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Motor and Cognitive Characteristics in Young Music Students

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Abstract

This comprehensive study explores the intersection of motor and cognitive development in children, specifically examining their relevance to the initiation of musical education. Drawing on seminal theories and empirical studies by experts such as Seefeldt, Gallahue, Piaget, and others, the research identifies critical developmental stages in children aged 7 to 11. It underscores the importance of fundamental motor skills, highlighting key movements like throwing and hitting an object in relation to hand-eye coordination and mobility. Moreover, the study delves into manual dexterity, indicating its peak development at 8 years and its relevance to instrumental practice. It emphasizes external influences on motor development, elucidating the impact of guidance, practice opportunities, and environmental factors on skill acquisition. Additionally, it examines cognitive development within Piaget's concrete operational stage, showcasing children's emerging capacity for logical thinking and problem-solving. The abstract concludes by affirming that 8-year-old children possess foundational motor skills, cognitive capabilities, and body awareness essential for embarking on instrumental training, thus mitigating concerns regarding their readiness.

Keywords: Motor Development, Cognitive Growth, Instrumental Education, Child Development, Fundamental Movement Skills.

Abstract (Spanish)

Este estudio exhaustivo explora la intersección del desarrollo motor y cognitivo en niños, examinando específicamente su relevancia en el inicio de la educación musical. Basándose en teorías fundamentales y estudios empíricos de expertos como Seefeldt, Gallahue, Piaget y otros, la investigación identifica etapas críticas del desarrollo en niños de 7 a 11 años. Se destaca la importancia de las habilidades motoras fundamentales, resaltando movimientos clave como el

lanzamiento y golpeo de un objeto en relación con la coordinación mano-ojo y la movilidad. Además, el estudio indaga en la destreza manual, señalando su desarrollo máximo a los 8 años y su relevancia en la práctica instrumental. Se enfatizan las influencias externas en el desarrollo motor, elucidando el impacto de la orientación, oportunidades de práctica y factores ambientales en la adquisición de habilidades. También se examina el desarrollo cognitivo dentro de la etapa operativa concreta de Piaget, mostrando la capacidad emergente de los niños para el pensamiento lógico y la resolución de problemas. El resumen concluye afirmando que los niños de 8 años poseen habilidades motoras fundamentales, capacidades cognitivas y conciencia corporal esenciales para iniciar la formación instrumental, mitigando así las preocupaciones sobre su preparación.

Palabras clave: Desarrollo motor, Crecimiento cognitivo, Educación instrumental, Desarrollo infantil, Habilidades fundamentales del movimiento.

Introduction

It is well known that music learning has huge advantages for children, and usually the younger they start, the better. In fact, the education curriculum in Spain for the regulated musical education establishes the ordinary age to begin these studies the year that the child becomes 8 years old. Nonetheless, since this is a school year, it must be taken into account that this period will encompass boys and girls from 7 years of age (those born at the end of the year) to 9 years of age (those born in January will be 9 and a half years old at the end of the school year). However, learning and working on the technique of a musical instrument requires —even from the beginning— complex movements and thinking. Therefore, it is worth considering at what stage of their development the students are, what motor and cognitive abilities they have, and whether this could be a limiting factor in teaching.

In fact, D. L. Gallahue illustrates in the following passage the importance of knowing the developmental process of students in order to develop a quality teaching practice:

> *Understanding the developmental process of the typically developing individual provides vitally important guidelines for effective teaching and learning. Knowledge of developmental processes is at the core of education, whether in the classroom, in the gymnasium or on the playing field. Without a solid understanding of the developmental aspects of human behavior, we can only guess at appropriate educational techniques and intervention procedures. Developmentally based instruction incorporates learning experiences that are not only age-appropriate, but are also fun and developmentally appropriate.* (Gallahue, Ozmun, & Goodway, 2012, p. 3)

Although child development can be approached from different behavioral domains (psychomotor, cognitive, and affective), as a result of the influence of the domains proposed by B. Bloom in his well-known taxonomy, it is essential not to lose sight of the fact that these three are closely linked. According to Winnick, although this division may be useful from a research point of view, such a perspective is of little value when it comes to understanding the learning process (Winnick, 2011, p. 380). Thus, although these domains are usually studied as individual units, it should always be kept in mind that they are in constant interaction. As Payne states, "everything we do in the motor domain is affected by our emotions, social interactions, and cognitive

development. Furthermore, all behavior in the affective and cognitive domains is strongly influenced by motor development" (Payne & Isaacs, 2012, p. 32). Therefore, both motor and cognitive development are considered in this article, in order to obtain a more complete perspective of the students' abilities when working on a musical instrument learning.

Finally, it is significant to add that the vast majority of authors agree on the regularity of the sequences of both motor and cognitive development. Although there is a great variation in temporality at the individual level, the stages are usually the same for all children. This means that, although each infant may reach each of the developmental stages somewhat earlier or later, they generally all pass through the same stages with similar characteristics. For example, Cheatum explains: "After birth, certain stages of growth and development are common to most children. They will enter and pass through those stages in roughly the same order and at about the same age as other children" (Cheatum & Hammond, 2000, p. 17); or Gallahue: "Although everyone's 'biological clock' is quite specific in terms of the sequence of movement skill acquisition (maturation), the pace and extent of development is individually determined (experience) and dramatically influenced by task demands" (Gallahue, Ozmun, & Goodway, 2012, p. 5).

First Approaches

One of the pioneers in the study of child development was psychologist and pediatrician Arnold L. Gesell. Born in Wisconsin in 1880, he conducted an extensive longitudinal study with multiple children, following them with extensive observations and assessments from birth until adolescence. The result of all this research was the publication of several books in the middle of the 20th century, in which he established a series of typical developmental sequences. Gesell and his team described a multitude of milestones that children reach throughout their development process, related to different areas such as motor control, language, perception and socialization. Therefore their research, although not focused exclusively on motor development, offers a fairly broad picture of each of the years through which a child passes until they become an adolescent.

In relation to the aspects relevant to this article, Gesell (1993) states that the 7-year-old child already shows signs of critical and reasoning capacity, as well as a greater capacity for reflection. According to the author, the child takes time to think, is interested in conclusions and

logical developments, and it is possible to reason with him (p. 548). That is to say, in the earliest stage of regulated musical education some cognitive traits can already be glimpsed that allow work on somewhat more complex concepts, which go beyond learning notes and rhythm.

In the eighth year of life, Gesell notices a quickening of the child's psychomotor rhythm: "the child wants to speak, read, write and practice his piano lessons at maximum speed" (p. 578). Regarding physical development, the author explains:

The eight-year-old's body movements have fluidity and often grace and balance. He walks freely. He is aware of his own posture and sometimes remembers to sit upright; [...] He enjoys theatrical attitudes and expression through a great diversity of postures and gestures. (p. 584).

And a little further on:

There is increased speed and fluency in fine motor operations. The approach and grasp are rapid, smooth, and even graceful; the release is made with sure and precise gesture. [...] Eight can change posture with a greater sense of adaptation. [...] Eight can think before he acts; but he also delights in doing things quickly, so that the preliminary pause is not prolonged. (p. 584)

Finally, for the nine-year-old child Gesell highlights a further increase in cognitive abilities:

Self-motivation is the cardinal feature of the nine-year-old. It is the key to understanding him in his progress towards maturity. The child possesses an increasing capacity to apply his mind to things, on his own initiative or with only slight suggestions from the environment. (p. 610)

Eight turns a certain amount of attention to a difficult task, but his energy is soon exhausted. Nine is able to draw on reserves of energy and renews his attack in repeated trials. This is due to the greater maturity of his entire endowment and behavior. It is not surprising that he is such a good student, willing to tackle anything that is reasonably within his ability. Nine is an optimal age for improving expertise in the handling of tools, in the fundamental operations of arithmetic and other skills. [...] He likes to plan ahead and anticipate things. If a task is complicated, he asks for the successive steps to be explained. Then, when he attacks a problem without immediate success, he reveals his power of self-appraisal. (p. 611)

Similarly, this increase in cognitive abilities goes hand in hand with an increase in physical abilities. The nine-year-old child has a greater capacity to analyze his movements, both before and

during the action. He shows greater skill in his behavior and enjoys showing off his skill. In particular, as far as manual activity is concerned, he is generally able to use both hands independently of each other, and also the fingers show a new differentiation (Gesell, Ilg, & Ames, 1997, p. 617). Interestingly, the author states: "The child plays the piano on the table, pinches, paws, and plays with the edge of a paper he is reading" (p. 617).

As can be seen, and in spite of the generalist nature of Gesell and his team's observations, the typical student in first year of musical learning would already have the resources to begin working with the instrument, both physically and cognitively.

However, well into the twentieth century and continuing to the present, more specialized studies and research have been carried out in different areas of motor and cognitive development, which can offer a more in-depth vision of these aspects, which, as mentioned in the introduction, are important to know in order to develop an effective teaching task.

Seefeldt's model

In 1979, Vern Seefeldt, a recognized expert in child motor development, published in the journal *Psychology of motor behavior and sport* (edited by the North American Society for the Psychology of Sport and Physical Activity) an article entitled *Developmental Motor Patterns: Implications for Elementary School Physical Education*. In it, he proposes a model for motor development divided into four levels of motor efficiency acquisition: the level of reflexes and reactions, the level of fundamental motor skills, the level of transitional motor skills, and the level of sport- and dance-specific skills. In addition, he associates each of these levels of efficiency to a period of children's life. Thus, the first level corresponds to the neonatal period, the second to early childhood, and the third and fourth levels to middle childhood, extending into adulthood.

Especially important is that the author places a proficiency barrier between the second and third levels, thus indicating the importance of these fundamental skills for the subsequent development of other skills. That is, the skills located at the second level (such as jumping, throwing, catching) can be combined or modified in various ways to generate specific skills such as those of the third level (rope skipping, playing paddle tennis). But to do so, one must have

achieved proficiency in such fundamental movements, and be able to cross the barrier between levels. In general, the pyramid shape of the model implies that success at any level (except the first) is dependent, at least in part, on the level of competence attained at the lower levels.

In another publication by the same author (Seefeldt, 1986), the characteristics of middle and late childhood are described, covering the ages between 8 and 14 years, of which 8 years would correspond to the transitional level of the model described above. At this stage, according to Seefeldt (1986), motor behavior is marked by the refinement of fundamental motor skills acquired during early childhood and by the development of basic dance and sports skills (p. 66). Likewise, the plasticity of motor behavior during this stage makes it the ideal time to promote change and acquisition of new skills and the refinement of those already learned (p. 93).

Therefore, if dance and sport are equated to the practice of a musical instrument, given the similarity in the need for highly specialized and coordinated movements, from the model proposed by Seefeldt it can be understood that the 8-year-old student has already surpassed the level of fundamental motor skills and has been able to cross the proficiency barrier, so that they can already perform more complex motor skills.

Gallahue's Triangulated Hourglass Model

One of the most accepted and up to date models for the description of motor development in infants is the one proposed by David L. Gallahue and his collaborators in their work *Understanding Motor Development: Infants, Children, Adolescents, Adults*, whose latest revision dates from 2019. This model, similar to the previous one in structure, is however more comprehensive.

In the aforementioned work Gallahue proposes a model called the Triangulated Hourglass, which is intended to serve as a "heuristic resource" or "conceptual metaphor" that provides general guidelines for describing and explaining motor behavior (Gallahue, Ozmun, & Goodway, 2012, p. 56). This model equates the person to an hourglass, which keeps filling up with sand, representing "the stuff of life." This sand comes from two containers, representing the two fundamental aspects that contribute to motor development: genetic inheritance on the one hand, and the influence of

the environment on the other. The sand fills the lower part of the hourglass, which represents the different stages of a person's development. As more sand fills the hourglass, the pile increases in height and reaches higher levels of development. At a certain point, usually a few years before or after the age of 20, the hourglass is inverted, and all the sand that had been poured into the lower part of the clock during the first years of life passes through the filters of heredity and lifestyle to fill the new container. Thus, everything acquired during the first phase of the model, with the addition of what Gallahue calls "lifelong learning opportunities," is what the adult will count on to continue to develop and maintain their physical activity.

Particularly interesting in this model is the division into ages that the authors make, given that although they maintain at all times that these age ranges are approximate guidelines and that there is great individual variability in the temporality of motor development, they make it possible to acquire a notion of what capacities would be expected in students according to their age. Two of these ranges are important for the type of students considered in this work: the Proficient Stage and the Transitional Stage.

The Proficient Stage takes place between 5 and 7 years of age, and would be the stage that the students concerned in this paper have either just passed or are at their most advanced point. It is therefore a stage whose characteristics can be taken for granted. According to the authors of the study, this stage is characterized by "controlled, coordinated and mechanically efficient actions" (Gallahue, Ozmun, & Goodway, 2012, p. 53). Competent fundamental movement skills are already in a mature state with respect to these three aspects (control, coordination, and mechanical efficiency), but they can still continue to improve as far as movement product is concerned. That is, the how far, how fast, how many times, and how accurately can be improved with continued practice opportunities, encouragement, and instruction. Specifically, Gallahue states that according to most data, children can and should be at the proficient stage by age 5 or 6 for most fundamental skills, given that neurological configuration, visual perceptual skills, and anatomical and physiological characteristics are already sufficiently developed. However, manipulative skills requiring visual tracking and interception of moving objects tend to develop somewhat later because of the more complex visual-motor coordination demands of these tasks.

Finally, the authors again emphasize that most children do not reach this stage through maturation occurring in the body alone, but that a combination of opportunities for practice, motivation, and instruction in an environment that fosters learning is required. In fact, the lack of these opportunities could greatly hinder the acquisition of competence in these fundamental movement skills, which would in turn make it difficult for the application and development of the phase that follows: the Specialized Movement Phase, the first stage of which is the Transitional Stage.

This new phase, which begins at age 7 and continues until adult life, is characterized as an extension of the previous phase, where the movement patterns are the same as those that had been consolidated in the fundamental phase, but progressively refined, combined and elaborated to be applied in increasingly demanding situations. During this phase, movements become tools to be applied to a variety of complex activities in daily life, leisure, and sports practices. The stage that initiates this phase, and which directly follows the Proficient Stage, is the Transitional Stage, and according to Gallahue it takes place between 7 and 10 years of age, that is, the point at which the vast majority of students in the first year of musical education are. During this stage the individual begins to combine and apply the same elements that made up the fundamental movements to the practice of specialized skills in sports and leisure environments. In fact, it is at this time when potential athletes learn how to train to develop high skills and performance, which could be assimilated to the study of an instrument. These transitional movements, as mentioned, contain the same elements as the fundamental movements but with greater form, precision and control, i.e., in a more complex and specific way.

Later in Gallahue's book, in the chapter on growth and development, the child's increase in height and weight during late childhood (6 to 10 years) is described as slow but steady, accompanied by progress toward greater organization of the motor and sensory systems (Gallahue, Ozmun, & Goodway, 2012, p. 176). According to the authors, this slow but steady pace allows the child to become accustomed to their body, which in turn is propitious to a "dramatic improvement" in motor coordination and control during these years.

Therefore, and similar to Seefeldt's, the model proposed by Gallahue and his team describes the student beginning musical training as an individual who has already consolidated fundamental movements, and who is in a position to develop them to learn new, more complex movement patterns. In this case, with the age range delimited to 7 to 10 years, corresponding to the transitional stage. In addition, it should be noted that it is at this time when those who practice activities that require highly specialized movements (sports, study of a musical instrument) begin to develop this specialization.

Studies on specific movements

In addition to the models, which propose a more general view of the evolution of the motor skills of the individual over the years, one of the most common approaches to the study of motor development has been the study of different types of specific movements. By analyzing these movements, either from the point of view of performance or from the point of view of outcome, it is possible to trace the child's evolution over time.

Although the range of movements on which studies have been carried out is wide, they are usually movements related to play. However, for this article two of them have been selected that, due to their characteristics, could offer information applicable to learning to play and working on a musical instrument: throwing an object and the action of hitting an object. This is due to their close relation with hand movements and hand-eye coordination.

In the case of throwing, it refers to throwing an object (small ball) over the shoulder. Applied to the piano, for example, this can give an idea of the mobility capacity of the arm and its coordination with the rest of the body. This type of movement was extensively analyzed in Monica Wild's study conducted in 1938, cited among others in the works of V. G. Payne (Payne & Isaacs, 2012, p. 383) and H.G. Williams (Williams, 1983, p. 230), a study that established the basis for the investigation of this type of movement. In it, it was concluded that from six and a half years of age the infant had usually already reached stage 4 for the over-the-shoulder throw, the highest of those defined by the author to analyze development in this movement. This implies that the infant is already performing a complex movement, which includes stepping forward with the opposite

leg in preparation, a clearly evident trunk rotation, and an arm follow-through to the hand movement to reinforce the effectiveness of the throw.

Subsequent research was conducted after this study to corroborate the findings, such as that conducted by Seefeldt, Reuschlein, and Vogel (1972), also cited in Payne (Payne & Isaacs, 2012, p. 384). In this study, five stages were described that form the developmental sequence for the movement analyzed, where again the fifth stage involves a higher degree of complexity, and the various parts of the body are involved to perform a more efficient throw. The results show that 60% of the boys reach this fifth stage at 63 months of age (just over 5 years) while for girls the age is 102 months (eight and a half years). Leaving aside the great difference between boys and girls, perhaps due to gender stereotypes that may have prevailed at the time of the study, and that perhaps today would bring the girls' results closer to those obtained by their peers, what the study shows is that by the eighth year of life, a large percentage of students have already reached the most complex stage in this type of movement.

The other movement that may be of interest for the work on musical instruments is that of striking an object, defined as "fundamental movement in which a body part or an implement is used to project an object" (Payne & Isaacs, 2012, p. 403). In this case, movement can offer insight into the ability to use both arms as well as eye-hand coordination and the tracking and anticipation of a moving object. Again a study by Seefeldt, in this case with Haubenstricker, and also cited in Payne (Payne & Isaacs, 2012) describes four stages that form the developmental sequence for the movement of hitting a ball with a bat. For the fourth stage, which involves weight transfer in rotation, elbow extension and pronation-supination movement of the hands, etc., 60% of boys at 87 months (just over 7 years) are able to bat with these characteristics, while the age for girls is 102 months (eight and a half years). Although in this case the gender difference is not as pronounced as in the previous movement, again it can be concluded that a considerable number of students in the first year of musical education will be able to carry out the action of hitting with a bat with the level of complexity explained.

Finally, and in relation to the action of hitting, it is worth mentioning Payne's comment on Wickstrom's reaction to the conclusions of his study. The latter is surprised at how similar the

movement pattern of the 4-year-old child and that of an adult are when performing a sideways hit (Payne & Isaacs, 2012, p. 403).

Manual dexterity

Finally, the scientific literature provides some data on hand and finger movement ability and skill in young infants. As in the previous section, these are not specific movements of any musical instrument, but in some way can offer a perspective of motor development more focused on these parts of the body.

In the above-mentioned work by Williams (Williams, 1983), the author alludes to the studies of Martha B. Denckla (1973, 1974), in which a series of finger and hand movements are analyzed in children from 5 to 10 years of age. The first of these is finger movements, consisting of repeatedly tapping the same finger on a surface as fast as possible (repetitive), or touching the thumb with each of the other fingers sequentially starting with the index finger to the little finger and back (successive). The results show a significant improvement between the ages of 5 and 7 years, yet there is little or no difference in the results for infants aged 8, 9 and 10 years. This conclusion is reinforced by the statement of B. J. Cratty when he indicates that often the performance on this task of children, and particularly girls, at age 8 is close to that of adulthood (Cratty, 1986, p. 217).

Another of the movements studied consists of hitting a surface with the hand (hand patting). In this task, children are asked to lightly tap their whole hand against a surface 20 times as fast as possible. Here the results show a gradual improvement from 5 to 8 years of age, after which there is a plateau in the performance of the infants analyzed.

The next movement analyzed is the alternation between pronation and supination of the hand, consisting of rotating hands and forearms from pronation to supination and vice versa as fast as possible. In general, there is an improvement in children between the ages of 5 and 8 years, with the most pronounced change occurring between the ages of 7 and 8 years. There is little or no change after the age of 8.

Finally, the alternation of flexion and extension in the hand is also studied. In this case the infant is asked to move the hand (and thus the wrist) from a flexed position to an extended position and vice versa as fast as possible. The speed with which this movement can be performed increases significantly between 5 and 7 years of age, and again little or no change is observed thereafter.

As can be seen, Denckla's studies show that the most significant changes in fine manual dexterity occur before the age of 8 years, after which no significant changes are observed.

Maturation vs. Learning

Notwithstanding all the above models and studies, which associate different ages with the respective abilities, it is also necessary to take into account other external factors that affect motor development and on which, in fact, the above authors have a bearing. That is to say, it is not only the course of time itself and the maturation of the organism that leads to development. Gallahue explains this very adequately in the passage below:

> *One of the major misconceptions about the developmental concept of the Fundamental Movement Phase is the notion that these skills are determined by maturation and are little influenced by task demands and environmental factors. Some child development experts (outside the area of motor development) have repeatedly written about the "natural" unfolding of children's movement and play skills and the idea that children develop these skills simply by getting older (maturation). Although maturation plays a role in the development of fundamental movement patterns, it should not be considered the only influential factor. Environmental conditions —i.e., practice opportunities, words of encouragement, instruction, and the ecology (context) of the environment— play an important role in the degree of development of fundamental motor skills.* (Gallahue, Ozmun, & Goodway, 2012, p. 52)

The author again alludes to this fact when discussing perceptual skills, stating that "the key to maximal development of more mature growth patterns in the infant is use," and that "practice and experimentation with maturing perceptual skills will enhance the process of integration with motor structures" (Gallahue, Ozmun, & Goodway, 2012, p. 177). And further on he reiterates that "The development of specialized movement skills is highly dependent on practice opportunities, adult encouragement, quality instruction, and the context ecology of the environment (p. 306).

Seefeldt, on the other hand, raises the question of whether young children's motor patterns can be modified through intervention or whether they are entirely controlled by maturational forces. To this, he offers the answer that the evidence is reasonably clear that, given appropriate tasks and sufficiently guided practice, the learning of gross motor skills in children can indeed be enhanced by planned instruction. Thus, the evidence suggests that in appropriate learning environments, motor skill acquisition can be enhanced during the early childhood years (Seefeldt, 1986, p. 65). And again, a little later, he expresses this idea in a more definite way: "There is sufficient evidence to conclude that gross motor skills can be effectively taught to young children if guided instruction, appropriate sequences of tasks, and sufficient practice time are provided" (p. 66).

As will be seen at the end of this writing, these conclusions de-emphasize whether or not students possess the necessary physical faculties, while placing greater importance on the external influences that teachers and the environment may exert.

Piaget's Theory of Cognitive Development

As it has been regarded in the introduction, it is inadvisable to approach motor development separately from the other domains of human development, since all of them are intimately interrelated. Especially linked to motor development is cognitive development, of which Jean Piaget is considered to be the greatest exponent.

The Swiss psychologist and philosopher elaborated, throughout his numerous publications, his well-known Theory of Cognitive Development. Similar to models of physical development, Piaget divided cognitive development into a series of four stages: the sensorimotor stage, the preoperational stage, the stage of concrete operations and the stage of formal operations. These represent the infant's evolution toward more abstract and complex forms of thought and knowledge of the world around him. In addition to describing the cognitive capacities for each of these stages, Piaget associated an age range in which boys and girls are in them, which allows us to estimate what type of mental processes students of a given age will be able to carry out.

Of the four stages mentioned, the one that concerns the present article is the stage of concrete operations, since it is the one that generally occurs between 7 and 11 years of age. The

fundamental novelty at this stage, as Aurelia Rafael explains, is that children "begin to use mental operations and logic to reflect on facts and objects in their environment," which facilitates "approaching problems more systematically than a child in the preoperational stage" (Rafael, 2007, p. 12). Specifically, these operations are seriation and conservation. That is, the infant is able to compare and order objects in logical progression, as well as to understand that an object can change some of its characteristics (shape, appearance, etc.) and still be the same object. Moreover, as Payne points out, these operations can be modified, organized and even reversed (2012, p. 42).

All this creates a network of mental processes that allow 8-year-old students to face more complex learning situations, since they already have a certain capacity to apply logic to understand the teacher's explanations as well as to understand the cause-and-effect relationships between the movements made and the results obtained. In addition, they can compare these results to look for the desired outcome. As Williams explains, "when compared with the previous period of development, behavior during this stage is characterized by the fact that thought can now precede and guide action, but not function independently of it" (Williams, 1983, p. 14).

Finally, the end of this sentence hints at the main limitation of this stage of children's thinking: although the mental operations that students are able to use are diverse, they are only applicable to real or experience-based objects, persons, events or situations. That is, children in the concrete operations stage are not yet able to mentally conceive and analyze hypothetical or abstract situations (Payne & Isaacs, 2012, p. 42).

Other considerations

A cognitive aspect that is also interesting to address is that of imitation, since it is one of the most effective resources for teaching how to play a musical instrument at the ages on which the present research is focused. In this regard, in Seefeldt's work (Seefeldt, 1986) it is mentioned that the 7-year-old child is able to use a model as an example to follow if it is given before practice, and that at the age of 9 he is already able to use it effectively regardless of whether the model is given at the beginning of the lesson or after having attempted the task (p. 130). On the other hand, Cratty states that "by the age of 6 or 8 years, imitation of both simple and complex gestures,

whether related to everyday actions or meaningless gestures, can be duplicated by most children (Cratty, 1986, p. 251).

On the other hand, some studies on cognitive development in children have analyzed the ability to identify body parts. This is an important aspect to consider, since during the work on instrument lessons it is common to refer to the different parts of the body involved in playing: not only the fingers, but also the wrist, elbow, forearm, shoulder, etc. Cratty states that according to the experiences of Ilg and Ames, more than 80% of 5-year-old children were able to identify parts of the face, arms and hands. Some parts of the hands begin to be identified at age 5, when the thumb is discovered, and the process continues until age 7, when the elusive fourth finger is finally detected (Cratty, 1986, p. 72).

In fact, it is at this age (7 years old) that B. A Cheatum states that most children can identify minor body parts such as ankles, wrists or shins. And it is as early as age 9 that the infant should be able to identify all parts of the body (Cheatum & Hammond, 2000, p. 92).

Conclusions

After analyzing the data obtained from various studies on both motor and cognitive development, which as it has been stated in the introduction are —in some sort of way— two sides of the same coin, we can reach the general conclusion that students in the first year of musical education are in a position to begin working on the technique of their instrument with certain guarantees.

First of all, with respect to motor development, the models reviewed describe an 8-year-old boy and girl who already has a solid command of the fundamental movements, and who is beginning to be able to combine and develop these movements into more complex and specific patterns. In addition, the longitudinal studies on specific movements that have been seen show that by the age of 8 years a large percentage of infants are able to execute with a high degree of competence movements such as throwing an object or hitting an object with a bat. Therefore, it can be concluded that motor capacity is not a limiting factor for technical work in the classroom. Although this research regards instrumental practice, it should not be forgotten that it is focused

on the beginning of the work of the technical work, so the movements will still be relatively simple, equivalent or even simpler than those shown in the studies.

Likewise, the results of the research on manual dexterity show that it is at the age of 8 years that the increase in these skills reaches its peak, given that in later years there is no significant improvement. This indicates that there is no reason why work on instrumental technique should be postponed to later grades.

What is really interesting from the data collected in this chapter is that motor development is not solely a function of maturation, but depends to a large extent on adequate instruction, a motivating and supportive attitude, and the opportunity for practice. And this is precisely what happens —or should happen— in the classroom environment. Therefore, the relevance of questioning whether or not students will be prepared is reduced in favor of the assertion that with good teaching, students will be able to improve.

Secondly, the child's cognitive development is found in what Piaget called the stage of concrete operations, and it is precisely these operations which allow students in the first year of musical education to be able to think with a certain logic and to understand the processes that can be explained to them in class. In fact, the main limitation of this stage, abstraction, is compensated by the figure of the teacher, so that the child does not need to hypothesize about imagined facts, but follows the teacher's indications. This too, as it has been explained, is something that 8-year-old students are capable of doing.

Finally, it should also be noted that children of this age are able to identify all the parts of the body, and are therefore aware of them. Thus, all explanations and indications about the parts of the body involved in the instrument practice will be more easily understood.

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