

## **Fixed “Do” in Numerical Notation Encourages Children Learning and Playing Music**

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### **Abstract:**

The objective of this research is to examine the effectiveness of Fixed Approach on Numerical Notation in navigating children to read notation and to play composition using pianika, a small wind keyboard instrument mandating in music class at most schools. The methodology uses library research, direct method and analytical descriptive method. Students aged 10 to 12 were asked to play a familiar melody written in movable numerical notation method in natural scale. The song was then composed into four voices harmony in which each child played different part. When the key was changed into F, they looked hesitated. To be able to read and play different scale with movable approach, students must understand the concept and the interchange position across the keyboard's white and black keys in which most children failed. When the composition was turned into Fixed Approach, the song could be completely performed. With the support of multimedia, more children from different ages eagerly joined and willingly to learn music in different scales. This study is limited to: how Fixed Numerical Approach arises the children's intention to read notation and to play music. It was found that the method enabling children to independently and easily learning and performing music, indicating that it can be effectively used in music classroom especially in post pandemic era where self-paced learning is indispensable.

**Keywords:** fixed “do”; numerical notation; harmony; multimedia

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## **INTRODUCTION**

It has been decades since the Author graduated from K-12 education, in which music is taught at all levels, but students' ability to read notation seems to be the same. The low

enthusiasm and passive attitude towards teaching and learning notation process (Ikhwanudin, 2022) is not surprising since the process of reading number notation (later the Author uses the term ‘numerical notation’) as found in music syllabus with the present method which is Movable Approach, needs more attention than only a state of reading. The change of scale which is not followed by the change of script complicated students. The notation degree uses the first seven numbers of Arabic numeral: 1, 2, 3, 4, 5, 6, and 7; and the way a melody written whether in C or F is the same -the only indicator differed the scale degree is shown on the top left of the script as C=Do, D=Do or so on. To be able to play a different scale while reading a same-still “natural” numerical script, students have to be able to imagine another new scale degree in the keyboard. Undeniably, it was one of numerical notation weaknesses not to mention the limitation to covering up the voice range that only appropriately covers a three-octave writing notation: the middle C and an octave lower denoted by a dot put under the notes; and an octave higher denoted by a dot put on top of the notes; makes it impossible to write down a wide range of instrument composition. In many cases the notation for instrument is backed up by chord codes (C, F, Ab, etc.) where students play chords and or sing melody separately. There is also a packaging of numerical and block notation for voice and instrument composition written separately as seen in most participants at Pesparawi 2022 (national annual church choir competition). The block note reading skill is usually got from informal or non-formal education institution rather than from school. Yet, it is understandable that to be skillful someone needs to get more practice outside school hours, but the notation taught at school must be understood as expected. If the two versions can be united into one inscription, the learning music process might be simplified. Different views on interpreting notation between voice and instrument also added another burden in learning notation at school.

Reading is a cognitive process wherein the brain does most works when the information taken by the eyes; it can develop students’ crucial skill such as analytical thinking, creativity, and comprehension (Djunaidi et al, 2021). The aural and visual connectivity is crucial for understanding notation reading; once the student acquired it, they may explore music more fully and carry the knowledge into adult life (Hackett et al, 1997). Reading is not a “just happens” occasion; the ability to read notation can be gained through hard work and virtuous application (Sloboda, 1978). In reading music, the ear is also included in the information processing; it evaluates the correctness of the pitch and its length. While in singing lesson or any subject using human voice the process of reading numerical notation does not seem to be as complicated as that of the instrument since it could be adjustably jumped higher or lower wherever pitches brought even though the script remains the same. However, in many cases, Instruments help students recognizing pitches.

In the grand staff, the “C”, “re”, “F”, or “la” for fixed or movable approach, can be visibly identified because any change obviously appears in the spaces or on the lines of each. Since the notes are put in certain level of lines or spaces, students may be smoothly directed to the keys of the keyboards, since a note position in the staff reflecting a fixed position in the keyboard. In numerical notation on the other side, where there is no line or space degree, there is no change of the script when a scale is changed; the number degree and the line are still the same. The only indicator of the change is the one written on the top left of the script shown as C=Do, D=Do, and so on. The present method of reading numerical notation which is movable approach, obliges students to know or imagine the new scale degree on keyboard without any change made on the script; the reason it was named “movable” because a “Do” or a “Re”, or

any notes, could be at everywhere in the keys. The fixed application of the sol-fa has been criticized since it was initially a movable approach for oral use only (Clement, 1978) and should be so. In numerical notation, the “1” is recognized as “Do” even though when the fixed “Do” approach applied. When a scale changes, the written numbers tends to play the role of letter “C” which is unmoved; however the written numbers should be still “1” because that is the way people understand the position in the keyboards. If the numbers are not referring the letters, there will be a double meaning of the “Do” or “1” as the movable sol-fa always appears in every scale. The Author named the fixed “Do” approach in numerical notation as Fixed Numerical Approach (FNA) to prevent misinterpretation of the “Do”.

There have been a number of researches emphasizing in reading notation problem. Nurhayati et al (2021) studied the correlation of reading notation ability with skill music and dance but did not characterize the notation reading approach as well as Banua et all (2022) who discussed about the increasing of learning block notation using Teams Games Tournament (TGT). Ikhwanudin (2022), worked on the musical notation reading comprehension using Problem Based Learning (PBL) Model and Peer Tutor Method Application. An article explained about Fixed Do method that inspired the Author was the one Jimmy Hartoyo wrote in 1996 discussing the idea of Fixed and Movable Do to resolve the problem of music education in Indonesia but did not come to demonstrate that concept nor show how it applied. In 2015, the Author packed manual books contained the songs written in Fixed Numerical Approach (FNA), both for school and church usage but did not academically expound the method. Another Fixed Do papers were exposed by researchgate.net pointed out the difference of the two methods in grand staff; Tamsyn in 2012 clarified the difference of the versions and using numeral code in interpreting the solfa combined with the staff, but did not justify the fixed numerical approach in the reading notes process; Violy in 2019 compared the difference of the two methods applied for violin and did not use any numerical codes. None of the study has explored fixed “Do” method in numerical notation.

Although the sol-fa was firstly used not for writing, movable numerical notation which incidentally the written version of it, has been understood as notation and widely used from east to west across thousands of Indonesia’s islands. The movable numeral notation has been taught to the people from generation to generations. Even though they have little understanding of it but somebody will easily identify the “1” as “Do” or the “2” as “Re” for numbers relating to music. This concept has narrowed this study into the numeric version of fixed approach to answer the question: why students are facing problem in reading notation whereas it has been taught for a long time.

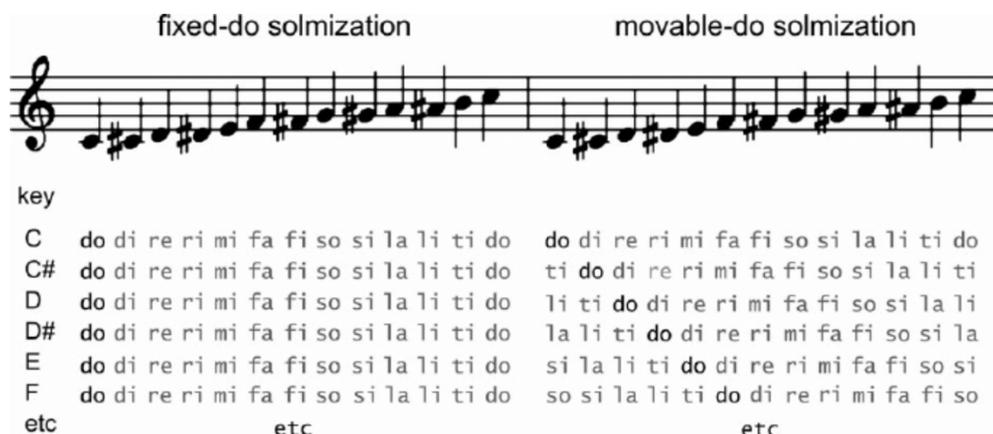
This study is limited the problems into how fixed “Do” in numerical notation arises children’s intention to read notation and play music. The main indicator of accomplishment is that students are able to play various composition in different scales using pianika.

### **Theoretical Study**

The concept of “fixed” and its application in sol-fa system has been shadowing the “movable” version, while some stated the two as “at war”. Guido d’Arozo in 11<sup>th</sup> century, originally used a non-written solfa degree (Harris, 1918) named Gamut to change the way the unknown songs learned outside the tiring and boring process of learning songs by memorizing; turned it to be sight read (Bridges, 1992) and it was movable with the use of first seven letters of the Roman alphabet: C, D, E, F, G, A, B associated with the syllables (ut, re, mi, fa, sol, la, si) for naming the

notes, scoping around human voice. At that time, the modern tonal system was founded and the instrumental players did use the letter names rather than the sol-fa (later commonly known as solfege or solfeggio), with sharps and flats to indicate semitone inflections. The ‘ut’ was then changed to “do” by the beginning of 1600s, considered it as more singable. The order was then becoming: do, re, mi, fa, sol, la, and si, the set of which is now known as solfa or solmization.

Indonesia, whose independence was in 1945, knows the sol-fa by the use of the first seven numbers of Arabic numeral: 1, 2, 3, 4, 5, 6, and 7 refers the do, re, mi, fa, sol, la, and si respectively rather than letters A to G; it might because the numerals show a level of high and low degree that is very logical related to the order of notes; people freely recognize “1” as “Do”, “2” as “Re”, and so on. For decades, the syllabus for music education in Indonesia has been using numerical notation employed in relative method. In 2014, as the implementation of Curriculum 2013, the grand staff system or block notation has been added into the syllabus creating a two-way notation system. Some teachers combined the grand staff notation with the numerical notation with firstly identifying where the “Do” or “1” located while some others tried to interpret those two styles distinctively.



Fixed and unfixed systems for naming pitches. In fixed-doh solmization, each pitch of an ascending chromatic scale is fixedly associated with a single solfege syllable irrespective of key. In movable-doh solmization, the pitches are associated with different names under different keys, as doh always represents the keynote.

**Figure 1. Fixed and Movable Do table in the staff. Source: researchgate.net**

The “fixed do” approach itself has been familiar to instrument learners using letters A, B, C, D, E, F, and G in the grand staff. As the name “fixed”, the place of the note is stable; meaning once a Do is on C, it will not be moved to any other note. The numerical notation on the other hand, has been implemented in Indonesia music education for decades. The numbers named the sol-fa, could be initially used to simplify the writing but then continuously applied in music teaching and learning. Most Indonesians will recognize the “1” as “Do” in music perspective and for a long time the numerical notation has been interpreted as the solmization. If movable approach applied in the grand staff could be easily recognized since the change is shown in different position, there is no change in the position of the numbers nor the degree when it comes to apply it in numerical notation. The numbers’ order is written in the same line, whether an abstract or a real line; the more the melodies are in, the more lines are put into. The only indicator is the one put on the top left of the script formulated as C=Do, D=Do and so on.

Numerical notation is presumably the simple form of the sol-fa that initially written to simplify the pitches constructed it and eventually known as solmization or notation in the

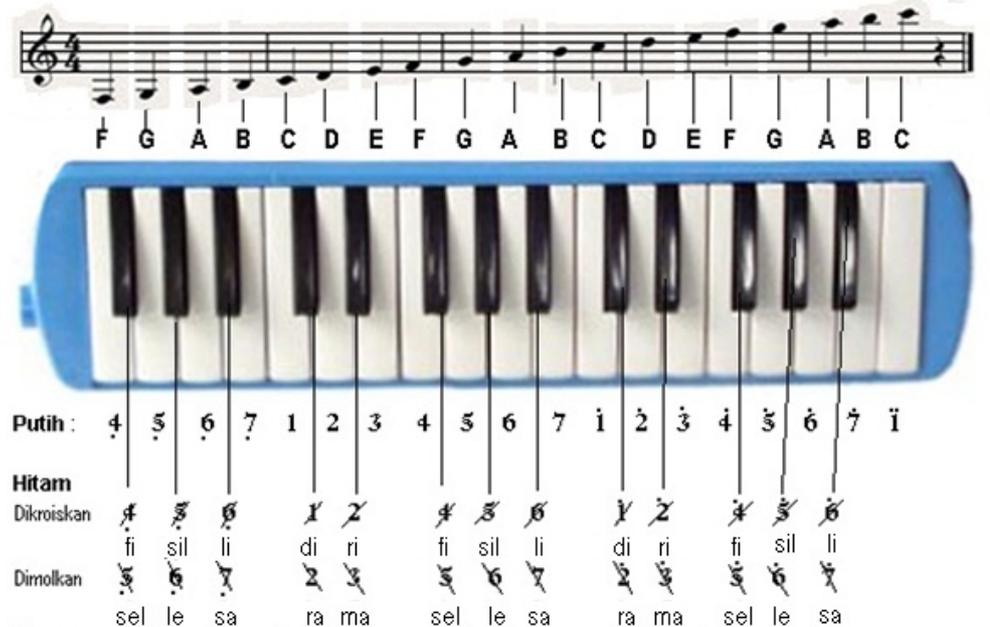
territory where grand staff is not familiar. The first seven numbers of Arabic numerals: 1, 2, 3, 4, 5, 6, and 7 are used instead of the Do, Re, Mi, Fa, Sol, La, and Si themselves. Just as the unwritten sol-fa, the order of the notes is flexibly applied to every scale. But this movable approach complicated the instrument learners who do not know the grand staff and unable to perform different scales of a flexible same-script notation to any instruments. For some times, most music learners were left unwillingness to connect the visual to audio form. When the Fixed Approach applied on it, the way to read notation is simplified because the learners can clearly see where the “1” in the keyboard is and do not have to think about the abstract keynotes in interpreting the unchanged numerical script in playing a non-natural or a non-C scale. However, applying a fixed “do” in numerical notation resulting in a double meaning of the “Do”; firstly, as the name refers the “1”, also read as “Do”, and secondly, as the unwritten “Do” of the sol-fa appears in every pitch it rooted. To naming it as “Fixed Do” Approach while there is another “Do” in the sol-fa, could be doubling the “Do” concept. Therefore, the Author used the term “Fixed Numerical Approach” to indicate the fixed “do” approach on numerical notation. The sol-fa is still moveable as it was in the beginning, but the way the numerical notes read and written is fixed. In this case, the numbers: 1, 2, 3, 4, 5, 6, and 7 is actually representing the letters version in notation: C, D, E, F, G, A, and B.

The idea to implementing fixed approach in numerical notation was started when the children were hesitantly playing the same numbers order in a non-natural scale on pianika. There would be sometimes needed to provide the understanding of the concept of reading notation in movable system where a few students gifted in music can survived, while the others failed. Students as categorized by Garner (2011) who are well in music, will easily recognize the change of the notes in the keyboards by the help of their musical feelings; some who are good in logical thinking will find a systematic way in playing the movable keynotes order; but those who are not very well in music nor logic will find it is hard to decide. Rationally, the fixed method applied in the grand staff would likely be effective implemented in the numerical notation. So, the Author substitutes the approach in the grand staff into the numerical notation version. As the result, the children proved to be easily recognized the “1” as C in the keyboard; the “2, 3, 4, 5, 6, and 7 representing the E, F, G, A, and B in the keyboard respectively. As for the semitones, the use of “/” indicating the sharp (#) and the “\” indicating the flat (b) that will not be difficult to distinguished since the system is also applied in movable approach. The syllables followed the semitones sign “/” put on 1, 2, 4, 5, and 6 become: di, ri, fi, sil, and li; and the ones applied by the sign “\” on 2, 3, 5, 6 and 7 are become: ra, ma, sel, le, and sa respectively, as shown in Table 2.

Music notation is meaningless until it is associated with sounds (Hackett et all, 1997). Students will be easily learning the pitch and duration when they understand the visual (notation) and aural (sound) relation. At this point, the notation can be read because the students to connect the script and the notes it refers. Once it happens, students are musically literate and can become independent music learners.

Music learning is the process to know and experience music. It should develop the children in three domains of education: the cognitive, the affective, and the psychomotor. The cognitive domain emphasizes in intellectual learning such as knowing, understanding, and thinking; the affective domain encompasses feeling and emotion: interests, attitudes, values, and appreciation; while the psychomotor domain focuses on the manipulative or physical skills: singing, playing, moving, and performing music (Hackett:1997).

Pianika is widely used among Indonesian elementary schools for music classes. The student's inability to play it has been the Author's concern not to mention the illiterate of notation. This 32 keys instrument similar to piano but in smaller size. When a key is pressed and a breath is blown through the plastic pipe, the sound is produced. The longer the breath endures, the longer the sound stays. It is important to manage the length of the breath to maintain the duration of the note. The fact that most students do not play it and their inability to read notation has forced the teacher to combine the two components into a study.



**Figure 2. The Pianika's voice range and the notation it refers both in grand staff and numerical version.**

***Putih* means white keys, *Hitam* means black keys; *Dikroiskan* means sharpened, *Dimolkan* means flattened.**

**Source: Manueke 2015**

There should be various instruments available for a viable music classroom representing the rhythmic, melodic and harmonic instruments. But, in case there is no availability of multi-characteristic instruments, the classroom can use a minimum resource. Pianika is easy to find and the price is affordable; it also a double function instrument of harmonic and melodic that probably made this piano-like instrument often used in music classes. Its players need to know the technique of breathing and the fingering. An easy method in reading notation will enlighten the students to focus on how to produce pitches smoothly at the first step of learning. When the notation is properly followed, the beauty of the harmony is created and children will be eagerly playing music.

Harmony is produced when two or more pitches are sounded together (Hackett et al, 1997). Three or more different pitches produced at the same time creating the combination of sound named chord. The series of the chord is known as harmony; the harmony of a song walks in accordance with melody. When the two components are combined, various textures are formed. The combinations of separate or distinct melodies are called polyphony. When a single melody is supported by the series of chord, the texture of homophonic is resulted. The composition of the sample song used in this study is polyphony arranged in SATB referring the

soprano, alto, tenor and bass respectively; taken from local church hymnal textbook called Lagu Sion, that originally translated from the English version.

In computation context, multimedia is the use of computer to combine text, sound, visual and video through a tool and link so it may be used to navigate, interact and create. In different perspective, it is related to the use of two or more medias to provide information (Munir, 2012). For example, music video is an information that provide audio or sound and video. Music recording only categorized as monomedia since it uses only audio component. The multimedia used in this study is grouped from two different functions that connected each other: the music text and the music accompaniment. The music text is the printing version of the song notation, worked from the computer; it was created hand-written. The notation was typed in using MS Word tool since there was no specific application to write down numerical notation. The accompaniment that supported the text is created using MIDI multitrack system in an electronic music keyboard which is a multi-instrument arrangement of the song. Musical Instrument Digital Interface or MIDI is the technology to compose and record various sounds or synthesizers in one device. It helps teachers or musicians providing a full orchestra or full band recording that basically required several musicians; by only using a computer or a keyboard electronic and can be replayed. The file then can be transferred into other forms; such as turned into a wav file, MP3 or MP4 file to be able to be replayed in other media such as player devices. In other case, it could be composed from a computer using certain tool such as Musescore and be replayed. The accompaniment made for this study is not notated or printed out. The children only played the print out melodies and the sample song's SATB composition where the accompaniment acted as the opening, the closing and the accompaniment of the song itself.

Cambridge dictionary explains 'encourage' as "to make someone feel more confidence." The fixed approach on numerical notation encourages children learning and playing music means that that method can awake the children's enthusiasm to learn and play enthusiastically and enjoyably.

## **METHODS**

The methods of data collections employed in this study are (1) library research; (2) direct method; and (3) analytical descriptive method. The library research method involved a comprehensive and critical literature review that defines the elements under examination; compares and contrasts existing studies; and shapes the research questions and methodology of the current study. The direct method refers to the anticipated means of data collection that will involve observing and interviewing students recruited to participate in the research conducted in oral and written test. In conclusion, the analytical descriptive method will be employed to re-analyse the data collected in the light of similar studies and existing literature that determines the value and potential of what is revealed.

The population is students of elementary school aged 10, 11, and 12 at grade 4, 5, and 6 respectively. They come from the same school but different classes; united every week for Sabbath School or Sunday School to study bible and sing songs. The fact that the church they attended use hymnals in four-part composition written in the grand staff, the only local church using block notation in the hymnal book, offered a big contribution to this study. Most congregation does not read notation whereas Author's desire is to let them sing in harmony as written in the text. A familiar song called "My Jesus, I Love Thee" was determined to be the sample song due to its simple rhythm and harmony pattern.

There was a written pre-test to determine the children’s music ability before the process started. Previously, they were tested about notation in the staff where two of the children who have had piano lesson answered the questions correctly; a child answered only one question and the other answered no question at all. The numerical notation was also pre-tested in which most of them interpreted well; it was written in the present numerical method. The problem occurred when it was being played in different scale; only two of the children could guess where the keynotes are for only two to three measures. Since the main purpose of the activity was to make the children performing music, the teaching method that could be easily followed by all children was needed. It was found that when the method has been changed into fixed version, all children easily found where the keynotes are and successfully played the whole song.

## RESULTS AND DISCUSSION

### Fixed Numerical Approach (FNA) Encouraging Children Reading and Performing Music Easily and Happily

This research was held in Manado, in a group of elementary children from different grades, different multiple intelligences, and music background but united in a church community called Sabbath School, similar with Sunday School, where they gather every week for bible study and singing. It was determined to use a familiar church song “My Jesus, I Love Thee” as the sample song so the product might be beneficial to the community. Since the study was held to take advantage of the children’s spare time, the easy method of learning was underlined.

Prior to the treatments, the children were given a written pre-test to determine their ability of reading notation (Table A of Picture 3). There were five different notes’ put in the staff and they needed to write down the name of those notes in letters (A, B, C, D, E, F, or G). Also, five numerical notes were asked to play in pianika; the length of the notes was not asked. Child number 1 (female, aged 12, grade 6) has a strong musical feeling, less logical thinking with partial piano lesson background; child number 2 (female, aged 12, grade 5) has a strong logical thinking, average musical feeling with fulltime piano lesson background; child number 3 (male, aged 10, grade 4) has strong logical thinking, less musical feeling with no music lesson background; and child number 4 (female, aged 11, grade 5) has no music lesson background, less musical feeling, less logical thinking but strong in interpersonal ability. Music lesson is a music learning class held in an informal school where the students were taught standard music notation or grand staff system.

A	Subject	Block correct answers (%)	Numerical correct answers (%)	B	Subject	Missing at bar number:	C	Subject	The correct notes played (%)
	Child 1	100	100		Child 1	3		Child 1	100
	Child 2	100	100		Child 2	2		Child 2	100
	Child 3	20	100		Child 3	2		Child 3	100
	Child 4	0	60		Child 4	1		Child 4	80

Notes:

- Table A: pre-test result on the block and numerical notation comprehension
- Table B: test result on playing sample song in F using movable numerical approach. Total bars: 16
- Table C: Test result on the Fixed Numerical Approach (FNA)

### **Figure 3. Tables of the test results on the children's comprehension of notation**

Considering the gap on reading block notes comprehension among students, the teacher used numerical notation instead, of course with the present method, the movable. With the same approach, they were divided into four groups to play different melodies of the sample song which are initially the parts of soprano, alto, tenor, and bass in a mixed choir composition. When playing the notation in natural key, where they all played well.

After the successful group harmony playing in C, they were asked to play the parts in different scale, F, which is the original key of the sample song (Table B), still using the present method. As predicted, they could not play the entire composition. The children were able to play only a few notes; only until bar 3 of 16 bars in total and then lost the rest of it. Considering the different musical background that needed time to establish a balancing level of understanding among them, the other approach was then applied. The result of the try out was a surprised since all of them can play their parts well (Table 3) with 60% played all keynotes correctly. Upon the four children, the only one who made a few mistakes was Child 4. The different pattern of bass part (she tends to imitating others) and the level of music intelligences are the factors that may cause. But, by the teacher's help, she improved.

After the main group performed the sample song in public, more children were interested to join and they were treated the same way. At this point, the main group becomes peer tutorial to the new comers and the teacher's role be limited to supervision only. To avoid monotony, the teacher provided other songs, unknown ones to balance the list of familiar songs. The Approach worked as good as applied to the sample song upon the main group; the chord that sounded was matching to the composition and everybody could sing along smoothly. Handel's Hallelujah Chorus was used as a countercheck of the children's reading comprehension where they all were successfully performed with the backup of the midi accompaniment in full orchestra composition. That marked the accomplishment of the study.

### **Along with other supporting elements, teachers' creativity and capability arise student's intention to enthusiastically learning and performing music**

The teacher's capability and creativity were the main part that this study was successfully conducted. The discipline that applied fairly to all children becomes a strength in managing the class that all instructions are truly followed. There were attendance checking as well as punishment and reward maintained their attitude toward others. The creativity the teacher showed has maintained their enthusiasm to keep learning and practice.

There are also some other important factors supporting this study such as music accompaniment, the use of multimedia and the playing in group technique which make it easy for the students to learn.

Pianika produced a kind of string-effect which is the reason the presence of other sound is needed to give the music different atmosphere. The singing composition used in this research was taken from the SATB parts arranged in four-part harmony, so they sounded like a singing

arrangement only. The availability of music accompaniment enriched it. It acts as the road opener, the closing, and the accompaniment itself, fulfilling the space of voices or the empty room of it, just as accompanying the congregation singing. It offers rhythm direction and the harmony. The guiding pulse and chord help the children deciding the time to play each note, analyzing the correctness of pitch, and involving in the song's chords. It enriches their sense of harmony and enlarges their enthusiasm on learning. The beats and harmony the accompaniment offered give the children direction on when to play and how the harmony sounded. Without it, the music will sounded like "acapella".

The accompaniment arranged for each song differs depending on the character or the atmosphere created. In certain song, a piano-only will match, yet in other songs, a full synthesizer that combining various kind of instruments are needed. The accompaniment's script is not provided in this research, but the text of the song composition that is written in Fixed Numerical Approach notation is a must. The accompaniment and the music text walked side by side in this study.

The accompaniment arranged for the sample song used in this study was created with the support of MIDI, the technology that helped people to provide composition that originally required several participants, with using only a computer or an electronic keyboard with synthesized. With this technology, various sounds can be composed in one device; for example: percussions, strings, piano-organ, guitar or wind instruments can be set up to play the arrangement of a group band or even classical orchestra. The file can be replayed again and again. Along with the music text, it helped the teacher in managing classroom and conducting most the activities. With the support of peer tutorial, the teacher's tasks can be reduced to only for supervising. Through the support of multimedia, more children from different ages eagerly joined and willingly to learn music because they enjoyed the learning process.

To play chord with pianika, someone needs to put much effort especially for the beginners. But, mastering the breathing and fingering techniques is not the focus of this research. An easy way to provide a harmony effect is by separately playing different melodies simultaneously. The combination of four distinct melodies constructed for choral composition resulted the harmony of song. While each of the children is playing a melody pattern, together they are creating and listening the harmony of the song and enjoying such beauty. Playing in group also helps students improving their social relationship where they bound to each other. They will feel how dependent they are on each other in the process of learning, practicing and performing. If someone is missing, the performance will be affected.

## **CONCLUSION**

Fixed Numerical Approach (FNA) can be used at elementary school as it was effectively implemented for worship purpose to teens and teenagers. It also can be used in other level of school that needs instruments to demonstrate music; or in choir class that learn unknown song. The accomplishment of FNA for pianika indicating the possibility to apply it to other instruments as well, for example kolintang, a traditional music of Minahasa. It also becomes a solution to the problem in reading numerical notation in Indonesia. FNA might become an alternative to learning and teaching music in post pandemic era, where self-pace learning is indispensable. Following studies are needed to assest its use to other instruments.

The Pjbl model provides an opportunity for learners to hone their creativity both in terms of choral format arrangement ability, improvisation in single singing. In addition, it provides an opportunity for students to be able to learn the technology used in audio recording. Pjbl with a euritmika dalcroze approach can maintain the quality of vocal learning outcomes, especially in the elements of pitch, phrasing, and dynamics even though it is carried out in a student center. For subsequent researchers, they can apply the PjBL model with the euritmika dalcroze approach to other music learning, or it can be applied with other music learning approaches such as Carl Orff, Kodaly, and so on.

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