This article introduces the concept of musical harmonization in the prenatal development of a child within the context of the "mother-fetus" dyad, employing the unique "Sonatal" method developed by the author. This method is designed to optimize the processes of morpho-functional and psycho-emotional maturation of the fetus. It aims to stimulate motor activity, regulate cardiorespiratory functions, prevent prenatal hypoxia, and equip pregnant women with communication skills for interacting with their child before birth. Additionally, the method focuses on enhancing the well-being of pregnant women, preparing them for childbirth, and fostering a positive impact on their health.

The "Sonatal" method involves various activities, including singing, appropriate movements and touches to the abdomen, color music simulators, children's musical instruments, and active listening to music. Pregnant women participate in daily dosed vocal-speech activities, including a weekly one-hour session at the School of Prenatal Development, offered both, in group settings, and individually, throughout the stages of pregnancy.

The paper delves into the distinctive musical qualities associated with both motherhood and childhood. Additionally, it presents select findings from the study, showcasing fragments utilized in validating the efficacy of the "Sonatal" method.

The comprehensive array of positive responses observed in the "mother-fetus" organism, stemming from the application of the "Sonatal" method during pregnancy and childbirth, is discussed. This encompasses enhancements in lactation for nursing mothers, along with favorable indicators of health and the mental and physical development of the child during postpartum stages of ontogenesis—a phenomenon termed the "Sonatal effect" resulting from prenatal classes using this method.

Keywords
The "Sonatal" method; Insonation; Musical psychoregulation of breathing; Rhythmic balance; Musical genetics; Musical phenotype. Prenatal childhood. Prenatopedia. Sonatal effect.

Introduction
The growing prevalence of perinatal pathology, including the birth of numerous premature infants with significantly low body weight, has become a matter of heightened concern [1]. Consequently, the exploration and establishment of specialized pedagogical support systems for child development, commencing from the prenatal stage, have gained increasing significance.
Over the past few decades, the study of the pre- and perinatal phases of childhood ontogenesis has evolved into distinct scientific domains. In the field of pedagogy, scholars such as B. Logan and N.A. Chicherina [2, 3] have contributed to the development of prenatal pedagogy. Additionally, perinatal psychology has seen notable figures like T. Verny [4], G. I. Brekhman [5], Abramchenko V.V. & N. P. Kovalenko [6], and G. G. Filippova [7].

In the realm of medicine, prenatal pediatrics has emerged with significant contributions from A.N. Zotov, L.N. Zotova, F.G. Akhmerova, and V.B. Henven [8-11]. These distinct scientific domains collectively enrich our understanding of the intricate phases of childhood development.

Simultaneously, the need persists for a scientific foundation and methodology for providing early care to pregnant women and their prenatal children, along with the establishment of standards for such care across pregnancy trimesters. Equally pressing is the inquiry into methods of pedagogical support for the development of infants, toddlers, preschoolers, and school-age children who have undergone various prenatal prevention courses. The absence of a universally recognized acknowledgment of the necessity for psychological and pedagogical sessions with pregnant women, the absence of a structured system for training prenatal psychologists and teachers, and, crucially, the underdeveloped theory and methodology of prenatal psychology and pedagogy underscore the need for further exploration.

This underscores the relevance of continued research into optimizing the mental and physical development of children and emphasizes the imperative to explore new psychological and pedagogical technologies and systems for harmonizing child development from prenatal stages. This necessity is compounded by WHO criteria for live birth (22 weeks, 500 grams) [12] and the absence of legal status for a child of the same age who has not yet been born [13, 14].

**Study Objective**

This research aims to provide theoretical justification and formulate a psychological and pedagogical model for fostering the harmonized mental and physical development of a prenatal child within the dynamic interplay of the "mother-fetus" dyad. This model is uniquely characterized by the active integration of music as a central component.

**Methodology**

The methodology employed in this study draws upon a multifaceted approach to comprehensively investigate the impact of the "Sonatal" method on prenatal and early childhood development. The research design encompasses elements from various established research methodologies to provide a holistic understanding of the intervention’s efficacy.

1. **Experimental Research:**

   To assess the effects of the "Sonatal" method, the study adopts an experimental research design, implementing interventions and carefully observing their outcomes on various health and developmental parameters.

2. **Longitudinal Study:**

   This research takes a longitudinal perspective, spanning from prenatal age to early childhood. This extended duration allows for the examination of the sustained effects of the "Sonatal" method over different developmental stages.

3. **Comparative Analysis:**

   Comparative studies are conducted to evaluate the "Sonatal" method in comparison with other prenatal education methods, such as the "Prelonging method" and traditional practices of listening to classical music.

4. **Mixed Methods:**

   Utilizing a mixed methods approach, the study integrates both quantitative and qualitative data. Clinical observations, physiological measurements, and parental surveys contribute diverse data types for a comprehensive analysis.
5. Observational Research:
Observational research plays a pivotal role, providing insights into the day-to-day impact of the "Sonatal" method on various aspects of prenatal and child development.

6. Survey Research:
Surveys are employed to gather valuable information, particularly in the assessment of parental perceptions and experiences. The "Sonatal scale" serves as a structured tool for collecting and analyzing survey data.

7. Physiological Measurements:
The study incorporates physiological measurements, including cardiorespiratory tests and sound-breathing tests. These measurements contribute a physiological research component, allowing for a detailed examination of the intervention’s impact on bodily functions.

8. Educational Research:
Collaboration with educational institutions forms a crucial aspect of the research, involving surveys of psychologists in these settings. This educational research component enhances the understanding of the intervention’s implications for educational outcomes.

In summary, the "Sonatal" study employs a tailored blend of experimental, longitudinal, comparative, mixed methods, observational, survey-based, physiological, and educational research methodologies. This comprehensive approach aims to unravel the intricate connections between the "Sonatal" method and prenatal and early childhood development.

The "Sonatal" Method: A Comprehensive Approach to Prenatal Development

In Russia, the musical method of prenatal education known as "Sonatal" (derived from the Latin "sonus" meaning sounding and "natal" denoting birth, thus Sonatal is sort of birth music) has undergone 40 years of rigorous testing [15-18]. This method is designed to optimize the processes of morpho-functional and psycho-emotional maturation of the fetus. It aims to stimulate motor activity, regulate cardiorespiratory functions, prevent prenatal hypoxia, and equip pregnant women with communication skills for interacting with their child before birth. Additionally, the method focuses on enhancing the well-being of pregnant women, preparing them for childbirth, and fostering a positive impact on their health.

The "Sonatal" method involves various activities, including singing, appropriate movements and touches to the abdomen, color music simulators, children’s musical instruments, and active listening to music. Pregnant women participate in daily dosed vocal-speech activities, including a weekly one-hour session at the School of Prenatal Development, offered both, in group settings and individually, throughout the stages of pregnancy.

The health-improving effects, constituting the sanitation of the "mother-fetus" dyad, are achieved by simultaneous influences on the left hemisphere (sense), right hemisphere (image), and cardiorespiratory system. These activities are strategically conducted at specific times of the day and physiological cycles, considering the term of gestation.

The "Sonatal" method incorporates three fundamental components: insonation (sound), aeration (breathing), and kinetization (movement).

Insonation: It involves the singing of a pregnant mother using color music simulators to create an adjustable sensory influx. "Insonation" triggers the formation of various types of the child’s intellect within the mamalysh’s body, including musical, tactile-spatial, linguistic, logical-constructive, and emotional intelligence.

More specifically, the pregnant mother’s singing, accompanied by color music simulators, facilitates a modifiable sensory influx [19], engaging in the process of insonation (from Latin "in" — in, inside, and "sonus" — sounding) - the internal vocalization of prenatal ontogenesis. Unlike the use of this term in the context of "ultrasound exposure or treatment" [20], we employ "insonation" in analogy with "insolation" - light irradiation. In addition to the mother’s singing and her play on the
children’s wind instrument, the wind harmonica, insonation occurs through choral (family) singing sessions, utilizing diverse color-music simulators [Patent1] and children’s musical instruments, as well as listening to pre-recorded musical compositions. The collective impact of all auditory stimuli on the prenatal child’s body (referred to as “mamalysh” in method’s terminology) is encapsulated within the Sonatal method as a “singing body.” Insonation, enriched with singing and speech elements, initiates the development of key aspects of the child’s intellect in the mamalysh’s body (following G. Gardner’s theory of multiple intelligences [22], as adapted by the author): musical, tactile-spatial (foreshadowing artistic), linguistic, logical-constructive, and emotional intelligence.

**Aeration:** Apart from insonation, the method allows for aeration in the "mother-fetus" dyad, involving regulated oxygen enrichment through musical psycho-regulation of breathing. This component, termed “singing breath,” aims at establishing cardio-respiratory balance. More specifically, aeration is achieved through sound breathing exercises performed by the pregnant mother during vocalized breathing and singing specially composed songs. The primary objective of musical psycho-regulation of breathing is to establish a cardio-respiratory equilibrium, known as "eurythmia" [23], where the ratio of breathing to heartbeat is 1:4. To enhance this component of the method, the wind harmonica is utilized [Patent2], and practical tests, including the cardiorespiratory test [CRI] and Lazarev’s sound-breathing test [25, 26], have been devised to gauge its effectiveness. The cumulative impact of this element on both the mother's body and the prenatal baby is labeled as the "singing breath."

**Kinetization:** In addition to insonation and aeration, kinetization involves motor accompaniment to songs, including activities like prenatal walking [Patent5]. Considering that every motor action of the pregnant mother while executing the "Sonatal" method is governed by the musical content of songs, this facet is designated as a musical psycho-regulation of movements - "singing movement." In implementing this aspect for the prenatal child, the mother imparts to the child (or lays "in store," following P. K. Anokhin [28]) the fundamental prenatal patterns through her own motor activity. These encompass motor stages, motor qualities, and fundamental movement types that the child will subsequently acquire.

All three components operate in specific modes, considering daily, weekly, monthly, and seasonal biorhythms. The implementation of the "Sonatal" method includes specially composed music called the "music of motherhood and childhood."

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1 (author’s patent 1) The idea behind the invention is to arrange colored elements on a vertical field according to the colors of the rainbow. These elements, when touched, can produce a sound of the corresponding pitch through a built-in system of sound sensors. Simultaneously, the pregnant mother can make vertical movements while touching the elements to create the desired pitch sound.

2 (author’s patent) The wind harmonica, tested in the rehabilitation of children with bronchial asthma and described in the invention, serves a dual purpose. It facilitates vibrodrainage of the respiratory apparatus of a pregnant mother by utilizing different pitch notes (various registers). Additionally, it establishes reflex links between cardiorespiratory processes and sound pitch (musical hearing) within the “mother-fetus” dyad.

3 The cardiorespiratory test assesses the deviation of the breath-to-heartbeat ratio from the eurythmic one [23]. A higher number (above 4) indicates increased tension of autonomic homeostasis.

4 Lazarev’s sound-breathing test (duration of sound pronunciation with a closed mouth) evaluates the external respiratory function. It correlates with apparatus methods of respiratory diagnostics, such as spirometry and spirometry.

5 (author’s patent) The invention suggests that a pregnant mother sings prenatal songs in nature while walking to the tempo of the song. This can be accompanied by a phonogram listened to through headphones or using a gadget attached to the anterior abdominal wall. The breathing cycles are performed in a specific ratio of one breathing cycle to the number of steps. The duration and tempo of prenatal walking-singing are determined by the nature of the song (morning, afternoon, evening) and the gestational age.
Harmonizing Development through Musical Intelligence: The "Sonatal" Music of Motherhood and Childhood

The creation of the music of motherhood and childhood was a deliberate endeavor to craft a musical form analogous to the acorn-oak concept (inspired by Tchaikovsky: "the entire Russian symphonic school is enclosed in Glinka's Komarinskaya, like an oak in an acorn") [29], embedding the musical genetics of a child's personality. This form is designed to unfold collaboratively, involving both the mother and the child post-birth.

In the "Sonatal" method, music assumes the role of the primary cognitive-somatic (cognosomal) simulator, facilitating continuous cross-functional training of the prenatal child's body. To underscore the unique role of music in prenatal and early childhood development, the concept of musogogy (derived from ancient Greek μοῦσα - muse and ἀγω - leading) is introduced—music pedagogy, where music takes the lead in the physical and mental development of the child throughout ontogeny.

Considering the insights of domestic and foreign scholars, particularly G. Gardner's theory of multiple intelligences [22], we view the musicality or "musical intelligence" of a child both before and after birth as a comprehensive set of mental and physiological processes. These processes emerge during active or passive musical activities, forming the foundation for harmonized development. Unlike other types of intelligence, musical intelligence has the remarkable ability to impact nearly all spheres of life, affecting the human body at physical, physiological, and psychological levels.

Within the paradigm of music pedagogy, aiming to mold the musical intelligence of the mamalysh (an author-coined term) as a central cognitive-somatic (cognosomal) formation of its prenatal persona, certain postulates are asserted. Primarily, there's the emphasis on the initial development of the auditory analyzer in fostering the intellectual realm. Additionally, it emphasizes the vital link between the development of the auditory cortex and the evolution of all functional facets of the body.

The foundational factor in the genesis of musical intelligence lies in the rhythm of the mother's heart. This rhythm induces alterations in the oxidation cycle within the mamalysh's organism, leading to the inception of primary tempo-rhythmic musical hearing. The second pivotal factor is the mother's voice. The maternal voice serves as the cornerstone for various facets of musical intelligence, including primary intonation, timbre, phonemic and rhyme-poetic hearing. It also establishes primary speech-language structures tied to native languages, vocal-speech breathing, tactile music perception (influenced by maternal diaphragm pressure), primary musical emotions (influenced by maternal hormones), and the primary cardio-respiratory rhythm (influenced by changes in the mother's hemodynamics).

The mother's locomotor movements during singing contribute to the emergence of intonation-gravitational sensations in the mamalysh, as per G.S. Frid's gravitational theory of music [30]. This also contributes to the formation of seven prenatal musical-motor patterns ("saxony," "cradle," "spring," "ball," "shuttle," "bird," "snake"). Tactile accompaniment of singing, involving touching the abdomen with the images being sung, gives rise to the development of primary figurative thinking and "tactile vision." Songs associated with daily rhythms contribute to the establishment of primary circadian biorhythms.

The concept of musicology envisions the emergence of a prenatal musical subculture, placing significant emphasis on cycles of prenatal holidays. These celebrations include conception, first heartbeat, first stirring, first movement, prenatal name, and first smile, with societal acknowledgment of this subculture manifested in the form of a Day of Prenatal Music. Neurophysiological aspects of a child's prenatal development establish the specific principles of prenatal music, including replication, balance (fret, temporal, genre, functional), diversity, temporal lability, circadian considerations, and phylogenetics (from ancient music to modern). Motor adequacy is a crucial aspect, along with its components ("intonation," "rhythmotone," "tactiloton," "myoton"), and the emergence post-birth of "tsveton" (a color image of notes according to the colors of the rainbow).

Taking into account these factors, more than 1000 songs and 15 children's operas have been composed. The songs are integrated into a cognosomal program, allowing metered loads on various arbitrary spheres: motor, emotional, cognitive, digestive, and biorhythmic (including singing modes
before and after meals, songs of the day), respiratory, protective, and adaptive (in air and water environments), vocal, and speech.

In consideration of the nuances in the development of musical intelligence, a specialized algorithm was crafted for learning prenatal music, incorporating sensory cards both before and after birth. The prenatal class algorithm entailed a sequential approach, organized by months and trimesters of pregnancy, covering sections such as vibronatal (vibroacoustic reactions), aquanatal (vibro-vascular reactions), aeronatal (vibro-respiratory reactions), chrononatal (vibrobiorhythmic reactions), myonatal (vibro-motor reactions), sensonatal (vibro-emotional reactions with tactile and light accompaniment), and cognatal (vibro-informational processes).

To solidify a pregnant woman’s understanding of the program sequence, a color music thematic score of pregnancy was devised (Scheme 1). This score serves as a visual guide, enhancing the comprehension of the cognitive-somatic gymnastics in prenatal children within the framework of the "Sonatal" method.

![Scheme 1](image)

Going beyond the prenatal age, the concept of musicology outlines a musical periodization of prenatal and early childhood development, ensuring a comprehensive approach to nurturing musical intelligence (see scheme 2).

![Scheme 2](image)

**Validating the "Sonatal" Method: Comparative Studies and Developmental Milestones**

Between 1990 and 2002, a groundbreaking comparative pilot study was conducted on the "Sonatal" method, contrasting it with the "Prelonging method" (also known as the "heart method") devised by American psychologist Brent Logan, a pioneer in prenatal education in the United States [31]. The "Prelonging" method employs a technical device called "Baby Plus," involving digital processing of a pregnant woman’s heart tones over 16 consecutive audio lessons. This method, widely adopted in East Asian countries, has gained such prominence that November 11, 2006, was designated as World Prenatal Schooling Method Day in Hong Kong to honor the multitude of children benefiting from its prenatal training [32].

As a control, a group subjected to the method of listening to classical music at specific times of the day was included. The assessment utilized a questionnaire based on the CLAMS (Clinical Linguistic and Auditory Milestone Scale) [33, 34].
The outcomes revealed that, following prenatal stimulation, all three groups of prenatal children exhibited enhanced biorhythmic activity, auditory responsiveness, communicative engagement, and a sense of rhythm. Notably, motor activity characteristics such as thrusts, movements, and motor endurance were most clearly presented during the lessons. The impact of music itself surpassed the influence of selective factors like timbre, tessitura, genre, and composer, indicating its significant role in behavioral characteristics. Additionally, the contact between the fetus and the mother, along with the manifestation of the mother's emotionality, emerged as predominant factors in the "mother-fetus" dyad. These findings were documented in an international journal and featured in a scientific documentary film titled "Brave New Babies," produced by TV company Wall to Wall in the UK in 1994 [35,36].

The trends identified in the initial pilot study were substantiated in subsequent research fragments conducted in various research and practical institutions across Russia. These included the Russian Scientific Center for Restorative Medicine and Balneology in Moscow (1998-2008), the Scientific Center for Children's Health of the Russian Academy of Medical Sciences in Moscow (2009–2015), private centers like "Planet of Children" in Vladivostok (2015) and "Mamalysh" in Yoshkar-Ola (2009-2023), as well as children's polyclinics and women's consultations in Moscow and Naberezhnye Chelny. A population study in the city of Naberezhnye Chelny, involving 39 thousand pregnant women who underwent prenatal Sonatal-school from 1995 to 2015, further supported the trends observed. The study's results were consolidated through parent surveys utilizing the specially developed "Sonatal scale" on the "GOOGLE" Internet resource tables platform [37].

In various segments of the study, a range of physiological and psychological processes and phenomena were explored. Overall, the "Sonatal" group demonstrated a notable advancement of 2-3 weeks in key indicators of psychomotor and mental development compared to both medical observations and parents' questionnaires (see Diagrams 1 and 2).

Diagram 1

![Advancement in development in children who have taken the Sonatal school. The data of the parents' questionnaire in comparison with the results of medical observation](image)
Enhancing Maternal and Infant Well-being: A Comparative Study on Safe Birth and Prematurity

The Russian Scientific Center of Restorative Medicine and Balneology (RSCRMB) conducted a comprehensive study in 2002 focusing on safe birth and prematurity. Seventy-one women participated in the examination, divided into two groups: Group "C" (SONATAL group, II and III trimesters of pregnancy) comprising 34 individuals and Group "K" (control group) with 37 participants. The examination extended to include all children born to these women. The average age in Group "C" was 30.2±0.6 years, and in Group "K," it was 28.0±1.8 years.

The findings indicated a more physiologic birthing experience in Group "C." In this group, the duration of labor for women averaged 7.1±0.5 hours, with difficult labor noted in 24% of cases. In contrast, Group "K" experienced longer labor duration, averaging 8.8±0.9 hours, and a higher incidence of difficult labor, reported in 38% of cases. Notably, prematurity (birth not earlier than 39 weeks) was more prevalent in Group "C," with 90% of children born meeting this criterion, compared to 75% in Group "K."

Lactation

The study also delved into the impact of the "Sonatal" method on lactation. The results affirmed a positive effect, revealing that the "Sonatal" group exhibited a twofold increase in the number of lactating mothers by the end of the first child's life compared to the control group (see Diagram 3).
Perinatal Health Programming: A Comparative Analysis of the SONATAL Method

In the years 2009-2012, a significant study was conducted on perinatal health programming, focusing on the impact of the prenatal SONATAL school on children's health. The main group comprised 84 children who had participated in the prenatal SONATAL school at Children's State Primary Care No. 58 (Ф№ 1) in the North-West Administrative District of Moscow. The control group consisted of 106 children observed in Children’s Hospital No. 58 (Ф№ 1) in the same district. The source of information included mini-questionnaires and Form №112.

The average age of pregnant women in the SONATAL group was 28.2 years (ranging from 22 to 35 years). At the beginning of the class course, the average gestation period was 27.8 weeks, increasing to 36.86 weeks by the end of the course. The average number of classes attended was 7. In the control group, the average age of pregnant women was 30.1 years (ranging from 19 to 36 years). At the time of examination, the average age of children in Group "C" was 30 months (ranging from 15 to 41 months), while in Group "K," it was 34.2 months (ranging from 19 to 50 months).

The study focused on analyzing the influence of the SONATAL method on the structure of morbidity in the first year of life, particularly the percentage of respiratory diseases. The findings revealed a significant difference between the two groups. In the Control group, respiratory diseases held the top position, constituting 24% of all diseases, whereas in the SONATAL group, respiratory diseases ranked 4th, accounting for only 12% — a notable decrease by 2 times.

To affirm the reliability of these results, the author of Sonatal Pedagogy compared them with the findings of independent researchers who employed Sonatal pedagogy methods in various cities of Russia. This included the examination of data published in candidate and doctoral dissertations on psychology, pedagogy, and medicine [38-43].
Impact on Infant Mortality: Noteworthy Findings by T.V. Kashaeva

In assessing the efficacy of the "Sonatal" method, a pivotal contribution stems from the research conducted by T.V. Kashaeva [20]. The study delved into the correlation between the percentage of pregnant women engaged in Sonatal school and infant mortality in Naberezhnye Chelny.

The findings highlighted that the widespread integration of the prenatal education system into maternity and children's institutions, with coverage ranging from 20% to 40% of women, resulted in a substantial and enduring reduction in infant mortality. The statistics demonstrated a notable decrease from 17.1 in 1995 to 11.6 in 1998.

(Diagram 5) visually represents the impactful outcomes of this study, underscoring the positive implications of incorporating the "Sonatal" method into perinatal care strategies.
Infant Mortality Reduction: Unveiling Complex Dynamics

While attributing the decline in infant mortality solely to Sonatal School classes might seem overly simplistic, it's equally impossible to disregard the significant correlation observed. Over the four years of introducing the Sonatal method in Naberezhnye Chelny, there was a remarkable 32% reduction in infant mortality. Notably, this positive trend coincided with an increased adoption of the Sonatal method, covering 6% of all pregnant women in the first year and expanding to an impressive 42% in the city by the fourth year.

The intricate dynamics of the Sonatal method’s impact, including the relationship between results and the number of classes, are graphically depicted in Diagram 6. This visual representation underscores the evolving influence of the Sonatal method over time, revealing a compelling connection between increased engagement and positive outcomes in infant mortality rates.

Diagram 6

Correlation Between Classes and Child Development Indicators

Drawing from the parent GOOGLE survey in Naberezhnye Chelny, a compelling correlation emerged between child development indicators and the number of Sonatal classes. This correlation was notably high, with a correlation coefficient (rs) of 0.88 for “APGAR” and -0.82 for “Word.”

Given this strong correlation, it becomes evident that a comprehensive prenatal course of Sonatal classes is crucial for optimal child development. To delve further into the impact of the “Sonatal” method on children’s adaptation to educational institutions like kindergarten and school, a survey of psychologists in educational institutions in Naberezhnye Chelny was conducted. The results revealed a significant smoothing of age crises at 3 and 7 years of age, emphasizing the method’s positive influence on children’s overall adaptation.

(Diagram 7) visually encapsulates these findings, highlighting the constructive impact of the Sonatal method on age-related developmental challenges.
Safety Assurance: Absence of Adverse Events

Throughout the study, a noteworthy aspect emerged — the complete absence of information concerning undesirable phenomena. This encompassed not only pregnant women and their prenatal children during classes using the "Sonatal" method but also extended to children engaged in the Sonatal pedagogy program in subsequent periods of childhood.

The findings underscore the safety assurance provided by the "Sonatal" method, highlighting its efficacy without any reported adverse events. This aspect further solidifies the method's reputation as a secure and reliable approach to prenatal and childhood education.

Conclusion: A Symphony of Developmental Benefits with the "Sonatal" Method

This study unequivocally supports the fundamental tenet of music pedagogy: music, particularly through the "Sonatal" method, holds unparalleled potential in harmonizing the physical and mental development of a child. Serving as a comprehensive cross-functional simulator, music, especially in the form of singing, emerges as the integral foundation for enhancing the child's overall well-being, beginning from prenatal age within the mother-fetus dyad.

The positive impact of the "Sonatal" method extends across various developmental stages. From prenatal age—where it influences the motor analyzer and mitigates prematurity—to subsequent phases of ontogenesis. The method fosters speech formation, enhances psychomotor development, cultivates musical and artistic abilities, reduces morbidity, and facilitates smoother adaptation to kindergarten and school. Notably, the effectiveness hinges on the timing of application—earlier stages being preferable—and the duration of engagement, requiring a minimum of 8-10 sessions.

A comprehensive analysis of study results reveals not only the existence of functional reserves within the prenatal organism but also the potential for prenatal health programming through adept management of these reserves using prenatal pedagogy methods.

The "Sonatal" method, showcased through the "Sonatal effect," empowers pregnant women to establish voice-tactile-motor contact with their child, shaping the nature of movements and influencing daily biorhythms of motor activity. This effect manifests through several phenomena, including the prenatal childhood phenomenon, harmonization of pregnancy, perinatal maturity, lactation maturity, and harmony in infant and early childhood development.
In essence, the "Sonatal" method orchestrates a symphony of developmental benefits, creating a harmonious interplay between music and the multifaceted aspects of prenatal and childhood growth.

**Implications**

The comprehensive exploration of the "Sonatal" method and its multifaceted impact on prenatal development opens avenues for significant implications in both the field of prenatal education and broader healthcare practices. The findings underscore the potential of integrating music, specifically the "Sonatal" approach, as a powerful tool in promoting cognitive, emotional, and physiological well-being for both the mother and the prenatal child.

In prenatal education, the "Sonatal" method introduces a novel paradigm, emphasizing the role of insonation, aeration, and singing movement in shaping the prenatal environment. These components not only contribute to the formation of multiple intelligences in the child but also foster a harmonious mother-fetus dyad. The establishment of a prenatal musical subculture, complete with cycles of prenatal holidays, suggests a cultural shift in acknowledging and celebrating the importance of musical experiences even before birth.

Moreover, the "Sonatal" method demonstrates its potential in addressing specific health-related concerns. The positive influence on labor duration and the reduction in difficult labor instances indicate its relevance in promoting physiologic childbirth. Additionally, the observed increase in lactation rates among mothers who underwent the "Sonatal" method highlights its potential benefits in postnatal care.

The implications extend beyond individual cases, with population-level studies showcasing the method's positive impact on infant mortality rates. The correlation between the percentage of pregnant women engaged in Sonatal school and the reduction in infant mortality presents a compelling argument for widespread adoption of prenatal education programs incorporating musical elements.

Furthermore, the development of a structured algorithm for learning prenatal music, coupled with sensory cards and a color music thematic score, provides practical insights for educators and healthcare practitioners. These tools can be employed to tailor prenatal music programs, ensuring a systematic and effective approach to prenatal education.

In conclusion, the "Sonatal" method offers a holistic framework that intertwines music, education, and health, presenting promising implications for prenatal and early childhood development. Embracing this approach has the potential to revolutionize prenatal education practices and contribute to the overall well-being of both mothers and their children.

**Future Directions**

The groundbreaking insights garnered from the extensive exploration of the "Sonatal" method lay the foundation for exciting future directions in prenatal education, healthcare practices, and research endeavors. As we look ahead, several avenues emerge that promise to enhance the effectiveness and applicability of the "Sonatal" approach.

**Refinement of Methodology**: Future research endeavors could delve into refining the methodology of the "Sonatal" method, considering variations in cultural contexts, musical preferences, and individual differences. An in-depth understanding of how these factors influence the reception and impact of the method would contribute to its adaptability on a global scale.

**Longitudinal Studies**: Longitudinal studies tracking the development of children who have undergone the "Sonatal" method from prenatal stages into early childhood could provide valuable insights. Examining the sustained effects over time would offer a more comprehensive understanding of the method's long-term impact on cognitive, emotional, and physical aspects of development.

**Integration with Technology**: Exploring the integration of technology to enhance the "Sonatal" method opens avenues for innovation. Interactive apps, virtual reality experiences, or online platforms could extend the reach of prenatal education programs, making them more accessible to a diverse audience.
Cross-disciplinary Collaboration: Collaboration between experts in music, psychology, pedagogy, and healthcare can enrich the "Sonatal" method. Cross-disciplinary research can deepen our understanding of the underlying mechanisms at play and foster a holistic approach to prenatal education and healthcare.

Community Engagement and Education: Initiatives aimed at community engagement and education could promote the wider acceptance and adoption of the "Sonatal" method. Workshops, educational campaigns, and partnerships with healthcare providers can contribute to creating a supportive environment for prenatal music programs.

Exploration of Therapeutic Applications: Investigating the therapeutic applications of the "Sonatal" method in addressing specific health conditions or promoting well-being in different populations could open new doors. Collaborations with healthcare professionals specializing in various fields can guide targeted applications of the method.

Global Implementation: Efforts to globally implement the "Sonatal" method could involve adapting the approach to diverse cultural and healthcare settings. Research on its integration into existing prenatal care structures and alignment with diverse educational systems will be instrumental in its widespread adoption.

In conclusion, the future of the "Sonatal" method holds immense potential for innovation and positive impact. By embracing these future directions, we can further unlock the benefits of prenatal music education, contributing to the well-being of mothers and laying the groundwork for enhanced child development.

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References


the 30th anniversary of the establishment (faculty) of the Institute of Physical Culture, Sports and Health MPGU, Moscow, 2022, pp. 96-100.


