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## Chromotherapy: An alternative treatment for mathematics anxiety among elementary school students

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**Abstract.** Mathematics is often a frightening subject for students. Such conditions are caused by a stressful learning atmosphere, mathematics subjects that create anxiety. Anxiety experienced by students in learning mathematics has the potential to cause depression conditions on the mathematics. Based on this, a chromotherapy treatment was used to reduce the anxiety of elementary school students to mathematics. Chromotherapy is a treatment designed with the foundation that any color contains healing energy. The effect of color affects the work of sympathetic and parasympathetic nerves and improves mood. Chromotherapy provides an element of relaxation, which from various studies found to reduce anxiety in individuals. This research uses single-subject design to five students of elementary school with high anxiety. The instruments used are observation, interview, DASS Inventory. The results show that chromotherapy provides relaxation and reduces anxiety among students. Instruments used Mini Mathematic Anxiety Scale (MMAS) and observation. Based on such things this therapy can be one alternative treatment in helping elementary school students cope with anxiety to the subjects of mathematics.

### 1. Introduction

Mathematics is the main subject in every educational unit [1]. Mathematics courses need to be given to all students from elementary school [2] to equip them with logical, analytical, systematic, critical, and creative thinking skills, and the ability to work together [3]. The essential values contained therein, and their functioning in everyday life [4] make this lesson very important to learn [5].

One of the characteristics of mathematics is to have an abstract object [6]. This abstract nature caused many students to have difficulty in mathematics [7]. Meanwhile, mathematics learning in elementary school [8],[9] was the basis in the application of mathematical concepts to the next level. That is, the



results of their understanding of mathematics in primary schools will determine the achievement of understanding in the next level. This becomes a pressure [10],[11] for students. They are required to master a lot of materials as the target of achievement at the school level, which ultimately leads to a negative attitude. It is also suggested by Ho the affective factor of math anxiety was related to mathematics achievement in the negative direction [12]. As for students who have negative attitude toward mathematics, rarely complete math tasks, and experiencing mathematics anxiety.

Anxiety is defined as an emotional state that causes discomfort characterized by feelings of worry, anxiety and fear that can interfere with life [13],[14-17]. Furthermore, Steven Schwartz points out anxiety is a negative emotional state marked by foreboding and somatic signs [18] of tension, such as the racing heart, sweating, and often, difficulty breathing (anxious, meaning means constriction or strangulation) [19]. Anxiety is similar to fear with a less specific focus [20]. Whereas the fear is usually a response to some immediate threat, anxiety is characterized by apprehension about unpredictable dangers that lie in the future. Anxiety was defined by Freud as "something felt," an emotional state that included feelings of apprehension, tension, nervousness, and worry accompanied by physiological arousal [21],[22].

Anxiety has been found to be one of the most prevalent emotional problems associated with mathematics [23]. Anxiety students in the face of mathematics lessons can be interpreted as an emotional state of unpleasant students, characterized by anxiety, unhappiness, worries, unwarranted fears that there will be things that are not desirable when students face math lessons. Students' anxiety about mathematics will have an impact on their test results. The psychometric literature is also very clear on the global consequences of mathematics anxiety [24],[25],[26]. People who are highly math anxious avoid math: They avoid elective coursework in math, both in high school and college, they avoid college majors that emphasize math, and they avoid career paths that involve math [27]. The worst impact of this anxiety [28],[29] can cause depression [14],[30],[31] to the lesson. To prevent this adverse effect, chromotherapy treatment [32],[33] can be used to reduce mathematical anxiety in elementary school students.

Chromotherapy, also known as color therapy [34],[35], uses specific colors to address specific needs. It can be defined as the therapeutic use of color to balance energy. Color therapy is a form of therapy method using certain colors [36]. Color therapy is created because it is based on the statement that each particular color contains healing energies [37],[36].

Chromotherapy is a method of treatment that uses the visible spectrum (colors) of electromagnetic radiation to cure diseases [36]. It is a centuries-old concept used successfully over the years to cure various diseases [38]. Color therapy is one of the non pharmacological therapies that can reduce anxiety [39]. The effect of color affects sympathetic and parasympathetic work and improves mood.

A number of studies have elaborated the relationship between the human body and colors [36]. The human body, according to the doctrine of chromotherapy, is basically composed of colors. The body comes into existence from colors [40], the body is stimulated by colors [41] and colors are responsible for the correct working of various systems that function in the body [42]. All organs and limbs of the body have their own distinct color [38]. Chromotherapy can give effect to physiological changes more than just psychological stimulation alone. For example, red color can stimulate the autonomic nervous system, while blue has a calming effect. So that color therapy can provide an element of relaxation, which from various studies of relaxation can reduce anxiety or anxiety in individuals.

## 2. Method

This research used a single subject research (SSR) method [43]. Single subject research (SSR) is a method used in the study of psychotherapy by conducting individual investigations based on two views of the individual as an object and unit of analysis [44]. The research design used was ABA (Baseline (A1) - Intervention (B) - Baseline (A2)). The subjects of the study were five people with the very severe anxiety level based on the results of the previous assessment need. At this design, the first step is to collect the target behavior data at the first baseline condition (A1) data collection, used the Mini Mathematic Anxiety Scale (MMAS) adaptation from DASS [45],[46] and observation sheet. MMAS used five category: normal (0-4); low (5-6); medium (7-8); high (9-10) and very high (11-21). After the data stabilized at baseline condition, intervention (A1) was given. The collection under intervention

condition was carried out continuously until the data reached the trend and a clear level after which each baseline condition (A1) was repeated on the same subject [47]. The data obtained were analyzed used Wilcoxon Signed-Rank Test [48] and visual data analysis [49]. The research data set can be accessed in Open Science Framework [50].

### 3. Result and Discussion

Measurements of anxiety levels were performed three times at the baseline phase (A1), then three times in the intervention phase (B) and three times in the next baseline phase (A2). The estimation of the tendency of direction indicates at the baseline phase (A1) steady trend direction, the median value of 13 at the beginning of observation to the end of baseline observation (A1), and in the intervention phase (B) decreases. As for the median value of 10 down to 6 as well as in the baseline phase (A2) the trend showed a steady decline to the median number 4. Anxiety level at the end of the baseline was 13, then 6 at the start of the intervention and gradually decreased to 4 second baseline (A2). This suggests that the more interventions given, the lower the target behavior.

When calculated from the baseline condition (A1) in the last session of measurement (13) and the first session under intervention condition (B) (10) then obtained the difference between the baseline data points last baseline with the preliminary data treatment is 4. This means that the change decreases target behavior indicates an improved meaning (+) or effective treatment lowers the client's anxiety level. The results of graphical analysis in groups can be concluded that chromotherapy is effective to reduce mathematical anxiety in elementary school students.

In addition through observation, researchers also conducted data collection, used the Mini Mathematic Anxiety Scale (MMAS). MMAS was given back to the client to measure the client's overall anxiety level after receiving treatment with Chromotherapy. The results of the MMAS also showed significant results of the observation process. Five clients are at an extremely severe anxiety level based on the results of a MMAS before being given Chromotherapy treatment. However, after getting treatment, five clients showed an anemic-lowering level that is at the level of simple and light.

Furthermore, based on Wilcoxon Signed Ranks test obtained data comparison between data MMAS after and before treatment with Chromotherapy with total five cases, all tend to be negative. This means that the level of anxiety clients after getting treatment is lower than before getting the treatment. This indicates the client's anxiety level after the intervention of Chromotherapy treatment decreases.

The test results at different levels of client anxiety through the pretest and posttest MMAS also shows results that support the results of the previous analysis. When compared pretest and posttest data, the value of Z is -2.041, which falls on probability 0.041 ( $<0.25$ ), which means  $H_0$  is rejected. There are a significant difference in the client's anxiety level between the pretest and the posttest of the MMAS. However, this suggests that chromotherapy treatment may be used to reduce client anxiety, with significant results.

The findings above show many as five respondents experienced decreased levels of anxiety after treatment. Mathematic anxiety [51],[52] that occurs on the client can be seen from the symptoms shown, including: 1) Physical symptom or emotionality [53], such as tense when doing math problems, nervous, sweaty, trembling hands when having to solve math problems or when starting math lessons; 2) Cognitive or worry symptoms [54], such as pessimists themselves are not able to do math problems, worried that the result of his mathematical work is bad, not sure of his own mathematical work. Fear becomes a laughing matter if not able to do math problems; 3) Symptoms of behavior [55], such as silence for fear of ridicule, do not want to do math problems for fear of failure again and avoid math lessons. However, chromotherapy proved significant in reducing mathematical anxiety in students.

Chromotherapy is a holistic and non-invasive therapy [56] that involves use of colors for treating various physical ailments and emotional disturbances. Chromotherapy uses a set of principles to create harmonious color and color combinations for healing [57]. Chromotherapy can create a feeling of relaxation and comfort. In practice, there are two techniques in chromotherapy [57] treatment that can be done, namely: 1) Rainbow healing technique, this technique is very simple and easy. Principally, water when exposed to sunlight in a colored container (such as a colored bottle), will receive vibrational energy from that color; and 2) Color breathing technique, this technique is one form of visualization techniques. Clients are asked to imagine inhaling and exhaling certain colors.

#### 4. Conclusion

Chromotherapy is effective in reducing mathematical anxiety in students; there is a significant change between before being treated with after being given. Before given Chromotherapy treatment, the students' anxiety was in very heavy category, then after being given treatment of anxiety was down on a simple and light category. It thus proves that Chromotherapy is effectively used to reduce mathematical anxiety.

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