

Learning theories, the topic this chapter is concerned with, have contributed to advances in thinking about educating and teaching the child in settings of formal schooling. Some of these theories have found acceptance and application in research on music learning as well, and they have impacted music educators' thought on how to sequence instruction in the classroom. Some learning theories also have guided sequencing in computer-assisted music instruction. However, depending on the philosophical perspective underlying any particular theory, different degrees of emphasis on behavioral, cognitive, or constructivist thinking have shaped the models used to explain how a child learns and hence to sequencing the instructional steps deemed necessary for effectively teaching a child.

Learning theories specifically derived from behavioral and cognitive psychology have appeared as roots of music education research since the 1960s. Developed outside the field of music, the theories seek to describe, explain, and possibly predict musical behavior. This "outside-in" approach continues to influence music education research and practice today, as many of the constructs used to describe nonmusic behavior also are widely accepted as valid descriptors of music behavior. Music educators have embraced the theories with the argument that musical behavior, as a part of human behavior in general, is subject to the same laws that govern all of learning. Conversely, there are researchers working to create theories of learning unique to music. Unfortunately, these theories of musical learning conceived from "inside" the musical domain continue to be less prevalent though they may have the potential to help music educators better understand the unique process of music learning. This chapter contains two broad sections: (1) a review of how theories from the general field of psychology have been applied to music education, and (2) an examination of research attempting to create learning theories unique to music.

Learning Theories and Their Application to Music

A Brief Chronology

Many important events guided by educators, psychologists, theorists, and researchers have contributed to the prevalence of general learning theories as roots of music education research and practice. These contributions, mostly influenced by educational psychologists, began with the educational and societal transitions of the 1960s. Interest in learning theories gathered momentum during the years of the Ann Arbor Symposia and continue to be impacted by technological advances, the resurgence of interest in "learning through doing," and—related to it—the application of "situated learning" to the study of music learning.

Prior to the 1960s, little evidence supports learning theories as important foundations of hypothesis-driven research in music education. The decade of the 1960s, however, focused on how learning theories could serve in the improvement of curriculum development and instruction. For example, Bruner (e.g., 1960, 1966) introduced theories of conceptual learning that led to a call for developmentally sequenced curricula. Bruner, influenced by the translation of Jean Piaget's research into English, theorized his own developmental stages of learning, which have found wide acceptance in a number of subject matters, including music. At the same time, behaviorist theories focused on the application of stimulus-response learning to the improvement of instructional strategies.

As Mark (1986) observed, the Tanglewood Symposium in 1967 and the resulting Music Educators National Conference (MENC) Goals and Objective (GO) Project in 1969 promoted the "application of significant new developments in curriculum (and) teaching-learning patterns" (p. 59). Bruner's spiral curriculum and emphasis on conceptual learning became the foundation of an elemental approach to teaching music. Aesthetic education (Reimer, 1970) gained momentum as music educators sought to secure the value of the arts in education. Here, too, Bruner's model of learning served as the basis for developing teaching strategies that would reach the goals of aesthetic education.

In the late 1970s and early 1980s, the Ann Arbor Symposia on the Applications of Psychology to the Teaching and Learning of Music reinforced the relationship between learning theories and music education research and practice. Leading music education researchers met with psychologists to determine how knowledge and expertise from both domains could improve scientific inquiry in music education. The original title of the Ann Arbor Symposia, "Implications of Learning Theory to the Teaching and Learning of Music," reveals one of the symposia's purposes: to strengthen the case for research and teaching grounded in learning theory.

In 1978, MENC and the Music Educators Research Council (MERC) created the Special Research Interest Groups (SRIGs). The titles of two of these original interest groups—Perception and Cognition; Learning and Development—indicated the interest in the community of music education researchers to make cognitive learning theories integral components of their work. Since then, the accessibility of the computer has added to the practice of using learning theories as a theoretical basis not only for research on music learning but also for seeking to improve instruction. Programmed instruction based on behavioral learning theories has evolved into computer-assisted instruction (CAI). More recently, computer programmers have created a form of artificial intelligence (AI) that simulates human cognition or thinking; the impact of AI has broadened research involving the learning theory of human information processing (HIP) as well as the constructionist school of thought, which uses interactive models to explain learning. In fact, the renewed interest in Bruner's writings (1990, 1996) as well as recent translations of Vygotsky's teachings from Russian to English (1997a, 1997b) suggest a stronger focus on cognition and constructivism as theoretical bases for explaining the nature of how an individual learns than seems to have been the case for the 1970s and 1980s. Nonetheless, as has been the case with behaviorist learning models, they were always readily and quickly applied to instructional practice, regardless of how systematically their construct validity had been tested.

Major Theoretical Constructs

In this chapter, learning theories are restricted to those identified as behavioral, cognitive, and constructivist. The behavioral model has as its base the linear connection between stimuli that trigger responses. This model allows the researcher to look for those external forces that increase the likelihood of desired behaviors. These models are useful when one studies group or individual behavior in a variety of instructional settings.

Cognitive models describe learning behaviors from a more internal, developmental perspective, in that age, maturation, and perceptual experiences in combination make a learner take in new information in a stepwise process of exposure, reaction to the exposure, examination of the experience, and adjustment of previous experiences to new ones. Such theories stress the description and examination of appropriate internal stimuli on the readiness for new ones. Furthermore, the models seek to explain how an individual negotiates old and new information in relationship to each other. Such an approach requires study of learners as they respond individually to specific tasks.

Constructivist models of learning focus on describing in detail the many relationships that connect the learner to his or her internal as well as external environments. The environments include experiences and contacts with both the physical and the mental world by the learner both as an individual and as a member in a particular group. As the interactive nature of all experiences together results in learning, constructivist theories tend not to separate either internal or external stimuli or what constitutes a stimulus or a response. Similarly, it is not always clear what sets a constructivist theory apart from an instructional theory or, because of the close connection between any such theories and motivation theories, either of the former from the latter.

Constructs of Behavioral Learning Theories. Behavioral learning theories emerged from an effort to move away from the humanistic tradition of analysis through introspection and interpretation. To make research more robust and scientific, directly observable behaviors were to lead to laws of behavior. For behaviorists, learning is

> change in a subject's behavior or behavior potential to a given situation brought about by the subject's repeated experiences in that situation, provided that behavior change cannot be explained on the basis of the subject's native response tendencies, maturation or temporary states. (Bower & Hilgard, 1981, p. 11)

Although goals of behaviorism realize a close relationship between environment and organism and emphasize active learning (Wilson & Myers, 2000), action is ultimately determined by environment rather than by self. There are several theoretical subsets of behaviorism. Of those, *operant conditioning* influenced music education researchers who sought to develop instructional theories derived from behaviorist models.

The theory of *classical conditioning* introduced by Pavlov (1927) claims that a natural emotional response is associated with a neutral stimulus to the extent that the neutral stimulus alone will elicit the response. Building on Pavlov's theory, Thorndike (1932) maintained that a stimulus-response (S-R) connection constituted the basic learning unit. His connectionism included (1) the law of readiness, which maintained that one must be physically and motivationally ready in order to learn; (2) the law of effect, which says that responses followed by satisfaction will be strengthened; and (3) the law of exercise, which regards rewarded practice (as opposed to blind repetition) as key to learning. Watson (1925) defined the mind as a tabula rasa (a blank slate) and postulated both the law of frequency and recency to describe effective reinforcement. Guthrie (1935), via his contiguity theory, asserted that the last or most recent association between stimulus and response is the one that is retained (principle of postremity). He claimed that a single connection between stimulus and response constituted learning. Hull (1951) introduced characteristics of the organism as intervening variables in his stimulus-organism-response (S-O-R) model. Spence (1956) extended Hull's ideas through concepts such as habit strength, drive, and incentive motivation.

The theory of operant conditioning, developed by Skinner (e.g., 1948, 1953, 1968), says that reinforcements strengthen responses, and his law of extinction says the opposite: that lack of reinforcement weakens response. While he came to acknowledge mental events as real and measurable, Skinner consistently held that causes of mental change (learning) lie ultimately in the environment. Nonetheless, rather than a response elicited by the environment, the individual organism (operant) acts on the environment, emitting a response that alters it in some way. Skinner applied these laws extensively to research on instructional practice. He believed that students should enjoy and want to learn, that reinforcement should be consistent and positive, and that because students learn at different paces, instruction should be individualized (Schunk, 2000). Skinner argued that the proper arrangement of reinforcement contingencies (presentation of appropriately broken-down and sequenced material, active student response, immediate and appropriate feedback, individual pacing) are central to effective learning. Theorists building on Skinner's ideas have advocated curricula based on behavioral objectives, programmed instruction, contingency contracts, and personalized systems of instruction.

Applications to the Study of Music Learning. Much of the research of Clifford Madsen, Robert Duke, Harry Price, and Cornelia Yarbrough follows the operant conditioning model of learning. Their research has focused on instructional principles that guide "good" or "successful" teaching. Here, the role of appropriate and inappropriate reinforcement is integral to understanding learning behaviors. In this regard, researchers in music education have looked at a wide variety of issues regarding the effect of reinforcement (praise) and feedback (verbal corrections) on musical discrimination, attitude, and performance. More recent reviews of literature are by Duke and Henninger (1998), Taylor (1997), and Madsen and Duke (1985). In addition, the use of music itself serving as a mechanism of reinforcement has been studied, among others, by Greer (1981) and Madsen (1981). (For more information, also see chapters 18 and 19.)

The behaviorist learning model has significantly impacted music researchers' interest in programmed instruction and CAI. Programmed instruction, for the most part, involves programmed sequential patterns. The general idea is that a teaching machine (ranging from sequences of worksheets to CAI) can provide appropriate stimuli in the form of digestible bits of information, elicit responses in the form of easily accessible questions, and provide feedback/reinforcement through additional information and/or praise. Initially, programs were linear in that all students went through the same process, though at varying speeds; later programs were branched, allowing for more advanced students to skip material. Reviews of programmed instruction and the use of CAI in music education practice are provided by Orman (1998) and Higgins (1992). A related area of research, personalized systems of instruction (PSI, the Keller Plan), has been explored by Jumpeter's (1985) study in which he demonstrated PSI to be an effective mode of instruction in college music appreciation courses.

Constructs of Cognitive Learning Theories. Cognitive theories focus on efforts to map an individual's learning processes as new information is integrated with already familiar knowledge. Often viewed as the antithesis of behavioral theories, cognitive learning theories developed as reactions to and/or extensions of behaviorism, although today the constructs tend to emphasize aspects of self-determination in the learning process. Learners actively construct knowledge on the basis of their reactions to sensory stimuli. Critical to cognitive theories in music education is an understanding of major constructs inherent in Gestalt psychology as the latter describes cognitive development. Beyond that, constructs of cognitive theories have found application in theories on HIP and the phenomenon of "connectionism" as applied to brain research.

Gestalt psychology is a theoretical subset of Gestalt theory, an early theory of perception developed by Koffka (1935), Kohler (1929, 1969), and Wertheimer (1959). Their theory maintains that learning is insightful and relies on an active process of problem-solving strategies rather than on reactions (responses) to random trial-and-error experiences. Gestalt laws state that a person will impose order on perceived disorder according to the laws of similarity, proximity, closure, continuation, and common fate. As the terms suggest, similarity refers to an individual matching observed objects with others of similar form or color; proximity makes an individual relate a perception to another one that comes closest to it. Closure indicates an individual's tendency to want to complete imperfect wholes; similarly, good continuation means that natural successors will complete an incomplete series of observations or sensations. Finally, "common fate" is the term used to describe an individual attributing characteristics of the whole or of parts of the whole to individual parts, based again on "best match." This means that the individual seeks to place component parts of a new experience into the already familiar context of previous, familiar experiences.

Studies in *cognitive development* gained in popularity among educators as a result of Piaget's (e.g., 1928, 1952, 1972) observation of young children's learning processes. His resultant theory was both cognitive and developmental in that it sought to explain (1) how children process information and (2) how those processes change with age. His proposed stages are well known. They have been described as sensorimotor learning, or learning through motor activity and manipulation of objects (age 0 to 2), to preoperational learning, which is the transformation of sensorimotor to symbolic learning (ages 2 to 7), to concrete operations, manifested by increasing ability to classify objects and events (ages 7–11), to formal operations, manifested by thought processes typical of an adult (age 11 onward). Influenced by Piaget, Bruner (1960; Bruner, Goodnow, & Austin, 1956) studied how people actively select, retain, and transform information inductively relative to three developmental modes of assimilating knowledge: enactive (experiential), iconic (visual or mental pictures), and symbolic (symbolic systems such as language, mathematics, or musical notation). Bruner's (1966) spiral curriculum, another construct influential for music education research, proposed to structure learning, and thus teaching, in such a way that any subject, no matter how complex, may be introduced at appropriate levels and periodically with greater levels of complexity. Piaget also influenced Gardner, who in 1973 began his quest for understanding the arts from a developmental perspective and influenced the research conducted for the past several decades by Project Zero.

A number of cognitive theorists developed their ideas in response to behavioral learning theories. Chomsky (1957) responded to Skinner's ideas about verbal behavior by arguing that language learning is too complex to be explained by behavioral theories. He described language development as a cognitive process involving structuralism: surface structures (individual words as they are spoken or read) and deep structures (grouping of individual words into phrases). Transition from surface structures to deep structures and vice versa are made possible through what Chomsky called transformational rules. Tolman (1932), a behaviorist with cognitive ideas, postulated that learning can occur without reinforcement or changes in behavior, that there may be intervening variables and individual differences, that behavior is purposeful and goal-oriented, and that learning results in an organized body of information. Ausubel (1968) disagreed with Skinner's claim that an individual must emit an active response in order to learn; he claimed that a student might be cognitively active without overt physical action and that expository instruction has its place as long as information is meaningful and can be applied to previous learning. Associated with the idea that learning involves a hierarchy of instructional steps, Gagné (1977, 1985) believed that simpler (behavioral) principles are taught first and then lead to the development of higher order (cognitive) principles.

Information-processing theories utilize metaphors from computer science to explain how the mind works. A precursor to information processing was information theory, developed by Shannon (Shannon & Weaver, 1949); he showed that information could be measured as binary digits representing yes/no alternatives, which became the fundamental basis of today's telecommunications. Miller, Gallanter, and Pribram (1960) developed an early information-processing model of learning: TOTE (test-operate-test-exit), a feedback circuit whereby behavior is organized according to assessment; TOTE determines whether the state of affairs is personally followed, if necessary, by actions to reach an optimal state. Well known for his idea of chunking, Miller (1956) believed that short-term memory (attention span) can only hold seven (plus or minus two) chunks of information. Atkinson and Shiffrin (1968, 1971) originally developed the dual-storage model of memory: Input enters the brain via the sensory register and is processed by the working (or short-term) memory; long-term memory influences the working memory and stores perceptions that have relevance and impact (Schunk, 2000).

A subset of information-processing theories includes *connectionism* and related theoretical constructs that allow the study of artificial neural nets as potential models of brain function. As a theory, connectionism offers an alternate paradigm to information processing in that it frees cognitive models from dependence on symbolic/metaphoric language. As documented by Beach, Hebb, Morgan, and Nissen (1960), Lashley (1929) demonstrated that neural connections are distributed and that cortical areas can substitute for each other. Hebb (1949), a student of Lashley, postulated that learning is based on modification of synaptic connections between neurons. Extending these ideas, Rumelhart, McClelland, and the Parallel Distributed Processing Research Group (1986) introduced their theory of parallel distributed processing. In another study of neural mechanisms, Posner and Keele (1968) wrote about how neural mechanisms underlie selective attention. The theory of Schmidt (1975) posited schemas as abstract sets of rules for determining movement, as, for example, in motor learning. Witkin, Moore, Goodenough, and Cox (1977) studied field dependence-independence that "refers to the extent that one depends on or is distracted by the context or perceptual field in which a stimulus or event occurs" (Schunk, 2000, p. 422).

Applications to the Study of Music Learning. The application of cognitive theories to the study of musical learning has been most prevalent in the use of Gestalt psychology to explain processing of musical information. Thus, the laws of similarity, proximity, and closure have been used to describe and distinguish between processes of music perception, development, and cognition. Wang and Sogin (1990) reviewed the study of Gestalt organizational principles in music. Gestalt concepts also are implicit in Karma's (1985) exposition of hierarchical music concepts.

Lehrdahl and Jackendoff (1983) formulated a generative theory of musical grammar based on the linguistic theories of Chomsky. According to Lehrdahl and Jackendorff, acoustic information triggers mental operations that impose order onto input. If there is sufficient exposure to music, musical understanding will occur through enculturation rather than formal training.

Research employing cognitive theories to describe the musical development of children has received the widest attention and emphasis since the 1960s. Detailed reviews of those efforts have been offered, among others, by Funk and Whiteside (1981), Hargreaves (1986), Hargreaves and Zimmerman (1992), Scott-Kassner (1992), and Zimmerman (1986). According to Hargreaves and Zimmerman, Piaget's theory has impacted at least three areas of research in music learning: developmental stages; development of symbolic function made manifest through language, drawings, and make-believe; and the concept of conservation "according to which young children gradually acquire the understanding that two properties of a concrete object can covary to produce an invariant third property" (p. 378). Zimmerman (née Pflederer, 1964, 1966, 1967; Pflederer & Sechrest, 1968) is generally acknowledged as a pioneer in studying conservation in music. Swanwick and Tillman's (1986) spiral model of creative musical development also draws on Piaget and Bruner. Their model builds on four developmental stages: (1) mastery (age 0–4) during which children develop a sense of and respond to sounds; (2) imitation (4–9) during which children include the use of sounds to represent event or objects; (3) imaginative play (10–15) during which children combine sounds creatively; and (4) metacognition (15 and up), during which adolescents reflect on their own thinking about and experience with music.

Bruner's three modes, enactive, iconic, and symbolic representation, were also the foundation for all of the research and publications of Eunice Boardman Meske. Gromko (1996) investigated children's invented descriptions of songs relative to Bruner's modes of learning and wrote a detailed review of developmental literature, particularly as it evolved from Gardner's (1983) earlier work, including Davidson and Scripp (1988, 1992) and Upitis (1990, 1992). A similarly neo-Piagetian approach was taken by Elmer (1997), while the "discovery method" advocated by Bruner was investigated in a musical context by Hewson (1966).

As early as in the 1970s, Andrews and Deihl (1970) reviewed the ideas of Bruner and Hebb in music education. Much of the research in concept learning has centered on student vocabularies, a topic summarized by Flowers (2000) and Chen-Hafteck (1999). Cutietta (1985) described and applied the hypothesis-testing model of Bruner and others to the development of musical concepts. Booth and Cutietta (1991) explored the possibility that cognition can be divided according to Tulving's (1972) theory into episodic and semantic memory (verbal processing versus concept formation). Carlsen (1987) and Adachi and Carlsen (1995) discussed and outlined research according to the theory of expectancy, which proposes that previous musical experiences and concepts shape how new information is perceived and processed. Thorisson (1997) compared the utility of prototype versus exemplar theory in the development of musical style concepts in music appreciation texts.

Four theories of motor learning have had varying degrees of application in research on music learning: closed-loop theory, open-loop or motor program theory, schema theory (mental knowledge), and the Bernstein approach (Gabrielsson, 1999). Applications of the first three have been reviewed by LaBerge (1981) and Sidnell (1981a). Two major studies conducted by Ross (1985) and Coffman (1990) have focused on mental practice in music learning. Both give informative reviews of related literature and discuss the positive effect of combined mental and physical practice and the theoretical roots of mental practice in the writings of Tolman (1932) and Kohler (1929, 1969). DeLorenzo (1989) investigated creative thinking from a problem-solving/problem-finding perspective and gives an extensive overview of related cognitive studies in musical creativity.

Research on hemispheric dominance, cognitive style, and field dependence/independence in music education has seen a proliferation of studies since the 1970s. Baumgarte and Franklin (1981) reviewed studies related to right or left-brain dominance in musical information processing; they concluded that a number of factors determine where music is processed in the brain and that musical processing is neither completely right- nor left-brain situated. Hemispheric dominance was also related to learning style in the research of Zalanowski (1990). Scheid and Eccles (1975) provided an extensive historical overview of brain hemisphere research and applications in music cognition studies. Strong (1992) examined hemispheric laterality as it related to disabled students' learning. Perhaps the most extensive discussion to date regarding cerebral hemispheric dominance and/or roles was made by Marin and Perry (1999). Barry (1992) reviewed studies that looked at field dependence/independence in music performance and perception. (For a more in-depth discussion of field dependence/independence that includes cognitive style, see Ellis and McCoy, 1990.)

Information theory for music was initially explicated by Abraham Moles and served as the foundation for the musical understanding theory of Leonard B. Meyer. The application of information theory to music education research was discussed by Krumhansl (1990) in the context of developing a hierarchical model of musical cognition. These efforts were reviewed by Coffman (1990) in a study measuring musical originality and creativity. Information-processing theory also was advocated by Williams (1981, 1982) and Williams and Peckham (1975), who developed a music information-processing model based on the work of Atkinson and Shiffrin (1968) in verbal-auditory processing and concept development. Tallarico (1974) described a three-phase concept of memory and how it might be implemented in the study of music cognition. In his discussion, he drew from a wide array of sources in information processing, including the writing of Norman, Rumelhart et al. (1986), and Hebb (1949). Cutietta and Booth (1996) provided an overview of research related to categorization of musical information in memory. In this regard, Miller's (1956) idea of "chunking" has found frequent acknowledgment in music cognition research. Probably the most extensive and recent discussion of music processing and memory was presented by Deutsch (1999).

Regarding the application of "connectionism" and neuroscientific processes to the study of music learning, Fiske (1984) reviewed the controversy between serial and parallel processing and established a background for connectionist theory, primarily drawing from Posner and Keele (1968). Fiske (1992) proposed that musical information processing involved the brain's ability to construct three patterns from auditory information: a given pattern, a variation of a given pattern, and a distinctly different pattern. The brain classifies or encodes information according to cognitive processing rules and then compares patterns in order to determine their function. This connectionist model became apparent in subsequent studies by Fiske (1995, 1997). His research is central to the work of Bharucha (1999), who has collaborated with Krumhansl in developing a music learning theory. Leng, Shaw, and Wright's (1990) theory of neural firing patterns, based on Hebbian learning principles, has been reviewed and tested by Rauscher (1999). Neurological studies in music education that do not rely on computer simulation were reviewed by Gruhn, Altenmüller, and Babler (1997).

Constructs of Constructivist Learning Theories. These theories acknowledge the interconnections between the learner and his or her environment as crucial for understanding the process of learning itself. Therefore, the study of learning is approached from a more holistic perspective. Interactive theories acknowledge the multifaceted, multidimensional complexity that ensues when an individual encounters and responds to musical stimuli not only in the context of the group(s) of which he or she is a part but also in the context that is created by the mental and physical environments surrounding the interactions. As with connectionism, a cognitively based perspective, learning is viewed as a complex serial process without any clear and identifiable beginning and end points.

Lewin (Lewin, Lippitt, & White, 1939), considered by some writers the father of social psychology, derived his field theory of learning from Gestalt theory, an approach that emphasizes context familiarity as an important descriptor of how individuals learn and process information. However, similar thoughts were expressed before him by Mead (1934) and again in 1941 by Dollard (Miller & Dollard, 1941) when they argued that all social interactions lead to learning. As individuals interact with others in any social setting (even the interaction of two people with each other is considered such a social setting), they take on "behavioral" roles that are articulated to them by other members in the group or by people they hold important ("significant other"). According to Buttram (1996), this "imitative" approach to learning in social contexts was first applied to the study of formal learning by Miller and Dollard. Through their work in social psychology, the stimulus-response-reinforcement model of the behaviorists was widened to include inner processes, such as drives, in guiding responses. Bandura (1986) also stressed the place of personal awareness of one's social context in any stimulus-response model of learning, and he introduced the idea of observational learning, whereby individuals learn because they emulate the behaviors of those with whom they wish to identify.

Connected to this social interactionist model is Dewey's model of experiential learning. In fact, a resurgence of interest in Dewey's social constructivist thinking can be observed in the renewed focus on reflective practice and "learning through doing." Another social constructivist, Vygotsky (e.g., 1962, 1987, 1997a, 1997b), has received renewed attention as well, especially his theory of the social nature of knowledge and of the zone of proximal development (ZPD) that reflects a child's current abilities and knowledge.

Similar to any if not all of these approaches toward explaining learning from a constructivist perspective is the assumption that learning is most successful in the context of apprenticeships and "communities of practice." This and other types of "situated learning" have been outlined and described by Bredo (1997); Brown, Collins, and Duguid (1989); Rogoff (1996); Wenger (1999); and Lave and Wenger (1991). In this context, the work of Schön and Argyris (Argyris & Schön, 1974; Schön, 1987) needs to be mentioned. They developed a theory of reflective practice that argues that learning takes place as a result of both reflection-in-action (the "doing") and reflection-on-action (the post facto analysis of "doing"). Also known as the double-loop theory, it argues that learning requires both processes if it is to lead to conceptual, that is, personally owned, knowledge.

Applications to Music Education Research and Practice. Although advocated by some music educators since the 1960s and 1970s, the application of constructivist constructs of learning to the study of music learning has only more recently begun to enter the mainstream of publications in American music education. (For an in-depth discussion of sociology in music education, see chap. 31 of this Handbook). Two recent symposia on a sociology of music education contained papers and addresses that reiterated the usefulness of social constructivism and situated learning as constructs for the study of music learning (Rideout, 1997; Rideout & Paul, 2000). In addition, a renewed interest in applying John Dewey's theoretical constructs to music research can be observed and has been documented by a number of recent studies. For example, Whitaker (1996) applied Dewey's idea of reflective thinking to expert listening and teacher training. Elmer (1997) applied Piaget's epistemology as well as social constructivist ideas to a microanalysis of song learning. Campbell (1999) enlisted Dewey's idea of learning by experience in building a social constructivist framework for teacher development. Younker and Smith (1996) focused on Dewey's emphasis of process over product in studying musical composition.

Wiggins (1994b) drew together ideas of Gardner, Vygotsky, and Rogoff in a social constructivist study on teacher research. Later (2000) she integrated an overview of social constructivist theories, including the idea of distributed intelligence, in her study of shared musical understandings. Della Pietra and Campbell (1995) explored and reviewed social constructivism in improvisation, and Davidson and Scripp (1992), drawing from a large number of nonmusic researchers, proposed the idea of a situated music cognition model.

Implications for applying constructs of social interactionism to music teacher training were outlined by Olsson (1997). Gholson (1998) developed a strategy for practice in violin pedagogy (mentoring) that builds on Schön's "communities of practice" and similar ideas of Vygotsky. Schön's reflective practice is discussed by Barrett and Rasmussen (1996) and Brand (1998), along with ideas for "theories-in-action." Brown, Collins, and Duguid's (1989) situated cognition model was used by Wiggins (1994b) and Bresler (1993) in studies about action research by teachers.

Critique: Learning Theories and Their Application to Music

The adaptation of general, a priori learning theories to explain musical learning has served music education well. By building a research base that is derived from educational and general psychology, a wide array of studies have sought to answer complex questions, and their answers have been translated into music education practice. Research articles between 1960 and 2000 make it evident that general theories of behaviorism adapt directly and successfully to music teaching. Behavioral learning theories in particular have led to research not just on music learning but also on teaching techniques, instructional strategies, sequencing of instruction, and student motivation and attitudes in the classroom.

Historically, behavioral research has examined behaviors of groups of learners. Insofar as music teachers work with larger classes whose success depends on techniques affecting the "majority," implications for practice-derived behavioral learning models will continue to serve music education well. Cognitive and interactive theories, in contrast, focus more on the individual because learning is defined by the relationship between subject matter and each individual learner. While teachers facilitate scholarship and instructional guidance, actual learning depends upon a wide variety of influences that act upon the learner in different ways than they do on the teacher. For this reason, research literature built on the application of cognitive and interactive learning theories has produced somewhat less concrete instructional results.

The focus on practical results, then, requires attention if the relative impact of behavioral, cognitive, and constructivist research related to learning theories is to be assessed. At present, the validity of a particular learning theory appears to depend on how quickly it can be translated into instructional practice. Without any question, learning theories derived from behaviorism have had the greatest effect in that regard. Yet some strides in translating cognitive research into music education practice, especially in the organization of material to enhance learning, have been made. Not only has the use of concept maps and advanced organizers become popular, but there is an increased awareness of the need to individualize instruction, work with each student's strengths, and provide different sequences of instruction for different groups of learners.

The greater question, however, is what renders a learning theory valid—that we can adjust our teaching methods quickly and efficiently, or that the constructs accurately describe what actually is going on when musical stimuli are processed and responded to either by an individual learner or by an entire group? This means that we need to know the purpose for which we want to study learning processes in music: to make instruction as efficient as possible or to learn more about the field of music itself. One requires that we find expedient ways for the student to reach predefined instructional objectives and learning gains; the other means to map learning processes in music for the sake of comparing them to other learning processes.

Learning Theories Unique to Music

This section emphasizes a review of studies and writings whose findings may be useful in the construction of a theory of music learning derived from the observation of musical behaviors themselves. This approach, though not necessarily informed but certainly supported by constructivist thinking, embraces the notion of leaving already established, nonmusic constructs behind and acknowledging musical behavior as its own "domain," situated in a context uniquely its own.

Ruttenberg (1994) defined music learning as an extended musical activity that is comprised of a progression of musical mental functions that go from sensation to perception, to cognition, to creativity. This progression has value in explaining musical processing as well as learning and thinking. Building upon Ruttenberg's (1994) definition, musical learning will be described for the purposes of this chapter as moving from sensation to perception to cognition, including a change in mental structure. This progression also may have value as a theoretical frame into which to place the many diverse studies in music education that address the nature of music learning from a music-specific vantage point. A few of these studies will be referred to later, but for the most part the work of five specific researchers will be highlighted: Edwin Gordon's efforts to develop a theory of music learning; Bamberger's work toward understanding how musical intelligence develops; Gardner's musical intelligence theory; and, finally, Cutietta's research, as well as Regelski's proposed praxis of music teaching, both of which may lead to a theory of music learning. In some instances, these perspectives have influenced research agendas of others, offer unique approaches toward researching musical thinking and learning, and contain commonalities as well as differences that may serve as the basis for an improved understanding of how music learning takes place. Eventually, the commonalities among the works may become the constructs for valid theories of music learning.

Edwin Gordon's initial research, beginning with the observation of individual students involved in the process of learning music, sought to develop a theory of music learning and not necessarily a measure of musical aptitude. After determining that individual students seemed to begin the music learning process at different stages, Gordon was "sidetracked [as he was] forced to embark on the study of the nature, development, and measurement of musical aptitudes" (Gordon, 1971, p. 8) rather than focusing solely on the development of a music learning theory. Though Gordon's contributions to music education are numerous, for the purpose of this chapter only his efforts at developing a theory of music learning unique to music education will be discussed. (For a more thorough review of Gordon's work, see chapter 22.)

Gordon's research into a theory of music learning, begun in the 1960s, derives from a search for a basic "key word" vocabulary of music. Unlike other educational thinkers, he focused his attention on aural rather than theoretical aspects of music. Thus, rather than follow educators who extracted from written music the conceptual elements of pitch, rhythm, dynamics, form, and timbre as basic components or "key words" of music, Gordon identified aural pitch and rhythmic patterns as the basic vocabulary of music. He arranged these key musical "words" in his learning sequences by identifying the most basic patterns, teaching them first, and then following them with increasingly more complex patterns as learning continued. Gordon believed that learning music resulted from building a musical vocabulary (aural pitch and rhythmic patterns) through repetition, rote learning, and drill.

A second feature of Gordon's approach was the parallel he drew to language development, in which thinking without sound can involve learning; thinking is conceived as "internally talking" with the use of words or the "voice in our heads." Gordon's music learning theory incorporates audiation or the process of thinking musically, as in hearing without sounds the "song in our heads." According to Gordon, children developmentally prepare to "audiate" by experiencing acculturation (a premature awareness of sound); imitation (some aural recognition of sounds); and assimilation (a more precise aural recognition of sounds).

On the basis of this chapter's definition of music learning, Gordon promoted the idea of internalizing musical patterns out of musical context so that the patterns may facilitate perception and change in mental structures within the context of music. By drilling and practicing predetermined, cumulative, and sequential pitch and rhythmic patterns (Gordon's theory of music learning translated into practice) learning occurs. As the musical vocabulary becomes ingrained in the learner, perceptual abilities grow, vocabulary becomes richer, ability to audiate becomes refined, and musical perception and learning is consequently enhanced.

Jeanne Bamberger's research investigating the development of musical intelligence began in the early 1970s. Her book *The Mind Behind the Musical Ear: How Children Develop Musical Intelligence* (1991) is the culmination of many years of observation of primary school children. Bamberger believed it was important to study musical behavior as it occurred in social context.

During individual or group sessions with young children, Bamberger observed and questioned them about their musical knowledge. Most of her work was concerned with how children reproduced music: They notated, primitively, what they heard and taught it to others using their original notation. Bamberger used as musical examples so-called simples, common pitch-time relations of tunes and rhythms that individuals can be presumed to have sung as children. Children learned about music through their own discovery and focused primarily on rhythm patterns and tune-building (pitch).

Bamberger described the children's inclination to hear, explain, and notate rhythm and pitch patterns figurally or formally. Figural hearing was motivic, as rhythm and pitch patterns were grouped according to what "goes together." Formal hearing attended to actual rhythmic durations or standard musical notation. For example, a familiar nursery rhyme appears (1) linguistically, (2) figurally, (3) formally, and then in (4) standard notation:

1. Five, six, pick up sticks, seven, eight, lay them straight
2. O, O, o o o, O, O, o o o
3. O, O, o o O, o o, O, o o O
4. Quarter, quarter, eighth, eighth, quarter; eighth, eighth, quarter; eighth, eighth, quarter

Notations 2 and 3 have 10 shapes derived from the 10 separate beats in the nursery rhyme; however, the figural representation (2) shows graphically the first two longer sounds and the following shorter sound, while the formal representation reflects the standard notation, as represented by the series of eighth and quarter notes (4). Formal hearing attends to duration, meter, and classifying rhythm and pitch patterns according to standard musical notation, while figural hearing is more motivic or graphic in nature. Because all children's drawings of rhythm and pitch patterns, regardless of developmental age, either involve figural hearing, formal hearing, or a combination of the two, Bamberger maintains that figural and formal hearing are inherent in perception.

Understanding and learning music is described by Bamberger as perceptual problem solving: Perception and cognition are intertwined and not discrete quantities (1982). Musical "hearings" (Bamberger, 1991, p. 3) are repeated hearings of the same piece of music and factor into perceptual problem solving; they are the same piece of music heard again and again, only differently each time as the learner accommodates new hearings. Bamberger therefore emphasizes the importance of multiple hearings in music learning: An individual can listen again to the same piece of music, perceive it differently the second or third time, and cognitively and conceptually reorganize the music before it is learned.

Bamberger believes music learning to be developmental, although it does not necessarily follow Piaget's stage development theory; rather, different ways of representing musical knowledge interact with each other in an ongoing multidimensional manner. For instance, as children create musical representations (both figural and formal) of what they hear, they create written material that "holds still" (Bamberger, 1991, p. 52) so that children can reflect on it. A conversation develops between the child's thinking and reflection about what is on the paper. This interactive component depends to some extent on reflection-in-action (Bamberger, 1991; Bamberger & Schön, 1991; Schön, 1987), which is the learner's ability (often with the help of the teacher) to move back and forth between reflection *of* experience and reflection *on* experience (Bamberger, 1991,

p. 52). Like other domains of learning, a child's musical learning is developmental: It is dependent on age or experience.

Music learning is a generative and sensorimotor process. "Generative," a term borrowed from linguistics, means that, like language learning, music learning is an active process whereby individuals organize sound/time phenomena as they occur (Bamberger, 1991). Organization of sound/time phenomena involves sensorimotor experiences, such as gestures, sequences of periodic movement, equilibrium, tension, and relaxation. These various sequences of motion in turn become "felt paths" (p. 10), which are akin to a performer's ability to play complex musical passages from memory: Felt paths or action paths become internalized in the learner.

Bamberger does not posit a *theory* of music learning; instead she describes the earliest stages of what summarily tends to be referred to as music cognition, meaning that a particular mental challenge leads to a change in mental structure. This transitional process is developmental; involves multiple hearings; includes sensorimotor experiences, reflection, and internalization (felt paths); and involves the ability to move from *figural* to *formal* hearings, descriptions, and constructions of music.

Developing Musical Intuitions (Bamberger, 2000) is an example of research evolving into practice. This book, a culmination of her life's work, is subtitled *A Project-Based Introduction to Making and Understanding Music.* Interactive computer software applications expose students to melodic structure, rhythm, and meter (i.e., duple and triple meter, scales, major and minor mode, I–IV–V harmonizations) that are derived from Bamberger's methodologies (1982, 1991). Students draw on what they know and create musical representations (in this case on the computer) that are derived from "chunks" (i.e., phrases) of musical material. These "chunks" come from figural and formal hearings, from subsequent drawings or representations of these hearings, and from figures that generate structural hierarchies (figures or motives that become part of phrases, which become part of sections) and metric hierarchies (a regenerating, living constituent as a piece of music moves through time).

Included in this interactive CAI journey described by Bamberger is reflection-in-action. The process of learning in *Musical Intuitions* (2000) depends on a "conversation," which is

> the usually silent conversations we have with materials as we are building, fixing, or inventing. As we handle these materials, arranging and rearranging them, watching them take shape even as we shape them, we learn. The materials "talk back" to us, remaking our ideas of what is possible. The back-talk leads to new actions on our material objects in a spiral of inner and outer activity; our inner intentions are reflected back by the results of our actions, leading to new outer actions and often to changing of our intentions. It is a kind of "re-search"—one that is as familiar to the scientist designing a theory as to the painter or composer designing an artifact. (p. 2)

Evan Zipoyrn writes in the foreword to Bamberger (2000) that Bamberger's greatest innovation is her ability to "get people to pay attention to what they already know and how they come to know it" (p. x). Bamberger believes the way to deepen musical understanding is to examine what is already known and reflect on what is being heard.

Howard Gardner, author of *Frames of Mind* (1983) and the theory of multiple intelligences (1999), contributes to the development of a theory unique to music learning through his many writings about artistic expression (e.g., 1980) and musical intelligence (1973/1994, 1983, 1999). He believes that humans possess varying degrees of seven "original" intelligences (1983) and possibly three or more additional intelligences (1999). In *Frames of Mind* (1983), musical intelligence is defined as skills in the "performance, composition and appreciation of musical patterns" (p. 42). Gardner supports his claim that musical intelligence is separate and unique with case studies of brain-damaged and brain-altered individuals; musical ability is located in specific spheres of the brain and can remain unaltered in individuals with brain impairment.

Though Gardner focuses on musical *intelligence* and not on musical *learning*, explanations of how individuals learn music are implicit in his writings. Like Bamberger, Gardner's hypothetical theory of music learning is developmental: Children involved in sensorimotor experiences move their bodies to music and babble songs and melodies. These innate responses are, in some instances, not distinguishable from the animal kingdom: Birds "babble" songs and chimpanzees respond physically to music. However, beyond the sensorimotor response, the differences between humans and animals are distinguishable as humans move into stages of concrete operations and formal knowledge.

In 1999, Gardner updated his definition of intelligence as: "a bio-psychological potential to process information that can be activated in a cultural setting to solve problems or create products that are of value in a culture" (p. 33–34). This definition implies an "intelligence" required for music *learning* that even the most "humanlike" chimpanzee does not possess: the ability to solve musical problems or create musical products. Inherent in the ability to solve musical problems is the "susceptibility to encoding in a symbol system" (Gardner, 1999, p. 37). Musical symbol systems include predictable genres: written language, musical notation, musical pictures, musical drawings, iconic musical notation, and so on, as well as unpredictable elements or materials that may but "need not be a physical object" (Gardner, 1973/1994, p. 128), as in musical sounds.

Implicit in Gardner's hypothetical theory of music learning is modal-vectoral sensitivity (1973/1994, p. 126). The latter is a humanlike quality that contributes to the transition of responding innately to musical stimuli in the sensorimotor plane, to responding to musical stimuli in the symbolic plane, that is, as musical stimuli having reference to something outside oneself. This transitional process allows individuals to move from sensation and perceptual experiences (innate responses) to cognitive experiences (outside referencing, remembering, recalling an experience or picture after seeing an object, and so on).

Modal-vectoral sensitivity involves the ability to feel bodily sensations (i.e., holding on, letting go, envelopment, intrusion) and perceptions (i.e., intensity, roughness, smoothness); these responses promote in humans the ability to organize sensations and perceptions into remembered experiences. Within the musical domain, symbols (i.e., notation, visual representations of instruments, aural motifs) arouse modal-vectoral experiences and continue to do so as humans transition developmentally from the sensorimotor to the symbolic plane.

> Far from being merely a feeling experienced by the individual, an act made, or a discrimination perceived, modes become schemes for organizing all experience, be it perceived, felt, or made; modes invoke discrimination, involve feelings, and are manifested in motoric activity. Indeed, persons can classify in terms of these categories in perception, produce instances of the categories in making (i.e. constructing), and experience these categories as affect. The modes and vectors provide both form and content for the child's earlier experiences. They are drawn on as the child proceeds from the sensorimotor to the symbolic stage, and remain as a backdrop and substratum for all later experience. (Gardner, 1973/1994, p. 111)

Like Bamberger, Gardner has focused three decades of his life on the development of intelligence and educational reform, specifically that which operates in artistic domains. His theory of general intelligence focuses not only on problem-solving abilities but on the ability to create products as manifestations of understanding and learning. Undoubtedly, his interpretation of a theory of learning unique to music would include: sensation, perception, cognition, and a change in mental structure, followed by the ability to use tools (symbols) that demonstrate learning through problem solving and the creating of products.

Other research in the field of music education parallels Gardner's and Bamberger's interest in music learning through the acquisition of musical representations of sound. Though this research does not hypothesize a theory of music learning, research agendas have been built on the acquisition of musical representations of sound, the use of invented musical notation, and their contribution to musical understanding. A summary of some of these research efforts follows.

Gardner, Bamberger, and other researchers who have built research agendas on their work (i.e., Davidson & Scripp, 1988) were early members of Gardner's Harvard Project Zero team, which investigated the development of children's musical symbolic intelligence (Gromko, 1994, 1996a, 1996b) and children's use of symbols in artistic domains. A common thread in much of Project Zero's work and other research agendas built on this work is that children's invented notation is a means of "assessing their understanding of the musical features of songs or instrumental compositions" (Barrett, 1999, p. 14). Given that this chapter's focus is on the development of a theory unique to music "learning" and not on a theory of music "making, creating, or performing" (i.e., the creation of songs and instrumental compositions), children's invented musical notation is discussed as a "window" into understanding musical learning and not into understanding musical creativity and performance. Research investigating invented musical notation is presented insofar as it contributes to furthering an understanding of what happens when a change in mental structure produces music learning.

Bamberger proposed that children's invented musical notation progresses from figural to formal as children's invented drawings mature from "figurative" musical examples (i.e., motivic examples or drawing the way the music goes) to "formal" musical drawings that depict actual rhythmic duration or even standard music notation. Davidson and Scripp (1988) took Bamberger's work one step further by suggesting that children's invented musical notation moves progressively through five distinct types of invented notational systems or "strategies" (Barrett, 1999, p. 14): pictorial, abstract patterning, rebus, text, and combination/elaboration.

The *pictorial* system involves use of invented musical notation represented by pictures. The *abstract patterning* system includes lines and dots that "represent melodic units of the song and record the rhythmic groupings, underlying pulse, melodic contour or phrase structure" (Davidson & Scripp, 1988, p. 204). The *rebus* system uses icons, conventional signs, and words; the *text* system uses words, letters, or imitations of conventional language symbols that often depict the graphic layout of direction of pitch and rhythmic groupings in the music; and the *combination/elaboration* system includes both abstract symbols in combination with text that show how the text is to be sung (melodically and rhythmically). Children's invented musical notation matures from pictures, to more abstract visual representations, to more symbolic depictions of music.

Davidson and Scripp (1988) looked at children's musical cognitive processing through the use of song text, perhaps because it is easier for young children to follow musical progressions of sound when defined by words as well as music. Regardless of the use of text, it is apparent from this research that music learning is a temporal (ongoing) and generative process, whereby individuals are organizing sound/time phenomena as they are occurring (Bamberger, 1991). For the purpose of this chapter, Davidson and Scripp might concur that a theory of music learning involves sensation, perception, and cognition, processes that produce an ongoing change in mental structure as individuals continually add and modify musical knowledge. (A thorough summary of the work of Davidson and Scripp has been outlined in the first edition of the *Handbook of Research on Music Teaching and Learning* [Hargreaves & Zimmerman, 1992]).

The research agenda of Gromko (1994, 1996a, 1996b; Domer & Gromko, 1996) focuses on an emerging musical intelligence in young children, manifested by their ability to use musical icons and symbols. Though she is not a member of the Harvard Project Zero team, Gromko's hypotheses were derived from both Gardner's and Bamberger's investigations into the theory and development of musical intelligence. Gromko's research investigating children's use of invented musical notation does not include the development of a theory of music learning; however, her work expands on the cognitive processes described in Gardner's and Bamberger's work that may produce a change in mental structure and, subsequently, musical learning.

Like Bamberger and Gardner, Gromko believes that music learning is developmental. The nature of change in children's invented musical notation as a measure of their musical understanding suggests a

> developmental progression that moves from: (a) scribbles not systematically associated with sound to (b) uninterrupted lines that account for the entire duration of the musical event and its regular pulsations, to (c) a melodic line drawing that accounts for the entire duration of the musical event and the highs and lows of its melody. (Domer & Gromko, 1996, p. 72)

Gromko (1994) also found that children notate pitch before rhythm and that their ability to represent pitch with lines and icons corresponds to their performance on the *Primary Measures of Musical Audition* (PMMA) (Gordon, 1979). She concluded (Gromko, 1995) that musical learning is enhanced by sensorimotor experiences. Like Bamberger, Gromko believes in studying children in a social, experiential context. Children who worked with tangible materials (i.e., colored blocks, glitter, felt) and made these materials correspond to the "way the music goes" were subsequently better able to construct symbols that represented music than children who did not. Concurrently, Gromko found that more developmentally advanced children were less dependent on sensory actions as an intermediate step between their perception and construction of musical representations. She, too, strongly believes in the process of reflection-in-action. Much of her research depends on a dialogue between the student and teacher about the music: "The process of invention may contribute to building understanding because the children's visual representations are images to be evaluated in a process of reflection" (p. 6).

Like Gardner, Gromko might concur that a hypothetical theory of music learning would include sensation, perception, and cognition, followed by a change in mental structure, and the subsequent ability to transform invented musical representations into musical symbols: "Invention, Piaget believed, is the inevitable result of understanding: to understand is to invent" (1994, p. 22). Much of Gromko's work traces the development of musical symbols in children (1994, 1995, 1996a, 1996b; Gromko & Poorman, 1998a, 1998b). She believes that

> [s]ymbolically fluent children are capable of more than imitation or reproduction, for they have fixed references that allow them to represent an event symbolically and, abstractly. Symbolically fluent individuals, those for whom symbols are meaningful conveyors of information, have internalized the properties that symbols embody. (1995, p. 5)

If Gromko were to formally turn her research into instructional practice, she would recommend the necessity and importance of a music curriculum rich in sensory experiences (i.e., moving, playing, creating, reflecting) in order to create a symbolically fluent child. Especially for young children, Gromko would advocate an environment filled with manipulatives, colors, sounds, and textures and would encourage not only activity-oriented musical experiences but thoughtful discussions with children about the music they are making.

Hypothesizing that understanding and learning music require perceptual problem solving (Bamberger, 1991) may be *Cutietta's* (1985, Cutietta & Haggerty, 1987; Booth & Cutietta, 1991) position that the mind "categorizes" musical sounds in a nonelemental (pitch, rhythm, timbre, harmony, and form), more holistic fashion. When Bamberger and Gromko asked children to initially "draw the way the music goes" their representations were abstract, holistic, and figural and not representational of pitch and rhythm. More formal representations evolved as children's musical minds became more "cognitive." Cutietta suggests that the mind perceives and hears music differently from how music theorists presume it does and that in order to produce a change in mental structure, musical practice might need to adopt a nonelemental approach.

Cutietta's (1985) research focuses on the nature of categories used by children and adults when classifying music and the musical features used to place music into chosen categories. When middle school students were asked to describe what was "the same" about diverse pieces of music heard in sequence, Cutietta found that students classified music in a "holistic" manner. Students forced a wide array of music into small mental categories related to musical styles of rock, opera, television, and church, and the only category used appropriately was rock. Other categorizations (i.e., opera, television, and church) related more to style of performance than actual music. For example, anything performed on an organ, regardless of music, was classified as "church." Likewise, any music performed vocally with vibrato was classified as opera, even if the song was a popular song.

Building on Cutietta's work, Zwink (1988) explored categories used by preschool children to classify music prior to musical training. After hearing a wide variety of music, children were asked, through age-appropriate questions and activities, to verbally describe what they heard; certain categories were used with regularity by a substantial number of children. Again, a consistency in the category of "rock" was used in musically accurate ways by both preschoolers and middle schoolers. Similarly, Cutietta and Haggerty (1987) investigated whether similar categorizations were common among an even broader age span (from age 3 to 80) by determining an individual's ability to categorize music according to nonmusical attributes such as color. Results showed the ease and consistency of categorizations across types of music and age groups.

Another study of categorization processes (Booth & Cutietta, 1991) involved college students being asked to place music into "types of music." Two pieces of music chosen to confound the task contained musical elements that dictated one style (played in an arpeggio style on a solo acoustical guitar with identical meters, tempos, and tonal structure) while more holistic characteristics favored a different style (one was from a Christmas carol and the other was a popular rock-and-roll song). These two pieces were never placed in similar categories but instead were classified with other pieces with little musical similarity (i.e., the popular song was placed in the category with loud and driving electric guitars and drums while the Christmas song was placed in categories with choirs and orchestras). Other examples within the study demonstrated that it was common and easy for listeners to ignore elemental musical characteristics in favor of more holistic characteristics (i.e., style). Another study (Cutietta & Booth, 1996) examined the order of melodies remembered in a free-recall task by musicians and nonmusicians. Melodies were created that systematically paired elemental cues, such as meter and mode, with more global cues, such as melodic contour and melodic flow. Consistently elemental aspects of the music (meter and mode) were discounted in favor of more global characteristics of music.

Several researchers have expanded on the work started by Cutietta. Lineburgh (1994) showed the ease with which students placed music into categories. Using first graders as subjects, she designed a task that encouraged students to place recordings of piano music into one of three categories, based on composer. Students were able to place music into a Chopin, Mozart, or Joplin category after minimal instruction. Furthermore, children were able to transfer this knowledge to unheard pieces by the same composer after just five instructional periods. Thus, she concluded "the act of classifying music is one that is readily undertaken by these children despite the fact that they do not seemingly have the knowledge base which one might assume necessary to undertake such fine discriminations. Clearly, the brain is eager to do the task" (p. 79).

Lineburgh's (1994) findings argue that other musically "correct" categories should be learned in early childhood besides those of the high/low (pitch) and slow/fast (meter). Berke (2000) presented preschoolers with instruction in the "holistic" task of anticipating harmonic changes in songs despite the fact that the students were untrained in more basic "preliminary skills" such as pitch height or pitch direction: After several months of training, 3- through 5-year-olds were able to anticipate and predict I–IV–V^7 chord changes, despite the fact that more "basic" skills of recognizing pitch direction were not mastered. O'Hagin (1997) designed a study using movement activities to ascertain the musical focus of preschool children using music that had inherent conflicts between traditional elements of music and more holistic characteristics of style and mood. Despite months of movement training in responding to elemental aspects of the music, the majority of children consistently favored holistic over elemental aspects of the music in interpreting the music through movement.

These three studies point to the fact that children can readily either learn to classify music using classifications such as jazz, rock, classical, and swing or respond to harmonic progressions before learning isolated pitch. Further, the studies suggest that discriminations usually reserved for more advanced study, such as the difference between classical and romantic solo piano works, are readily learned by young children if they are consistently encouraged to classify these correctly at an early age. The results of these studies open a discussion as to what musical characteristics children use to place music into categories if they have not yet learned to identify the "elements" of pitch, duration, rhythm, form, and timbre.

Cutietta (1993), in discussing implications of this line of research for music education practice, proposed changes not in instructional theory but instead in curriculum development. Commonly, music educators teach music according to its conceptual elements: melody (high/low), rhythm (fast/slow), harmony, timbre, dynamics (loud/soft), and form. These categories help musicians understand musical rudiments and impart musical knowledge to beginning musicians. Traditional curricula in series books and curriculum guides start with teaching basic building blocks of music from a theoretical standpoint, following models established for disciplines such as chemistry that begin with elemental components of a stimulus. Research findings on children's ability to categorize music according to prescribed criteria advocate reliance on the skills the child brings to the task of learning. The latter are primary learning tools and determine how musical information presented to the child is organized. This organizing principle could become the basis of any theory of music learning.

Cutietta (1993) suggests that curricula be structured in such a way that learning capitalizes on basic processes that are observable when learners make musical choices. Thus, before a change in mental structure can occur, it may be necessary to determine existing mental structures. While his research has not yet identified such structures in detail, it has demonstrated that fine discriminations, such as tempo or pitch height, may be not only unnecessary but not useful to young children who try to make sense of their musical world. Instead, it seems that holistic categorizations, based on musical styles or moods, are important first steps from a learning standpoint.

Regelski's (1982) work, too, is based on the observation of children involved in the music learning process. Believing that, too often, the child is told the "meaning" of knowledge as society sees it and not as the child sees it, he advocated that children must be encouraged to construct and create personal meaning from musical experiences in order for learning to occur. Theoretically, this view can be validated as a constructionist perspective. However, Regelski's concern about fostering a form of music learning that moves away from verbal learning models and toward an understanding of the child's own processes of "meaning making" in music reflects a more music-intrinsic approach toward developing a theory of music learning. This view is supported by Elliot's (1995) later proposed construct of "musicing," which means that the "doing" of music through performance and active listening is more important than the verbalization of learned concepts. According to Regelski (1982), too much of music learning is based on verbal models that lead to

> unhealthy states of mind among students in general music classes in the middle and secondary years. . . . Public school education has largely been a matter of acquiring verbal control over one's interaction with the environment. . . . Words, thus have come to stand between a person's perceptions and their actions. They have formed a semantic web that filters raw or pure experience. (p. 6)

Rather than base music learning on verbal models, Regelski believes that students should become more actively involved with making, creating, and manipulating musical sounds. However, he does not diminish the "verbalization" process, advocating that musicing must be accompanied by thoughtful and thought-provoking activity. Verbal learning does have a place in music education, but "it should be placed after the experience, not before it. And it should progress in the student's own terms. [If verbalization] is placed between the child and the reality, especially when the reality is music, all kinds of problems arise" (p. 10).

Regelski's model of music learning, which is, at the same time, his model of music education practice, does not differ essentially from those of other theorists seeking to develop constructs of music learning from within the field of music itself. Similar to Gromko's research, Regelski endorses initial musical learning as sensorimotor and as active, nonverbal musical experiences; Regelski warns that language is not needed before learning and that it can actually decrease learning. Comparable to Bamberger's research, Regelski relies on reflection as a means of facilitating learning; children construct personal meaning and understanding from experience based on past knowledge. Akin to Gordon's work, Regelski's work advocates aural rather than written or language-based musical experiences. As a way of furthering learning, Regelski recommends, as does Cutietta, beginning the instructional process with what the child perceives or knows.

Critique: Learning Theories Unique to Music

Any one theory of music learning derived from observing musical behaviors is likely to be the result of the work of not one but many individuals. Learning music is a complex and interwoven matrix of skills, knowledge, affect, and beliefs. To this end, it will take an array of researchers and scholars to bring these together.

The researchers reviewed here have made strides toward articulating what it means to learn and think musically. As is the case with any learning theory of any philosophical persuasion, categorizing sound is an essential first step in that regard. This is the commonality among them. How a learner is asked to describe musical experiences and group them, however, sets the researchers apart.

When looked at from a wider perspective, explorations such as the ones described begin to take on meaning beyond specific results yielded by any one study alone. Each contribution, while approaching the study of music learning from a different angle, becomes part of a larger whole. Gordon and Bamberger focused on how to make visible, without the use of words, what a learner does when presented with musical stimuli. Much, if not the majority, of research derived from learning theories outside of music makes the assumption that words are needed to document such processes. The inner "voice" that attempts to figure out something, or the fact that most of what is learned is mediated by words (either through reading, hearing, or speaking language), argues in favor of such an assumption. However, Gordon and Bamberger clearly reject the assumption that music involves verbal-type processes. Once this assumption is rejected, the first task toward creating a theory of music learning is to find what replaces the verbal foundation.

Gordon and Bamberger each took a different route to explore this fundamental question. Gordon looked within music, and Bamberger looked within the child. In Gordon's case, he found basic patterns within music that he believed represented the basic vocabulary of music. These pitch and rhythm patterns could be added together over a canvas of repeating beat patterns to represent music. In this way, sound patterns become the musical vocabulary for the inner "voice," but instead of talking, the voice sings. Since no word existed for this nonvocal singing, Gordon called it audiation.

Bamberger found that the children heard patterns similar to those proposed by Gordon. However, the patterns were not static, as Gordon suggested, but changed with each musical hearing. Because the child changed and evolved with each hearing, the musical patterning perceived by the child constantly changed and evolved.

Like Bamberger and Davidson and Scripp, Gromko explored this changing perspective and concurred that the perception of patterns is developmental. As children grow, their musical "encoding" grows with them. Gromko found that the earliest representations were holistic, while grouping of patterns appeared as the child got older. The work of Cutietta and others has concerned itself with *how* and *why* children select patterns. As the child starts to acquire musical patterns in the form of songs or pieces of music, he or she must find a place to store them for recall. It is clear from this research that children and adults group music together in memory. What causes them to group patterns and musical experiences in particular ways is still the question. Some say the answer lies in the affective nature of music; others argue that affect is the result of experience, exposure, and context.

Conclusion

The goal of scientific inquiry is the establishment or refinement of theory (Carlsen, 1987). Researchers in the behavioral, social, and "hard" sciences observe facts or data in their respective fields, seek answers to questions or problems arising from these facts, attempt to reason or hypothesize the origin of data on the basis of established or speculative theories, and measure and test these hypotheses in subsequent research. The end result is an attempt to unify the why and wherefore of phenomena as well as build a body of cohesive research in a given field. As Sidnell (1981b) wrote:

> Believing that music education is a study of the nature of, and modification of, human musical abilities, I am thoroughly convinced that we need to fashion a rational framework upon which a fabric of process can be woven to effect well-directed change in the people we teach. It is all about theory. (p. 175)

The use and creation of theories as the basis for research is the sign of a mature profession. Theories provide guidance and direction to research efforts and have allowed researchers to begin to build a body of literature that interrelates and collectively has the potential for making an impact. It requires an examination of the findings of seemingly diverse studies in the broader context of constructs that may explain the nature of music learning during different ages, developmental levels, and levels of experience with and exposure to music. It requires an understanding of learning both as a formal and as an informal endeavor and viewing the learner both as an individual and the member of a group. In both cases, the individual seeks to make meaning of and respond to internal and external stimuli, but the response may be different.

Over the 30-year period reviewed, there has been an ebb and flow of learning theories in the literature; clearly, some have been "in vogue" and then have become more obscure. It is not uncommon for a researcher to justify a particular study as a critical response to another study that utilized a different theoretical stance. In music education, this approach has often been somewhat naïve. Instead of showing a true, healthy skepticism toward theories or engaging in scholarly discourse over the relative merit of specific theoretical constructs, it too often has been the practice to "pit" one approach against the other or, worse, one researcher against the other. Far too many examples within the music education profession exist where justifying a study from a cognitive standpoint is based on the premise that all earlier research was behavioral or on the assumption that behavioral studies are tested with quantitative and cognitive theories with qualitative methodologies. Thus, learning theories are confused with research methodologies and constructs with design.

Instead, theories need to match the hypothesis tested. A study of improving trill speed in clarinetists or increasing practice time for band members might benefit from constructs derived from behavioral theories. Conversely, a study exploring how individual students approach the act of practicing might best involve variables more commonly found in cognitive or constructivist models.

Likewise, it is just as important to continue researching the creation of a learning theory unique to music as it is to examine the usefulness of importing theories from other disciplines to the music classroom. The profession is multifaceted enough to need a variety of diverse theories to explain different phenomena inherent in music learning.

In the future, the profession would be well-guided to increase the practice of grounding research in theory. Far too many studies still stand alone in the field with little or no relationship to the body of literature available. Greater strides will be achieved in translating research into practice when learning theories are used as the guiding and unifying force behind research efforts.

NOTE

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