

# The Use of Cymatics: Changing Face of Music Teaching and Learning in Ghanaian Schools



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## ABSTRACT

Functionally, Music and Science have a lot in common to offer humanity and are largely inseparable. However, very little attention is paid to an exploration that would expose music educators to the complementarity of music and science in their pedagogical approaches to music learning. The paper, therefore, focuses on the use of science in music to initiate innovation in music education through Cymatics. Using the experimental approach and Cymatic setup, the three main Ghanaian musical types and randomisation and five songs were selected from a collection of twenty songs based on the three musical types to generate cymatic figures which were induced by frequencies and amplitudes. It was observed that the figures created from the three Ghanaian musical types possessed some similarities, yet they uniquely stood out as a brand. It was also detected that melodies produced more figures than harmonised songs. The consumable sound levels (20 to 20000 Hz) were found to produce legible figures for use in other ventures. The study recommends that Music educators should record and use the generated frequencies and amplitudes for replication to aid comprehension in the teaching and learning process.

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Publication History

Received 25<sup>th</sup> October, 2022

Accepted 6<sup>th</sup> December, 2022

Published online 12<sup>th</sup> January, 2023

**Keywords:** *Cymatics, music teaching, science and music education*

## INTRODUCTION

Largely, inventions portray themselves as discoveries of nature's own laid-down principles or structures meant for a purpose to impact life and humanity. Such is the study of sound, revealing its unique connections to activities on planet earth. Undoubtedly, the scientific discoveries chocked in the study of sound waves which eventually gave birth to Cymatics are worth acknowledging. This is because scientific applications of cymatics in human endeavours seem to provide some unique avenues for a smooth adjustment to enhance livelihood in the areas of creativity, health, education, and socio-economic activities among others. However, the question that readily comes to mind is whether this invention is applicable and worth replicating in Ghana and Africa. Truly, not much has been heard and researched about Cymatics in Africa and Ghana in particular to discover the nature of cymatic patterns that can be derived from Ghanaian songs for use in education and other social activities. In this study, the experimental approach, cymatic setup and selected songs from the three main Ghanaian musical types were used.

## A Brief History of Cymatics

Research of various kinds in science certainly leads to amazing discoveries which when properly applied to humans and their activities, go a long way to aid the sustenance of life and the habitat of

man and all living organisms. One such discovery is the use of sand, powder, liquid or fluid, an oscillator, an amplifier, and a plate (Chladni plate) with sound at various frequencies to expose one of the mysteries of nature in a form of figurative patterns or figures. These figurative patterns were and are still very crucial to human life as it is being applied in therapeutic and other healing processes at major hospitals and other medical centres.

This all-important discovery which used to be referred to as *kymatik* (Greek), a word coined by Jenny Hans and which Jeff Volk describes as, “a study of a wave phenomenon, and generally called Cymatics, was also considered as a bridge to the unseen world.”<sup>1</sup> The account of John Reid and Annalese Reid revealed that “cymatics, a study of visible sound, could be referred back to about thousand years with African tribes who used drums made of stretched skin over a frame and sprinkle grains,”<sup>2</sup> usually sand on a vibrating drumhead during a performance of divine events. Though the practice of old was not accorded any scientific significance by the Africans, Reid and Reid suggest that the first scientist who noticed the phenomenon was Leonardo Da Vinci as he observed an odd behaviour of dust on a wooden table and commented that;

When a table is struck in different places, the dust that is upon it is reduced to various shapes of mounds and tiny hillocks. The dust descends from the hypotenuse of these hillocks, enters beneath their base and raises itself again around the axis of the point of the hillock.<sup>3</sup>

However, Hans, a Swiss medical practitioner and a scientist who has delved into visual sound is widely considered the father of cymatics-kymatik due to his contribution to knowledge by way of using waves to determine the periodic impact that sound and vibration possess over matter. Again, his scientific efforts saw him invent the Tonoscope, which was a device he projected that can aid people with deaf-related challenges to gain their speech. He was confident in his statement possibly due to his association with the Waldorf school system which is concerned with the education and training of children with physical impairment. Hans also wrote comprehensively on cymatic imagery and laid the scientific and mathematical foundations for the would-be scientist. Similarly, Volk expresses the view that “the period around 1680 -1830s saw the earlier works and experiments on sound visibility”<sup>4</sup> from researchers, philosophers and musicians such as Robert Hooke and Ernst Chladni who was known as the father of acoustics, and Margaret Watts Hughes who also discovered configuration of figures (patterns) on a plate using either fine sand or powder (flour) by bowing different edges of the plate. They realised among other things that, the sand or powder on the plate re-converged at an area of a comparatively lower frequency from a higher frequency.

Nonetheless, Volk also recognises the immense contribution of Hans whose works saw the addition of frequency generators and amplifiers to a variety of shapes, steel plates, animating with lycopodium powder which is a fine, spherical powder, highly responsive to vibration, and different types of denser pastes and liquids. This way, he gained comprehensive control over the entire experiment and as a result was able to reproduce a particular pattern with less effort. The magnitude of mastery also enabled him to create figures that resemble nature’s own creation. For instance, the figure, which completely looks like a guitar, and the other, which portrays a picture of a flying insect among others, were all energized by sound at different frequencies. The guitar was excited with a tone in the range of 520 cps. The sand used indicated the nodal lines of the vibrational mode. While the flying insect was also excited by sound at a frequency of 21.400 cps. In this case, a symmetrical plate-shaped with intricate subdivisions of 30cm width, 18cm length and with a descending order or top to down excitation was created.<sup>5</sup>

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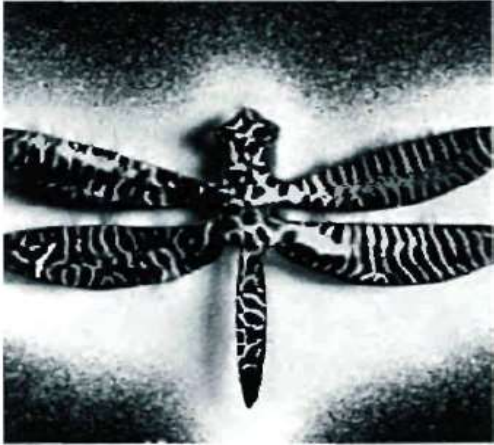
<sup>1</sup> Jeff Volk, “From Vibrations to Manifestation: Assuming Our Rightful Place in Creation,” *The Quester*, 2012.

<sup>2</sup> John Stuart Reid and Annalese Reid, “Music and Cymatics: Seeing Sound with Cymascope,” 2011, <https://cymascope.com/musicology/>.

<sup>3</sup> Reid and Reid, “Music and Cymatics: Seeing Sound with Cymascope,” 40.

<sup>4</sup> Volk, “From Vibrations to Manifestation: Assuming Our Rightful Place in Creation.”

<sup>5</sup> Volk, “From Vibrations to Manifestation: Assuming Our Rightful Place in Creation.”



### A Sound Energy Excited Guitar And Insect

Jenny was quoted as submitting that,

Wherever one fixes one's gaze, in whatever field of observation, be it astronomy, geology, orology (the study of wave movements within the earth) or in the life sciences, biology, cytology (cell development), anatomy, physiology, embryology, one may observe the principles of Cymatics at play.<sup>6</sup>

Indeed Volk stressed the fact that Jenny perceived and documented specific processes which were exhibited through the strong impulses of frequencies in association with matter. Empirically, he portrayed how some frequencies at the audible level form fluid figures in liquids, powders (lycopodium) and viscous pastes. Consequently, with the aid of technological advancement, contemporary researchers like Lauterwasser, a photographer and Reid who is an acoustic engineer and the inventor of the cymascope, a modern device used in creating visual patterns of sound, are able to create exact figures excited by sound also known as 'CymaGlyphs' employing water, lycopodium powder and sand. The accuracy of his calculations or perceptions results in the fact that the inert matter animated by sound can adopt a circulatory gesticulation to reveal a characteristic of a live organism or creature. In a commentary on Hans's book *Cymatics; a study of wave phenomena and vibration*, which was a compilation of books on cymatics, Volk remarked that;

I was immediately awestruck. I was particularly fascinated by one astonishing image of what appeared to be a snake, slowly undulating on screen, but stripped right down to its vertebrae. What was so amazing was that this was neither a reptile nor was it even alive. What I was witnessing was a small pool of glycerine being "animated" by sound! The imaginary snake was actually light reflecting off a series of wave trains creating this delicate, flowing form in the vibrating liquid. There were other images which mirrored biological forms and natural processes, as well as flowers, mandalas and intricate geometric designs, all these are a result of an audible vibration. These experiments seemed to reveal the hidden nature of creation, to lay bare the very principle through which matter coalesces into form.<sup>7</sup>

### Meaning of Cymatics

Ideally, for one to fully grasp the sense and the essence of the wave phenomenon, it is crucial to establish a premise with the question, "what is Cymatics"? A recapitulation of the thoughts and explanations of what supposedly used to be a mere scientific phenomenon, and now a process termed cymatics as expressed by various scientists such as Chladni, Hans, Volk, Reid, Watts- Hughes, seem

<sup>6</sup> Hans Jenny, "Cymatics: The Study of Wave Phenomena," *I and II Book (1967-1972)*, 2001.

<sup>7</sup> Volk, "From Vibrations to Manifestation: Assuming Our Rightful Place in Creation."

to converge around the propagation of sound waves and their behaviour as subjected to varied frequencies and densities. Since waves are naturally invisible, one of the means to identify their characteristics is through the use of fine dust, sand, powder, paste, water and other liquids on a plate fitted to a frequency generator, amplifier and oscillator to determine what nature communicates through sound. By this submission, generally one cannot be far from right in projecting that cymatics is a scientific process which is aimed at discovering nature through sound and the link with humans and other living organisms.

Similarly, Jin and Kim state that, “Cymatics is the study of the visualization of sounds. Cymatics analyzes sounds by applying basic principles of wave mechanics. Since sound is a type of wave, it can be displayed through visual media.”<sup>8</sup> They further add that the study of cymatics is highly instrumental in systemizing the visualization of sound for use in other areas of study.<sup>9</sup> For instance, they suggest that the systematic visualisation of sound will enormously enhance the communication processes of people with hearing impairment challenges.<sup>10</sup> Volk indicates that “cymatics is a study of sound wave behaviour and vibration. It is a scientific procedure which illustrate the vibratory characteristics of matter and how sound can be transformed into artistic figures for human use.”<sup>11</sup> Volk sums his thought as he describes cymatics as the “sound science at its finest and its implications are vast.”<sup>12</sup> Surely, one would agree with the assertion that the implications of sound science are numerous. This is because almost every aspect of creation whether animate or inanimate seems to respond to sound in one way or the other. This makes sound a unique phenomenon and inseparable from creation. In this regard, by the application of cymatic principles, there are new inventions such as Cyma therapy and Cyma scope among others to further portray the scientific influence of sound on humans.

### **Educational Importance of Cymatics**

Cymatics, a term coined by Hans which refers to the study of waves and the related mystery or phenomenon, as a membrane or a metal sheet (Chladni plate) with sand spread on it, is excited by sound to create patterns and figures. A close observation of almost all the patterns discovered by scientists in the field of cymatics has persistently exhibited a high standard of creativity, which is way beyond human description. This is an indication that to a large extent, sound in whichever form, plays a major role and has a lot to offer humanity. Consequently, at this point, it pays to accentuate the words of Reid and Reid by agreeing to “the notion that sound through cymatics is a bridge to the unseen world.”<sup>13</sup>

Agreeably, one’s ability to comprehend the manner in which sound and cymatics impact humans and their activities including the environment, require a process that involves the art of imparting and absorbing information resulting in the acquisition of knowledge. This is a process literally described as “education” which Plato identifies as the art of turning one’s eyes from darkness to light, as alluded to by Kpeglo.<sup>14</sup> This thought could barely be explained to mean the actions that an informed person takes to aid a non-informed individual from the state of ignorance to the brightness of knowledge acquisition. Furthermore, John Dewey also added that “education is a fostering, nurturing and a cultivating process that demands a change in the quality of experience until the uninformed is able to partake in the interest and the goals of the entire group.”<sup>15</sup> By extension, education as observed by Dewey is a growth, which must be progressively realized, present possibilities and make individuals better fit into society. Growth must be continuous, leading into the

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<sup>8</sup> You Jin Oh and Sojin Kim, “Experimental Study of Cymatics,” *IACSIT International Journal of Engineering and Technology* 4, no. 4 (August 2012).

<sup>9</sup> Oh and Kim, “Experimental Study of Cymatics.”

<sup>10</sup> Oh and Kim, “Experimental Study of Cymatics.”

<sup>11</sup> Volk, “From Vibrations to Manifestation: Assuming Our Rightful Place in Creation.”

<sup>12</sup> Volk, “From Vibrations to Manifestation: Assuming Our Rightful Place in Creation.”

<sup>13</sup> Reid and Reid, *Music and Cymatics: Seeing Sound with Cymascope*

<sup>14</sup> Amuzu Kpeglo, *Approaches to Administrative Theory in Education* (Unpublished, 2004).

<sup>15</sup> John Dewey, *The School and Society*, Chicago (Chicago: University of Chicago Press, 1929).

future. He opines that education is conceived either “retrospectively or prospectively”, suggesting a process of linking the future to the past so as to use the latter as a tool to fulfill the future.

Clearly, with Dewey’s submission, there is the view that the art of education involves the impartation and absorption of information, which could be comprehensively quantified as knowledge. If knowledge could be revered as power and authority over man and society, then it is very decisive to uphold the quest to discover the various spectacular means of unravelling the mystery of nature.

One such medium is undoubtedly the use of cymatics and its principles to engineering figures and patterns, powered by sound waves. The thought of cymatics and its practice practically employs the concept of the concentric approach, which supports the notion that the process of learning must be done from the known to the unknown. As Gary Fenstermacher and Jonas Soltis identify it to be “a teaching and learning process where teaching and learning are carried out in logical sequence for learners to deduce logical patterns and strategies to deal with scenarios.”<sup>16</sup> Accordingly, they opine that; “the materials are progressive, the children need what they learn today to be able to do the work tomorrow, each new learning builds on the last and leads to the next”.<sup>17</sup> This implies that teaching and learning must be done using information from the immediate environment to the abstract. Similarly, in cymatics, sound waves of known songs or tunes are mostly used to excite the cymatic apparatus, which results in the generation of abstract figures and patterns. The creation of the figures and patterns induce further learning as it creates the avenue for a series of analyses and interpretations for better comprehension of information developed in the form of figures on the plate or the membrane of the cymatic set-up. In this manner, the entire process of cymatics could be employed as a tool for education generally meant to school learners on how to scientifically, use sound to generate figurative patterns that are useful in other related areas of study such as arts, communication, mathematics, geography, music among others. In relation to the preparation of learners for the job market, it is vital for one to consider cymatics as a means to achieve an end.

### **The Pedagogy of Music Education in Ghanaian Schools**

Music teaching and learning in Ghanaian schools have fundamentally been handled by trained, semi-trained and in some instances untrained music teachers. In a research conducted by Ernest Amparbin, “it was evident that teachers who teach music (songs) and organise musical activities, particularly at the pre-school level are largely non-professional musicians.”<sup>18</sup> This fact, undoubtedly, raises questions as to what and how these teachers carry out their duties as music teachers in their various classrooms, and what response and impact they create on the minds of the learners concerning music.

Generally, music education in Ghana has been designed such that, the teaching and learning have to be done in segregation, though in the end, an expected objective has to be achieved. A critical consideration of the music teaching syllabi at all levels of education as indicated by the CRDD of the Ministry of Education, teaching and learning of music must be done under Composition, Performance, Listening and Appreciation. Clearly, these major areas will demand peculiar delivery processes and the would-be professional music teacher has to rise to the task.

Indeed, the Ghanaian professional music educator is endowed with teaching skills, methods and renowned theories among which are Howard Gardner’s Multiple intelligence theory and Carl Orff’s “Schulwerk” an approach which combines music, drama, and speech in music education to aid the learner’s developmental process. Notwithstanding these fine theories, the question still remains; what practical scientific achievements have been chalked apart from teaching learners to play instruments to possibly entertain?

Obviously, comprehensive impartation and absorption of knowledge at all levels of education, duel much on the availability and effective use of teaching and learning materials including

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<sup>16</sup> Gary D Fenstermacher, Jonas F Soltis, and Matthew N Sanger, *Approaches to Teaching* (Teachers College Press, 2015).

<sup>17</sup> Fenstermacher, Soltis, and Sanger, *Approaches to Teaching*.

<sup>18</sup> Ernest Francis Amparbin, “The Use of Songs in the Teaching and Learning Process of Early Childhood: A Study of Selected Schools in the Oforikrom Sub-Metro of the Ashanti Region” (University of Education, 2015).

methodology. However, the International Labour Organisation “explain that resource acquisition in educational outfits over the years and even recent, seems very challenging,”<sup>19</sup> especially, in the area of early childhood education where its cost-effectiveness strategy is meant to prevent and also remedy delays in individual learning capacity and disadvantages created by poverty and unfavourable socio-economic conditions. Though in Ghana, the government of the day seems to have made some strides towards alleviating the numerous challenges in the education field through its Free Education Policy, one would have thought that the policy would first work on drastic improvement of educational resources, including such teaching and learning materials which will enhance and fortify the teaching and learning of educational programme like music which builds the moral, emotional, spiritual and physical fabric of the learner to perfectly fit into the society. Undoubtedly, the lack of teaching and learning materials in Ghanaian schools has fundamentally impacted negatively on the teaching and learning processes of educational programmes in schools. Music education is no exception since schools offering music as a programme of study and are required in some instances to produce candidates for final examinations can hardly boast of a single standard piano.<sup>20</sup> This condition of the music education programme has unduly reduced music studies to mere entertainment and thereby negatively affecting music education holistically in Ghanaian schools.

It is therefore imperative for music educators or researchers to delve into the doldrums of the phenomenon tagged music and its processes, to discover its untapped benefits which impact positively on humanity and the environment focusing on the Ghanaian and for that matter African situation. Surely, the endeavour will inject an appreciable knowledge of music and sound in modern trends and its influence on human activities. Agreeably, the sense of urgency unleashed by the new trend in music studies will painstakingly turn around the unstable condition of music education in Ghanaian schools and on the minds of the citizenry.

### **The Use of Cymatics in Music Education**

Over the years, Music Education in Ghanaian schools as prescribed by the Curriculum Research and Development Division (CRDD) of the Ministry of Education, has undergone a series of reviews.<sup>21</sup> For instance, Music as part of Cultural Studies, Creative Arts among others. However, in all these modifications, the teaching and learning of music in Ghanaian schools has followed a four-part trend, consisting of Composition, Performance, Listening and Appreciation.

A critical consideration of these divisions in the education of music as it is being carried out in schools certainly requires a careful measure of theory and practical sessions. However, personal experience as a music teacher at various levels of education and institutions, reveals serious challenges in the delivery and absorption processes and most importantly the end product of what is taught as music. This situation demands rapt and thorough attention in respect of the provision of remedy which will also add physical quality to the education in music. The venture will surely open a new page for music education in Ghanaian schools and accordingly make teaching and learning of music attractive to the would-be patrons (learners) who would possibly move the discoveries in sound and music education to a higher pedestal.

An attempt to secure an equally reliable and modern-oriented means of teaching music, and also sensitising patrons and other learners on what music and sound can produce to satisfy modern trends, led to the discovery of Cymatics. Hans, however, did not consider the invention as a medium of teaching music but as the study of sound waves and how it could be used in terms of the creation of patterns or figurative works for further productive outcomes.

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<sup>19</sup> International Labour Organization (ILO), “Right Beginnings: Early Childhood Education and Educators” (Geneva, February 22, 2012).

<sup>20</sup> Ernest Francis Amparbin, “Challenges in Administration of Music Education at Senior High Schools in the Cape Coast and Winneba Municipalities” (University of Cape Coast, 2012).

<sup>21</sup> Ernest Francis Amparbin, “Beyond Kinematics: Exploring Periodicity and Figurative Patterns Elicited by Selected Ghanaian Musical Forms” (University of Cape Coast, 2019).

Nonetheless, the entire process of cymatics and the corresponding outcomes is practically revered as an end product of the teaching and learning of the rudiments of music. This is because generally when a musical note is sounded with its value duly observed either by clapping, singing, drumming or any other means, cymatically the chladni plate responds to the vibration irrespective of the frequency level and subsequently creates an equivalent figure which is visible for interpretation. For instance, a cymatic experiment conducted by Amparbin using an analogue SK20 Yamaha portable organ and a cymatic setup, produced a set of figurative patterns representing the notes on a C major scale as follows:<sup>22</sup>



*Figure 1. tonic note in C major (C3, 258 Hz and negative 8 decibels)*



*Figure 2. supertonic in C major (291 Hz and negative 12 decibels)*

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<sup>22</sup> Amparbin, "Beyond Kinematics."



*Figure 3. the mediant note in C major (280 Hz and negative 12 decibels)*



*Figure 4. the subdominant note in C major (355 Hz and negative 9 decibels)*



*Figure 5. the dominant note in C major (54 Hz and negative 18 decibels)*





*Figure 6. the submediant note in C major (54 Hz and negative 19 decibels)*



*Figure 7. the leading note in C major (495 Hz and negative 5 decibels)*



*Figure 8. the octave note in C major (C4, 528 Hz and negative 9 decibels)*

In another experiment conducted by Amparbin employing the cymatic setup and traditional song composed and recorded by the Onyame Nkrabea Nwomkro and Adowa group,<sup>23</sup> the yielded images are the semblance of the dominant note on the C major scale as shown in the pictorial images. Furthermore, the image metamorphosed into another image which was analysed to be an original image of a royal symbol called *Denkyemkye* of the Ashantis but still maintaining a semblance of the image denoting the dominant note on the C major scale as follows:



Figure 9. Adowa 1: Cantor and Drum Appellation (248 Hz and negative 18 decibels)



Figure 10. Adowa 2: Castanet, Solo voice, Drums (334 Hz and negative 12 decibels)



Figure 11. Adowa 3a: Cantor, Bell, Drums and Voices in Harmony (248 Hz and negative 18 decibels)

<sup>23</sup> Amparbin, "Beyond Kinematics."

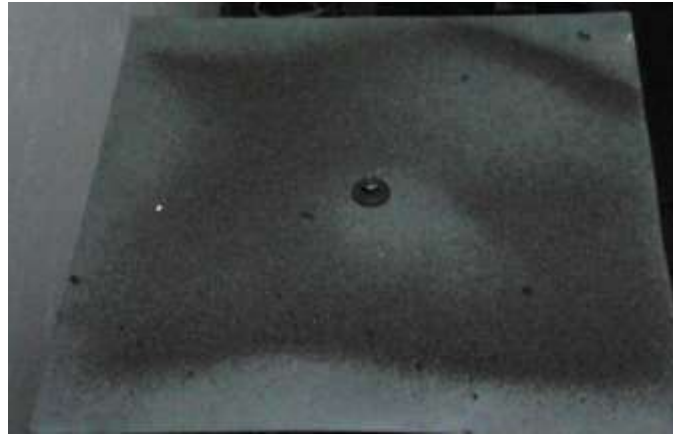


Figure 12. Adowa 3b: Voice parts with full Percussion (517 Hz and negative 22 decibels) an image of the *Denkyemkya*.



Figure 12. *Denkyemkya* as portrayed by photoshop (computer software)

Furthermore, the use of sea sand, sugar, table salt, lycopodium powder, and fluids among others, coupled with the cymatic setup as part of music studies in schools and institutions offering music will unquestionably create a trend in music education. The new trend in music education largely brings to the table a high level of anxiety and enthusiasm among learners as well as music teachers. Thus, the entire teaching and learning endeavour is ignited with an unimaginable altitude of excitement and an unmeasurable level of motivation among patrons. As a result, an inviting ambience is generated to draw more potential music lovers and talents to the fold. In this way, music education whether formal or otherwise will receive a new birth which will call for proper recognition in the educational field.

This is possible because the application of cymatics to music education in educational outfits significantly schools the learner on a unique job opportunity apart from instrument playing and performances. Certainly, per the functions of cymatics, the learner is able to produce overwhelming figurative patterns which could be adopted in several fields of endeavour, especially in the areas such as; communication design, packaging, textiles, fine art, music and art therapy.

Additionally, scientifically the use of cymatics exposes the learner to the external qualities of sound and how it is applied to impact life. For instance, cymatic applications in music and art therapies as well as a new discovery, which will blend the processes of music and art therapies into another

unique modern invention such as the cymascope and the digital scanner, to diagnose and improve healing processes.

## CONCLUSION

The discussion has portrayed that, the whole idea and the philosophy of Music Education, generally and particularly in African situations, is massively directed at shaping the three domains of the learner. Surely, the development of the domains will result in churning out well-balanced individuals who will perfectly carry out their core duties in accordance with the norms and regulations of society. However, this all-important objective is hardly realised, thereby painting a seemingly gloomy picture of Music Education as a programme of study in schools.

Yet, the discovery and application of cymatics in the teaching and learning processes of music introduce new trends in the use of sound and for that matter music, leading to the realisation of physical output in the form of figures and patterns coupled with the development of the domains is hugely welcoming.

Certainly, this study avails new trends for creativity and music teaching and learning. Consequently, modern music educationists and their respective learners will confidently take a sigh of relief with the assurance of resuscitating the face of music education to the level of the so-called important courses or programmes of study in Ghanaian schools.

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