Examination of a Subtle Energy Transduction Device on Anxiety Levels of Students in a Public School Setting: The Clarus QLink ClearWave

by

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The work reported in this dissertation is original and carried out by me solely, except for the acknowledged direction and assistance gratefully received from colleagues and mentors.

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Abstract

This study examined the effects of the Clarus QLink ClearWave, a subtle energy transduction device, on anxiety levels of students and teachers in a public school setting. Since anxiety may be caused by exposure to electromagnetic fields (EMFs), it is thought that by decreasing EMFs in the environment, anxiety in turn may be reduced. Quantitative measures used were the State-Trait Anxiety Inventory and the State-Trait Anxiety Inventory for Children. Findings indicate statistically significant differences (at $p=.08$) of state anxiety levels for students in the treatment condition group. No statistically significant differences were found for trait anxiety levels between the treatment and control conditions. Conclusions and possible implications are discussed relating to future research in this area.

Acknowledgements

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Chapter One

Problem Overview and Study Question

Introduction and Statement of the Problem

The industrial age of the early 1900's had, by the end of the century, morphed into a digital age that promoted a work and lifestyle that had given rise to the use of personal computers, cellular phones, and other electronically-based technological devices. While these devices are believed to serve humankind by increasing productivity, accuracy, communication, healthcare innovations, and a host of other benefits, there is a growing concern about the invisible electromagnetic fields (EMFs) that surround these devices, and the influence they may have on the physical body.

Specifically, studies have been conducted in an attempt to assess whether or not there are causal relationships between EMFs and different forms of physical illness or dysfunction, ranging from various forms of cancer to decreased response times needed to perform mental arithmetic or a working memory task (Wertheimer and Leeper, 1979; Becker and Selden, 1985; Savitz, 1988; Becker, 1990; London et al., 1991; Fajardo-Gutierrez et al., 1993; Linet, et al., 1997; Day, 1999; Koivisto et al., 2000(a)(b)).

What are Electromagnetic Fields?

Electric charges (known as "ions") create electric fields. Electric charges that move (i.e., electric current) create magnetic fields. Therefore, any appliance that is connected to a source of electricity produces an electric field. To produce a magnetic field, however, the appliance must be not only plugged in, but also operating, so that the current is flowing. The term "electromagnetic" field implies that the electric and magnetic fields are interrelated. Electric and magnetic fields may be static or may fluctuate, as with the fields produced by appliances using alternating current (AC). Static fields are created by objects with constant flows of current. The earth has a static, stationary magnetic field of 0.3 to 0.7 Gauss (G), which varies in its inclination and by location and time. Some consider alternating magnetic fields to be of greater concern in terms of adverse effects than stationary magnetic fields (U.S. Environmental Protection Agency, Office of Radiation and Indoor Air, 1992).

Sometimes this phenomenon is called an electromagnetic field (EMF), in an attempt to emphasize the connection between the field and the transmitter; other times it is called electromagnetic radiation (EMR), to put an emphasis on the outward-flowing aspect. Often, these two terms are used interchangeably, referring to the same phenomenon. For purposes of clarity throughout this paper, these two terms will refer to the same phenomenon.

When discussions about EMFs and health arise, it is likely in reference to either low frequency household current or higher radio frequencies, associated with cellular telephones. Electric and magnetic fields which operate at extremely low frequencies (commonly referred to as ELF) are generally associated with the 50 and 60-hertz (Hz) electric alternating current, the kind of EMFs that are created due to electricity generated by appliances and electrical wiring found in virtually every home and workplace. Radio frequency (RF) energy, which is greater in frequency than the electric energy in power lines, is produced by radio and television transmitters, cellular and cordless telephones, and microwave ovens. These EMFs generally operate at or around 900 megahertz (MHz).

Low-frequency energy is a form of nonionizing radiation. That is the frequency is too low to produce enough photon energy to ionize atoms. In contrast, ionizing radiation --- which is not produced by power lines --- can cause severe and well-documented health hazards. For example, nuclear weapons produce enormous amounts of ionizing radiation. In contrast, this energy can also be utilized in a more safe and functional manner, by using small, carefully controlled doses of ionizing radiation in medical X-ray equipment.

Convincing evidence exists that extremely low frequency EMFs, unlike ionizing radiation, do not disrupt nucleic acids or chromosomes, and that they are not mutagenic (Tenforde, 1992; Office of Engineering and Technology, Federal Communications Commission, 1989). According to Wilkening & Sutton (1990), radio frequency waves do not have sufficient energy to cause ionization; rather, their effects seem to be mainly thermal. The energy of radio frequency radiation is about one ten-thousandth that required to ionize tissue or disrupt cellular deoxyribonucleic acid (DNA). However, according to Castillo & Quencer (1988), overexposure to nonionizing radiation can damage human tissue by overheating it and other effects may exist that are not yet understood.

The higher frequency currents (for example, a microwave that operates at approximately three billion hertz) are easier to be shielded from as opposed to the lower frequency currents. This is because the wavelength of the microwave (about 1 centimeter) is much shorter than the wavelength of a 60-hertz field (about 5,000 kilometers). Thin metal sheets can be used to effectively shield from the shorter waves, whereas this will not work to shield one from the significantly longer waves.

Review of Related Literature

Historical Context: EMFs and Cancer Risk

While concern regarding possible health consequences due to long-term exposure to EMFs in the residential and occupational environments was made in the early 1970's (Becker, 1972, as cited in Marino, 1993), more attention was drawn to this concern when Wertheimer and Leeper (1979) published an article based on their own epidemiological study. They reported that children who had died from cancer were two to three times more likely to have lived within 40 meters of a high-current power line than were the other children in the study. This concern was further studied by Paul Brodeur, a journalist for the New Yorker Magazine, who wrote a series of lengthy articles on the subject matter. These articles were initially published beginning in 1989.

Since that time, there has been considerable debate in the field, as reflected in the literature, regarding the existence of causal relationship between illness and exposure to low-frequency EMFs. The National Cancer Institute directed an epidemiological study which found no association between childhood leukemia and either wiring codes or measured magnetic fields (Linet, et al., 1997). Similarly, The New England Journal of Medicine published these results together with an editorial calling for an end to wasting money on EMF research (Campion, 1997).

Additional studies have refuted the existence of any plausible mechanisms linking low-frequency EMFs and cancer. Day (1999) conducted a population case-control study covering the regions of England, Wales, and Scotland. All children diagnosed with childhood cancer (including leukemia) during the previous four years were eligible for participation in the study. Each case was matched with two controls who were randomly selected for gender and date of birth. The study found no evidence that exposure to magnetic fields associated with the electricity supply (50 Hz in Europe) increased risks for any childhood cancer.

Nonetheless, there has been an increase in interest within the general population asking the question: "Does a relationship exist between EMF exposure and increased physical and/or mental health problems?". In response to this public outcry, the United States Environmental Protection Agency (1992) stated, "At this point we are not at all sure that exposure to EMFs such as we find in our everyday environment has an adverse effect on our health. However, we cannot say with certainty that such exposure is safe for us either. More research is needed --- and underway" (p. 9).

While there are studies that refute any relationship between EMF exposure and illness, there are numerous studies that have been published in the literature which indicate that low-frequency EMFs may pose a potential negative effect to physical and/or mental health and well-being. The following are several studies that have examined the rates at which cancer or other forms of illness manifest in the body, relative to levels of EMF exposure.

One of the more controversial aspects of debate in the literature concerns what is considered a safe or dangerous level of EMF exposure. In a review of the literature on this question, Woodley (1999) suggests that safe levels of exposure range from 1 to 3 milligauss (mG).

When Tomenius (1986), conducted his study using measured fields to estimate exposure, his results supported Wertheimer & Leeper's (1979) original impression that the homes with a potential for chronic exposure to fields $\geq$ 3 mG had increased cancer risk. He found significantly increased risk estimates in homes with measurements of $\geq$ 3 mG but no increased risk in homes measured at 2 to 2.9 mG.

Savitz et al. (1988) introduced a $\geq$ 2 mG cut-off point in their statistical analyses, although the highest risk estimates in that study were seen for measurements above approximately 3 mG. These researchers likely chose $\geq$ 2 mG as the highest exposure level to analyze as there were not enough subjects with measurements ≥ 3 mG to generate sufficient statistical power. The Savitz et al. (1988) data suggest an elevated odds ratio (which would indicate increased or decreased risk for illness relative to the controls) for measurements at ≥ 3 mG, but no elevation at all for fields of 2 to 2.9 mG. In this study they found an association for incidence of all childhood cancers.

Olsen et al. (1993) used similar calculations based on high tension lines in Denmark, but did not analyze the 3 mG cut-off point. At a cut-off point of ≥ 4 mG, however, they also found (as did Savitz et al., 1988) an increased association of incidence for all childhood cancers.

Another study generates reasons to look at the very high end of residential field exposures as a risk indicator. Wertheimer et al. (1995) showed that people who lived in homes with evidence of high EMF exposure from ground currents had increased cancer risk estimates. Ground currents are a common source of localized fields in the house that are considerably higher than those generally attributed to power lines. Therefore, high-ground-current homes may have "hot spots" at various places in the house where fields in excess of 3 mG commonly occur. A house resident may intermittently spend fairly long periods of time (i.e., while sleeping in bed) being exposed to fields ≥ 3 mG, near such hot spots.

One study (Repacholi et al., 1997) provided strong evidence of a possible link between the use of mobile telephones and the development of cancer. The study involved 100 mice carrying cancer-causing genes that made them prone to develop lymphoma, a cancer of the immune system. The incidence of lymphoma doubled from the spontaneous rate of 22% to 43% when the mice experienced prolonged exposure to the kind of electromagnetic fields that are emitted by modern-day digital mobile phones.

Feychting and Ahlbom (1993) reported that the relative risk for leukemia increased in Swedish children who lived within 50 meters of a transmission line. These researchers concluded that this study provides additional evidence for a possible link between EMFs and childhood leukemia. Skeptics, however, are quick to point out that the generalizability of this study is severely limited, as the risk calculations were based on a very small number (n=7) of cases. Nonetheless, their data indicated that for the cases involved in this study, the relative risk of manifesting childhood leukemia was 3.8 for fields $\geq$ 3 mG, and that the trend for increasing risk with increasing field strength was statistically significant.

The accumulated data from many of these studies appears to show quite consistent and significant evidence that exposure to EMF fields over

3 mG is correlated with an increased cancer risk. In fact, Feychting and Ahlbom (1995) concluded that the correlational evidence on leukemia in children appears rather consistent. The hypothesis that EMFs lead to the development of cancer, however, cannot yet be considered proven.

In accordance with the above premise, a report issued in 1989 from the Office of Technology Assessment was quoted, according to Lechter (1994), as saying:

> "It is now clear that 60-hertz and other low frequency electromagnetic fields can interact with individual cells and organs to produce biological changes. . . The nature of these interactions is subtle and complex. The implications of these interactions for public health remain unclear, but there are legitimate reasons for concern" (p.1).

Clearly, this statement begs the fact that more research is needed in order to more carefully examine the effects of low-frequency EMFs on health.

Historical Context: EMFs and Biological Functioning

In addition to hypothesized relationships between EMFs and various forms of cancer, some studies indicate that humans exposed to power line fields experience slowing of the heart, changes in the electrocardiogram, decrements in performance, and suppression of nocturnal melatonin secretion (Graham, 1994, cited in AMA Report 7, 1994).

Some studies have found that persons sleeping under electric blankets have lower-than-normal levels of melatonin production when the blanket is operating, but their melatonin production returns to normal when the blanket is switched off. Melatonin is a hormone that controls the monthly female cycle and inhibits the growth of certain cancers, including breast cancer cells, in laboratory experiments. Other experiments on humans indicate that EMFs can cause fatigue, headache, slower heart rates, slower reactions times, and altered brain waves. Some scientists think the effect of EMFs on melatonin production may explain many of the apparent health effects of exposure to low-level electromagnetic fields (Lechter, 1994).

Not all species respond to magnetic field exposures in the same way. McCaig and Rannicek (1991) found that electric fields enhance the regeneration of peripheral and central nervous system neurons in various species, including lampreys, frogs, rats, and guinea pigs. The basic mechanism by which these phenomenon occurs, however, is not completely understood.

Lai (1998) demonstrated that laboratory mammals, when exposed to cell-phone frequencies (approximately 900 MHz), can suffer both short and long-term memory loss, as well as an increase in DNA single and double strand breaks, two forms of DNA damage. DNA damage in cells could have an important implication on health because such damage is cumulative. Thus, the effect of radio frequency EMFs on DNA could conceivably be more significant on nerve cells than on other cell types of the body. Cumulative damages in DNA may, in turn, affect cell functions. DNA damage that accumulates in cells over a period of time, according to Lai (1998), may therefore be the cause of slow onset diseases, for example, cancer.

Within the realm of cognitive functioning, there are several studies that indicate that some direct measures of brain physiology may be deleteriously affected by exposure to EMFs of the type emitted by cellular telephones (Koivisto et al., 2000(a)(b); Freude et al., 1998; Eulitz et al., 1998). Preece (1999) suggested that these effects on cognitive function might be the result of a slight increase in the temperature of underlying brain tissue which might affect synaptic transmission.

Huber et al. (2000) demonstrated that, with humans, exposure to high-frequency (900MHz) pulsed EMFs during waking time modified the brain EEG readings during subsequent sleep. This study provided further data which indicated that short exposure to EMFs (the type emitted by mobile phones) has an effect on brain physiology. It also demonstrated that the changes in brain function induced by this form of pulsed EMF outlasted the exposure period, therefore having a “carry-over” effect after the EMF exposure ended.

Becker & Selden (1985) reported that monkeys, exposed to a 200-gauss magnetic field for four hours a day, exhibited a stress response for six days as measured by cortisone levels, but then subsided, suggesting adaptation to the field. This is of concern, as initially the stress activates the hormonal and/or immune systems to a higher-than-normal level of functioning, which can facilitate the organism to combat illness or escape potential harm. However, if the stressful conditions persist over time, and the organism acclimates to those increased-stress conditions, the hormone and immune levels further decline, below the baseline levels. This can pre-dispose the organism to become more susceptible to other stressors and illnesses.

Methods for Minimizing Exposure to EMFs

The Office of Technology Assessment of the Congress of the United States recommends a policy of "prudent avoidance" with respect to EMF, for example, the measuring of EMF fields, determining sources, and taking action to reduce exposure. In order to help protect oneself from the potential negative effects of EMFs that are commonly found in the home and work environment, one has to know 1) where the sources of EMFs are, and 2) how strong these sources are. One should remember that EMFs travel right through doors and walls. One way to accomplish this is to obtain a meter that can detect and measure low-frequency EMFs.

Once areas of high EMF contamination are identified, EMF-reduction proponents advise that one should reduce his/her exposure to EMFs. Several ways to accomplish this are in print (see Lechter, 1994; http://www.lessemf.com/emf-news.html).

Additionally, to minimize one's risk of exposure to EMFs, there are a variety of devices on the market which are designed to mitigate the potentially negative effects of EMF by either 1) shielding people from EMF exposure, or 2) strengthening one's own subtle energy.

The first class of products listed above come in the form of devices which reduce the EMF output from appliances, tools, heaters, and lights by up to 90%. They include specially designed low-EMF hair dryers, non-electric doorbells, zero-EMF alarm clocks, zero-EMF wrist watches, as well as a "degaussing coil" which purports to remove magnetic fields from steel and iron. There are also shielding devices available which claim to reduce EMF radiation emitted from cell phones, television and computer monitors, as well as personal shielding devices such as shielding garments, bedding and grounding items. One can also purchase wire shielding, to help reduce EMF exposure from in-the-wall and exposed wiring applications. Also available are materials which allow one to make their own shield from EMFs, including fabrics, plastics, glass, paints, epoxy, and grease.

The second class of devices which purport to mitigate the potentially negative effects of EMFs are those which do not reduce the output of EMFs; rather they strengthen the subtle energies which exist around each person, thereby increasing each person’s own resistance to EMFs. These devices may be worn by an individual, or placed in a space in which people live or work, to strengthen their capacity to function in EMF saturated environments. One of these products, the QLink ClearWave (ClearWave), is manufactured by Clarus Products International, L.L.C.

Theoretical Basis for Efficacy of the ClearWave

According to Srinivasan (1999), the term ‘subtle energy’ is of recent origin. Subtle energy may refer to a physical energy, such as electromagnetic or acoustic, that is of such low intensity we currently do not have devices that can accurately measure it. This definition of subtle energy refers to a field around an organism that is of very low magnitude.

Maintaining his belief in the existence of subtle energy, Srinivasan (1999) purports that, in order to maintain health and avoid illness, communication ‘signals’ within the body are essential. As long as the body is receiving and processing clear ‘signals’, health is more easily maintained. However, when there is a ‘signal’ break down by the introduction of ‘noise’ into an organized system, and when the ‘noise’ exceeds the cumulative strength of the ‘signals’, then disease is more likely to prevail within the system. This parameter is called the Signal-to-Noise ratio. When that ratio is larger than 1 (i.e., ‘signal’ is greater than ‘noise’), health within the system is more easily maintained. However, when that ratio is less than 1 (i.e., ‘signal’ is smaller than ‘noise’), the system is more likely to break down and illness can more easily manifest. Therefore, reducing ‘noise’ and preserving the integrity of a ‘signal’ are optimal for maintaining good health.

The Clarus family of products is based on a proprietary Sympathetic Resonance Technology (SRT), in which the Clarus device acts as a transduction agent to the subtle energy around organisms. It acts in a manner to help strengthen the subtle energy fields by resonating at optimal frequencies that are in harmony with the frequencies that exist around organisms. When two systems are resonating in proximity to each other, they have the tendency to resonate at the frequency established by the stronger of the two oscillations.

In this respect, a pure ‘noise-free’ field is radiated from the Clarus subtle energy device. This acts to bring electromagnetic phenomena to a new coherent order with less fundamental ‘noise’ within the vicinity of the Clarus SRT devices. By doing so, one may conjecture that the system (human body) may be strengthened and may be less likely to degrade and become prone to illness.

Resonance and coherence, according to Srinivasan (1999), are two important aspects of subtle energy (SE) fields:

> The physical field that emanates from the SE device is highly coherent and induces resonance in material objects as well as electromagnetic force fields around it. The property of coherence is important in many systems, including the psychophysical. For example, information is transmitted across junctions in the human nervous system because of coherence. Even at the gross level, activities such as speech, movement of limbs and other functions are possible because of a coherent behavior of many subsystems. We can see the effects of loss of coherence in diseases such as Parkinson's and spasticity. (On-line: http://www.clarus.com/srinipaper.html)

As previously stated, EMFs are composed of both an electric field and a magnetic field. The electric field will be always be directly affected by shifts in the magnetic field. This is based on the principles of magnetics, where magnetic fields influence charged particles in motion such as photons, the carriers of electromagnetic force. Therefore, if a subtle energy device is able to influence electromagnetic phenomena, it would be theoretically expected to influence a wide variety of phenomena spanning physical, chemical, biological, and psychophysical systems (Srinivasan, 1999).

Research Question and Importance of Study

The present study is based on Srinivasan's (1999) subtle energy theory, and premise that SRT devices have the ability to impact subtle energies. In effect, this study is to more closely examine if one of the Clarus SRT devices, the ClearWave, has any discernable impact on levels of anxiety in both teachers and students in a public middle school.

It is reasonable to believe that individuals within a public school system may be exposed to low or extremely low levels of EMFs. There is evidence to support that the levels of EMF which are associated with a high-technology environment can induce the stress response in mammals:

> In 1976 a group headed by J. J. Noval at the Naval Aerospace Medical Research Laboratory at Pensacola, Florida, found the slow stress response in rats from very weak electric fields . . . They discovered that when such fields vibrated in the ELF [extremely low frequency] range, the rats showed increased levels of the neurotransmitter acetylcholine in the brainstem, apparently in a way that activated a distress signal subliminally, without the animal's becoming aware of it. The scariest part was that the fields Noval used were well within the background levels of a typical office, with its overhead lighting, typewriters, computers, and other equipment. (Becker & Selden, 1985, p. 278).

According to Becker and Selden (1985), “Extremely low frequency EMFs vibrating at about 30 to 100 Hz . . . interfere with the cues that keep our biological cycles properly timed; chronic stress and impaired disease resistance result.” (p. 327). They additionally state that exposure to very weak electric fields has been shown to impact the central nervous systems in humans and monkeys, by decreasing reaction speeds and response times. In one experiment conducted with monkeys, their response times were affected by ELF electric fields as weak as 0.0035 volts per centimeter, “roughly equivalent to the field from a color TV set 60 feet away.” (p. 285). Given that many modern day public classrooms 1) utilize electrical current operating at 60 Hz, and 2) are equipped with color televisions, overhead projection devices, and multiple computer stations, one can surmise that individuals may experience overall compromised functioning, including (but not limited to) perceptions of anxiety.

Therefore, the primary question that this study serves to examine is whether the Clarus ClearWave device has any discernable impact on aggregate student and teacher state and trait levels of anxiety, as measured by a standardized anxiety inventory.

Chapter Two

Methodology

Subjects

Three public school districts in Northeast Kansas were recruited to participate in the study via a letter of inquiry (see Appendix A). One district declined participation, one district did not respond to the letter of inquiry, and one district agreed to participate in the study. The participating district had one middle school which served all sixth, seventh, and eighth graders in the district. Of the grades present in the middle school, the seventh and eighth grades spent portions of each day rotating into the other classes for periods of study. This cross-contamination of classes excluded the seventh and eighth grade students from participation in the study.

The principal investigator met with the principal of the middle school and explained the study and protocol (see Appendix B). The principal then met with the eight sixth-grade teachers to discuss the study and ascertain if the teachers would be willing to participate. After agreement to participate was provided by all teachers, the principal incorporated, in the weekly school newsletter, a letter about the proposed study (see Appendix C) which was sent to all parents of sixth-grade students attending the middle school.

In this letter the school principal stated the intent of the study and provided the parents with choices to either 1) request more information about the study from the school, 2) decline to have their child participate in the study by contacting the school, or 3) not respond to the letter in which case their assent to allow their child to participate in the study would be inferred, and the study would begin in the middle of the following week, which was the start of the Spring semester, 2001.

This procedure, to allow for parental assent as opposed to parental consent for participation of their child in the study, was approved by the Holos University Executive Committee. The Executive Committee granted an exemption for review of the study by the Institutional Review Board. One parent contacted the school to request more information about the study. No parents contacted the school to decline participation of their child in the study.

Initial subjects included 8 teachers (4 male, 4 female) and 184 students (93 male, 91 female) from eight classes of sixth-grade students at a public middle school in Northeast Kansas. The teachers had a mean age of 42 years, 9 months. The teachers in Group A had a mean age of 38 years, 6 months (range 23 years, 5 months – 51 years, 9 months), had been teachers for an average of 13 years (range 1 year – 24 years), and all had earned their Bachelor’s degrees (1 had completed 40 college hours towards a Masters degree). The teachers in Group B had a mean age of 47 years, 1 month (range 38 years, 5 months – 52 years, 5 months), had been teachers for an average of 17 years (range 6 years – 28 years), and three had earned their Bachelor's degree, with one teacher having earned a Master's degree.

The students had an average age of 12 years, 0 months (range 11 years, 0 months – 13 years, 11 months). In Group A, there were a total of 101 students, of which 55% (n=55) were male and 45% (n=46) were female. In Group B, there were a total of 83 students, of which 46% (n=38) were male and 54% (n=45) were female.

In order to be included as a subject in the study, individuals had to complete each of the two baseline surveys and each of the eight intervention surveys. A total of 99 students met this criteria (53 were in Group A, and 46 were in Group B), and a total of 5 teachers met this criteria (3 were in Group A, and 2 were in Group B).

Materials

Two measures were used in this study: the State-Trait Anxiety Inventory (Spielberger, Gorsuch, and Lushene, 1970) for adults (see Appendix D) and the State-Trait Anxiety Inventory for Children (Spielberger, 1973, see Appendix E). These measures were selected because they fit several criteria which the principal investigator, through interviewing educators, found to be necessary or preferable for measures to be included in a school-based study. These criteria included:

1) Low teacher response cost: Educators stated that they were unwilling to participate in studies in which they would have increased demands placed on them;
2) Low student response cost: Educators stated that they were unwilling to participate in studies in which their students would have increased demands placed on them;
3) Not taking significant time away from the curriculum: Administrators stated that they could not get support from their local Board of Education to allow studies to be conducted within the school that took considerable time away from curriculum to be carried out in public schools (this was the reason cited by the one solicited district that declined participation in this study);
4) Not exposing students or teachers to undue stress or threats of harm (physical, psychological, or otherwise): Educators stated that they were unwilling to participate in studies which included measures that may result in increased levels of stress by either themselves or their students; and
5) Age-appropriate measures: Educators stated it was important that the measures selected for use in a study were specifically

designed to be used by the respective grade level(s) subjects included in the study.

The State-Trait Anxiety Inventory for Children (STAIC) was designed specifically to be used with fourth, fifth, and sixth-grade children, was designed to be self-administered, and generally required less than 20 minutes to complete both the 20-question State-Anxiety (S-Anxiety) and 20-question Trait-Anxiety (T-Anxiety) scales. In addition, it was designed so that it may be administered in groups. Each item on the State-Trait Anxiety Inventory for Children is a 3-point rating scale for which values of 1, 2, or 3 are assigned for each of the three alternative choices. Thus, scores on both the S-Anxiety and T-Anxiety subscales can range from a minimum of 20 to a maximum score of 60. A rating of 3 indicates the presence of a high level of anxiety present, while a rating of 1 indicates the absence of anxiety.

From a psychometric perspective, the STAIC appeared to be an appropriate tool as it has been utilized in multiple studies examining the state or trait levels of anxiety in similarly-aged subjects (Vila et al., 1999; Ruggiero et al, 1999; Burroughs, Wagner and Johnson, 1997; March and Albano, 1996;). The STAIC has also been used in school settings (Silvestri, Dantonio, & Eason, 1996; Weiss & Catron, 1996; Matthews & Odom, 1989; Nunn, 1988; Blumberg & Izard, 1986;), and has been administered on a weekly basis (DiGiuseppe & Kassinove, 1976). The STAIC has additionally demonstrated the ability to detect changes in state anxiety levels over time (Gaudry & Poole, 1975).

According to Spielberger (1973), test-retest reliability coefficients for the STAIC are high for the T-Anxiety scale (males: r=.65; females: r=.71) and moderate for the S-Anxiety scales (males: r=.31; females: r=.47). The alpha reliability of the STAIC was high for both the S-Anxiety scale (males: α=.82; females: α=.87) and the T-Anxiety scale (males: α=.78; females: α=.81). Evidence of the concurrent validity of the STAIC T-Anxiety scale is shown by its strong correlation with the two most widely used measures of trait anxiety in children, the *Children's Manifest Anxiety Scale* (Castaneda, et al., 1956) and the *General Anxiety Scale for Children* (Sarason et al., 1960) (CMAS: r=.75; GASC: r=.63). A study of the construct validity of the S-Anxiety scale revealed that for each item, moderate point-biserial correlations (males: range r(pb)=.29-.50; females: range r(pb)=.35-.54) were present.

The State-Trait Anxiety Inventory (STAI), Form Y, was specifically developed for use with high school and college students and adults. It was designed to be self-administering and takes approximately 10 minutes to complete both the 20-question S-Anxiety scale and the 20-question T-Anxiety scale. Each item is given a weighted score of 1 to 4.

Scores for both the S-Anxiety and the T-Anxiety scales can each vary from a minimum score of 20 to a maximum score of 80. A rating of 4 indicates the presence of a high level of anxiety present, while a rating of 1 indicates the absence of anxiety.

From a psychometric perspective, the STAI appeared to be an appropriate measurement tool to utilize with teachers, as it has been previously incorporated in such a manner (Westerback, 1984; Anderson, Levinson, Barker, & Kiewra, 1999), and has demonstrated consistent internal validity (Sherwood & Westerback, 1983; Martuza & Kallstrom, 1974).

According to Spielberger (1983), the test-retest reliability for the STAI scales, Form Y, was strong in T-Anxiety scales (males: r=.71; females: r=.75) and moderate-to-strong in S-Anxiety scales (males: r=.62; females: r=.34) at a 30-day retest interval. Alpha coefficients for Form Y was also strong in working adults (males: α=.93; females: α=.93) for the S-Anxiety scale and the T-Anxiety scale (males: α=.91; females: α=.91). Validity, as demonstrated through correlations between the S-Anxiety and T-Anxiety scales for working adults was strong (males: r=.75; females: r=.70).

The additional materials used in the study were Clarus QLink ClearWave devices, donated by Clarus to the principal investigator for the study. The active and inactive (sham) units were identical in appearance and differed solely with regard to if the device contained the active Sympathetic Resonance Technology or not.

Research Design

The study utilized a double-blind repeated-measures control group design, in which the principal investigator randomly assigned each of the condition groups to receive either the active ClearWave device or the inactive ClearWave device. The principal investigator was unaware, until after the data collection concluded, which group received the active devices and which group received the inactive devices. This allowed the examination of any statistically significant findings for state and trait anxiety scores between the two condition groups, A (control) and B (treatment).

As this study is designed to examine the potential effects of a device (which purports to work by affecting subtle energies), it should be noted that the researcher had an absence of intention with regard to the outcome favoring one result over another result. Rather, what was of interest to the researcher was whether or not there would be any statistically significant differences between the treatment and control conditions.

Procedure

Prior to commencing the study, the principal investigator met with the teachers, at school, during their daily group-plan period to discuss the protocol. Teachers were provided with teacher consent forms (see Appendix F) and student assent forms (see Appendix G) to have completed prior to the commencement of the study. Teachers were also provided with written instructions on how to administer the State Trait Anxiety Inventory (STAI, see Appendix H) for adults and the State Trait Anxiety Inventory (STAI-C) for children (see Appendix I). Teachers were asked to choose a day and class period that would be consistently used throughout the classes and across the weeks to administer the STAI and STAI-C surveys. The teachers collectively decided that Tuesdays between Noon and 1:00 P.M. would be when the surveys were administered. During this time, all of the participating students were in one of their core classes.

During the initial session of the study, potential student subjects were informed about the nature of the study and the level of commitment required for participation. The students were told that the study was an attempt to examine the effects of electromagnetic fields in the classroom. If they agreed to participate, they completed the assent form (returning one signed copy to the teacher and retaining one for themselves) and then completed the first baseline survey, which their respective teacher administered. All consent forms and surveys were picked up by the principal investigator later that week.

In order to ensure confidentiality and anonymity of the students participating in the study, teachers were instructed to give each student a unique number that each student would consistently use throughout the study. The student wrote their number, not their name, on the survey each time they completed the survey. The teacher kept the master list of each student and their corresponding number throughout the course of the study, and did not share this information with the principal investigator.

Of the eight classes involved in the study, four classes had students that remained in their respective class (with a ClearWave device) for all core classes (which lasted from 7:40 A.M. through 1:05 P.M., with a 30 minute break for lunch). These four classes were considered group A, and consisted of classes A, B, C, and D. The remaining four classes, consisting of classes E, F, G, and H (group B) had students that rotated among these four classes, E, F, G, and H (with a ClearWave device) throughout the day, during the same time period. The core classes for both groups A and B included language arts, social studies, math, science, and enrichment. The two classes that the students had outside of their core classes included 1) either music or physical education, and 2) exploratory class. Students were exposed to the ClearWave device (active or sham) only during the times in which they were in one of their core classes, approximately five hours each school day.

Each of the classes that comprised group A were separated from each of the classes that comprised group B by a space of approximately 76 feet. The placement of the ClearWave devices was such that the cross-contamination of the range-of-effectiveness of the active ClearWave device would not be within 40 feet of a classroom from the opposite treatment condition rooms. Each of the classrooms was approximately 900 square feet in size, and had seating for between 20 – 25 students.

Each of the classrooms were outfitted with a 27-inch color television, a VCR, a computer, monitor and printer for the teacher, two or three computers/monitors and a printer for the students to use, and an overhead projector. Each of the teachers had their computer/monitor/printer on their immediate desk area. Diagrams of the classrooms, with approximate placements of the ClearWave device, other electrical devices, student seating, and teacher seating are shown in Figures 1-8. The overhead projectors are not depicted in Figures 1-8, but were located near the front of each class.

Electromagnetic field readings were taken (using a TriField™ meter, manufactured by AlphaLab, Inc.) in each classroom, prior to commencing the study, in the following areas: 1) the areas in which students were seated, 2) the area around the teacher's station, 3) in front of the classroom computer/monitor/printer, where a student would be seated while using these devices, 4) in proximity to the overhead projector, where the teacher would be situated while using this device, and 5) 3 feet in front of the 27" color television and VCR. Readings were taken at both the 0 – 3 mG and 0 – 100 mG ranges on the TriField™ meter.

With respect to the areas in which the students are seated (i.e., at their primary desk or table), all EMF readings were at or below 1 mG in all classes. In the teacher's station, EMF exposure ranged from less than 1 mG to between 25 and 50 mG, depending on proximity to the computer/monitor/printer. In front of each of the computer/monitor/printers which are located in various areas in each of the classes (students would periodically use these throughout the day in conjunction with the curriculum), EMF exposure ranged from between 5 mG and 50 mG, depending on proximity to the devices. EMF readings for the computer and monitor were taken at where the hands would normally be positioned on the keyboard, and where the head would normally be positioned in relationship to the monitor. EMF readings for the printer were taken approximately 12 inches in front of the printer. With respect to the overhead projector, EMF exposure ranged from approximately 3 mG (at a 3-foot distance from the device) to over 100 mG, if the teacher was writing on a transparency film on the device. The EMF exposure from the color television and VCR for students and the teacher was less than 1 mG, as individuals were seated in excess of 5 feet from the television and VCR when watching a program.

The Clarus ClearWave devices were shipped to the principal investigator, directly by a Clarus representative, in separate boxes marked A and B. One box contained ClearWave devices that were fully functional, and the other box contained ClearWave devices that looked identical to the ClearWave devices in the other box, but were inactive (or shams). The clocks on both sets of the ClearWave devices were fully functional. The principal investigator was unaware of which units were active and which were shams.

The two school groups, A and B, were randomly assigned to receive either the A units or the B units by pulling a slip of paper out of a hat (two slips of paper were in the hat, one said “Group A gets A unit” the other said “Group A gets B unit”). Group A was assigned to receive the B units, thus group B received the A units. While there is a place for a 9-volt battery inside of each unit, to serve as a backup in case electricity is lost to the unit, none of the ClearWave devices were outfitted with a battery.

The principal investigator brought the units to the sixth-grade teachers after the students had completed the first baseline survey and before they had completed the second baseline survey. Each teacher was instructed to place the ClearWave device in their respective classroom and plug it in either the afternoon after the students and teacher completed the second baseline survey, or before the students came to school the following morning.

The principal investigator would make weekly visits to the school, prior to Noon on each Tuesday, to drop off an envelope containing the student and teacher surveys, as well as a cover letter (see Appendix J). The student surveys were printed on white paper, the teacher surveys were printed on goldenrod paper, and the cover letter was printed on pink paper. The cover letter included instructions from the principal investigator to the respective teachers, including a reminder of how the surveys are to be administered, that students are not to be forced to complete the survey, and other information (e.g., having students specify their gender or age) to include on their completed survey.

The envelopes that contained the surveys were placed in a pre-determined location in the sixth-grade teacher's workroom, where the teachers would pick up their respective envelopes. Each envelope had printed on it the date that the surveys were to be administered, the respective class letter (A – H) and the last name of the corresponding teacher. After the teachers had administered the surveys to the students, the teachers collected the surveys, replaced them in the envelope, and returned the envelope to the sixth-grade teacher's workroom, where the principal investigator would retrieve the envelopes later that week.

In order to determine which of the groups, A or B, had received the active and inactive ClearWave devices, the principal investigator brought the sealed envelope to the graduate seminar course that his advisor conducted on a weekly basis. The advisor, in the presence of the principal investigator and four other graduate students, opened the envelope to reveal that the B group (who had received the A devices) received the active ClearWave devices, and the A group (who had received the B devices) received the inactive, or sham, ClearWave devices (see Appendix K). From this point forward, the following designations will be used to identify the two groups:

Group A – control condition – non-rotating classes

Group B – treatment condition – rotating classes

Chapter Three

Results

Independent Variable

The independent variable of the study was the presence of the Clarus ClearWave device. Half of the classes (comprising group B) received the active device, while the other four classes (comprising group A) received the inactive (sham) device.

Dependent Variables

The dependent variables of the study were the state and trait anxiety scores for students and the state and trait anxiety scores for teachers. Two baseline data points (in which the ClearWave devices were not present in the classrooms) were collected, with one week between each data point. Six intervention data points were collected, immediately following the baseline data, at weekly intervals. The average state and trait scores are depicted in Figures 9 and 10.

Compliance with Survey Completion: Teachers

Of the eight teacher subjects who agreed to participate in the study, four teachers were in group A and four teachers were in group B.

In group A, one teacher (25% of subjects) completed zero of the baseline surveys, and three teachers (75% of the subjects) completed both of the baseline surveys. Additionally, three of the teachers (75% of the subjects) completed all of the post-baseline surveys, and one of the teachers (25% of the subjects) completed five of the six post-baseline surveys.

In group B, one teacher (25% of subjects) completed zero of the baseline surveys, and three teachers (75% of the subjects) completed both of the baseline surveys. Additionally, two of the teachers (50% of the subjects) completed all of the post-baseline surveys, one of the teachers (25% of the subjects) completed none of the post-baseline surveys, and one of the teachers (25% of the subjects) completed one of the post-baseline surveys.

Due to the low number of teachers participating in the entire study, particularly in the treatment condition (n = 2), meaningful statistical analysis was not possible, and therefore the decision was made to exclude teacher state and trait anxiety scores from the findings.

Compliance with Survey Completion: Students

Of the 100 students who comprised the classes in group A, only 53 completed both of the baseline surveys and all six of the intervention surveys. These 53 students comprised the subjects whose data were analyzed in the statistical analyses conducted. Of these 53 students, 26 (49%) were males and 27 (51%) were female.

Of the 84 students who comprised the classes in group B, only 46 completed both of the baseline surveys and all six of the intervention surveys. These 46 students comprised the subjects whose data were analyzed in the statistical analyses conducted. Of these 46 students, 18 (39%) were male and 28 (61%) were female.

Baseline Data - Students

Difference between treatment and control conditions

In order to assess whether the two condition groups were equal to each other during baseline, independent t-test analyses were conducted. The results of the t-tests yielded no significant differences for trait anxiety scores between the two conditions, $t(157)=-.34$, $p=.74$ for the first baseline data point, as well for the second baseline data point, $t(158)=-.55$, $p=.59$. For state anxiety scores, there was a statistically significant difference between the two conditions for the first baseline data point, $t(157)=-2.31$, $p=.02$, but not for the second baseline data point, $t(158)= -.53$, $p=.60$.

There is a 2.12 point differential between the two condition groups for state anxiety scores during the initial data point. However, when those students who completed only one of the two baseline data points were excluded from the analyses, and independent t-tests were computed, there were no differences between group A and B for state anxiety scores, $t(139)=-1.17$, $p=.25$. See Table 1 for average state and trait scores, across conditions, for these analyses.

Difference between combined baseline data points at week 1 and week 2

To examine whether or not there is a difference between the two baseline points, paired t-tests were conducted. While there was no statistically significant difference between the first and the second state anxiety baseline scores across both conditions, $t(139)=.46$, $p=.65$, there was a statistically significant difference between the first and the second trait anxiety baseline scores across both conditions, $t(139)=2.39$, $p=.02$. However, when these same analyses were run for groups A ($t(77)=1.63$, $p=.11$) and B ($t(61)=1.77$, $p=.08$) individually, there were no statistically significant differences for the first trait anxiety score data point and the second trait anxiety score data point. See Table 2 for comparison of baseline averages combining conditions and between-conditions for state anxiety levels. See Table 3 for comparison of baseline averages combining conditions and between-conditions for trait anxiety levels.

Intervention Data - Students

A general linear model repeated measures statistical procedure was conducted to examine both treatment effect and time effect. The general linear model repeated measures analyzes groups of related dependent variables that represent different measurements of the same attribute, in this case, anxiety. Treatment effect refers to whether or not there is a statistically significant difference between the scores of the two conditions. Time effect refers to whether or not there is a statistically significant difference with regards to the scores across time (as opposed to the comparison of the two conditions).

A within-subject time effect test indicated statistically significant differences for both state ($F(4.6)=4.83$, $p=.000$) and trait ($F(3.6)=16.12$, $p=.000$) anxiety scores for both conditions.

Table 1. Comparison of conditions, treatment and control, for baseline measures.

	Control			Treatment		
	n	Mean	SD	n	Mean	SD
State 1*	87	29.34	5.39	72	31.46	6.17
State 2	89	29.73	6.15	71	30.24	5.87
Trait 1	87	33.00	7.22	72	33.38	6.60
Trait 2	89	32.01	7.15	71	32.62	6.80

* This independent t-test yielded a statistically significant difference between control and treatment conditions, $t(157)=-2.31$, $p=.02$.

Table 2. Comparison of baseline averages combining conditions and between-conditions for state anxiety levels.

	State Week 1			State Week 2		
	n	Mean	SD	n	Mean	SD
Both Conditions	140	30.29	5.87	140	30.07	6.16
Control	78	29.47	5.41	78	29.99	6.40
Treatment	62	31.32	6.29	62	30.18	5.88

Table 3. Comparison of baseline averages combining conditions and between-conditions for trait anxiety levels.

	State Week 1			State Week 2		
	n	Mean	SD	n	Mean	SD
Both Conditions	140	32.99	6.76	140	31.91	7.07
Control	78	32.81	7.25	78	31.83	7.48
Treatment	62	33.21	6.15	62	32.02	6.59

A between-subject treatment effect test indicated a statistically significant difference between treatment and control conditions for state anxiety scores, $F(1)=3.17$, $p=.078$. While the same test did not indicate a statistically significant difference between treatment and control conditions for trait anxiety scores, $F(1)=.007$, $p=.935$. See figures 9 and 10 for means of state and trait anxiety scores, respectively, for both conditions across time.

Chapter Four

Discussion

Did the Clarus ClearWave device impact anxiety?

The answer to this question is mixed. As presented in the previous chapter, there were no statistically significant differences between the treatment and control conditions with regard to state or trait anxiety levels at the 95% confidence level. However, a statistically significant difference did emerge between the two conditions, treatment and control, for state anxiety scores at the 92% confidence level. This statement holds true if one considers that the state anxiety score on the STAIC, by themselves, is a valid indicator of state anxiety for this population.

The theoretical basis, which explains the principle of Sympathetic Resonance, on which the Clarus ClearWave device is purported to work, is based on the strengthening impact the ClearWave device has on the subtle energies of organisms in immediate proximity to the device. As Srinivasan (1999) pointed out, subtle energies cannot yet be directly measured, rather one has to rely on the effects of the Clarus Sympathetic Resonators on physical and psychophysical phenomena being tested. Given the very subtle changes which have been clinically demonstrated using a double-blind protocol on similar Clarus Sympathetic Resonator devices, (e.g., brain activity using EEG brain mapping, see Shealy et al., 1998), it is encouraging to see that a more gross measure, such as the STAIC, can produce compelling results for the potential effectiveness that such a device may have on a psychological dimension of well-being, for example, anxiety.

It is interesting to note that students in the study were exposed to the intervention for approximately five hours each school day, and that the classrooms in which the students were seated experienced relatively low-levels of EMF exposure in the direct areas in which the students desks were located (less than 1 mG of EMF exposure in all settings). While there were no statistically significant changes with regard to trait anxiety scores, it is plausible to postulate that if subjects were exposed to the SRT device for an extended period of time (i.e., longer than five hours), especially when subjects are more likely to be exposed to higher levels of EMFs (i.e., when watching television, playing on the computer or other electronic home entertainment system), a statistically significant discernable effect may appear with trait anxiety scores, relative to controls. It should be noted that trait anxiety scores have been found to be more stable over time than state anxiety scores (Newmark, Wheeler, Newmark, & Stabler, 1975; Gaudry & Poole, 1975, Brook and Knapp, 1976), and therefore may take longer to be effected (than the six weeks of this study) because of its reliance on general perceptions.

While state anxiety scores were statistically significantly impacted for the treatment condition, one is unable to know whether these changes resulted in meaningful differences for the subjects, and their perceptions of their environment, since qualitative data were not collected. Normative mean data for state anxiety level scores of 6^{th} grade students on the STAIC is 31.8 for males and 30.6 for females (Spielberger, 1973). In both the treatment and control conditions, mean state anxiety scores were around or below the reported mean levels for 6^{th} grade students, in general (31.4 and 28.6, respectively). The question remains, how many points does state anxiety have to decrease before individuals are able to experience any benefit in their immediate surroundings or lives? To date, this question has not yet been addressed by those using the STAIC for measurement in research.

<u>Possible explanations for state anxiety score differences between conditions</u>

As reported in the previous section, overall state anxiety scores were lower for the control group. One should consider why this difference existed. In the middle school in which the study was conducted, the sixth grade classes were comprised of the youngest students in the building.

As such, they may have experienced increased stressors associated with the transition from an elementary school (in which they were the oldest students) to the middle school. They were also faced with the challenges of needing to developmentally refine their social skills to interact with older students. In addition, they interacted with teachers who often have greater expectations of middle-school students than elementary school teachers do.

The teachers in elementary schools generally have a multi-year history with students, as students often will spend multiple years in the same elementary school building. They develop relationships with different teachers throughout their years of attendance in the elementary school. When these students transition to the middle school, however, they find themselves in situations where they do not have significant relationships with the adults in the school, and are forced to cultivate these relationships, essentially from the beginning.

Given these different challenges that face the sixth grade students, it is reasonable to expect that the students who encounter greater levels of stability within their new school setting would be more likely to make the transition to the new education setting with fewer problems and would likely experience decreased levels of stress and anxiety, relative to their peers who are not afforded with the same opportunities to experience greater levels of stability and structure.

In the control group, A, students received all of their core classes from the same teacher. Students in the treatment condition, B, rotated among four different teachers for their core classes. Therefore, it is plausible that students in the control group, in the non-rotating classes, were able to develop a more stable relationship with their core teacher than the students in the treatment condition, the rotating classes, who had to develop relationships with four different teachers, which may be a new developmental task for many in this population. The students in the control group, in the non-rotating classes, spent roughly 400% more time with their core teacher, as compared to students in the rotating classes (treatment condition) who spent considerably less time with any one of their core teachers.

Students in the non-rotating (control) classes had the advantageous opportunity over the students in the rotating (treatment) classes to develop a more positive relationship with their teacher, based solely on increased opportunities for interaction between student and teacher. These students were also provided with more opportunities to learn the teacher’s rules, tolerance levels, and personalities than were the students who had to learn the same information from four different teachers, in one-quarter the amount of time with each teacher. This may have impacted the perceptions the students had of their teacher and the classroom, both of which may have, in turn, impacted their immediate level of state anxiety.

For example, people (especially adolescents) often respond more favorably in situations and environments when the rules, expectations, and boundaries are clearly defined and predictable. It increases one's perception of safety for the environment and is more likely to allow one to feel at ease. This would likely result in a heightened *state* anxiety level, although not necessarily a heightened *trait* anxiety level, especially if the *state* anxiety level was being tested in an environment in which the individual spent a minority of their time, like in a class one was in each school day for less than a single hour (as is the case for the treatment condition, group, B).

Therefore, students in the rotating classes (treatment condition) may be expected to be under slightly elevated levels of stress relative to their peers in the non-rotating classes (control condition). This may account for the difference in state anxiety scores between the two conditions, in which the treatment group consistently scored higher than the control group, in state anxiety scores.

There was one week, week five, in which the aggregate state anxiety scores for the treatment group, B, increased during the intervention stage. For this week, the day on which the STAIC surveys were administered to the subjects was the day directly before Valentine's Day, which is considered to be a "big day" for students at the middle school. It is plausible to theorize that this day may bring increased stressors for many students, as they spend much energy wondering whether or not they will receive valentines (cards, gifts, and/or flowers) from specific students, or be acknowledged at all.

In the non-rotating (control) classes, it is possible that the relationships students had established with their core teacher might have mitigated the effects of these added stressors on their state anxiety levels, relative to their peers in the rotating (treatment condition) classes. Meaney (2001) reported that the perception of social support as an emotional resource may often act as a buffer to the development of depression and anxiety, and later on, to the development of chronic illness. This understanding may help explain why the students in the rotating (treatment condition) classes experienced an aggregate mean state anxiety score increase during week five, when there was an overall downward trend for state anxiety scores. At the same time, it could explain why the students in the non-rotating (control) classes did not experience a similar phenomena during that same week.

Throughout the duration of the study, the raw aggregate state anxiety scores for the treatment group decreased a greater average number of total points (3.42 points), relative to the control group (1.06 points). There was an initial discrepancy between state anxiety scores for control and treatment conditions (28.4 and 31.9, respectively). This initial difference may be indicative of a confounding variable that is currently unknown, and may have influenced the overall differences between the state anxiety scores, as discussed earlier in this section.

Ways in which the study may be strengthened

To rotate or not to rotate. . .

There are several factors that need to be addressed relative to this study, which may be corrected in subsequent replication studies and therefore may increase the overall strength of such studies. With regard to this study's design, one factor which was unable to be controlled was the fact that in one of the conditions, the students rotated among the four teachers throughout the core classes of the day (Group B, treatment condition), while in the other condition, the students remained in the same classroom for all core classes (Group A, control condition). Ideally, both conditions should have similar class rotations, as one group of students were exposed to four teachers who may have made comments regarding the study, while the other students were exposed to a single teacher. It is possible that the group of four core teachers, or the single core teacher, may have produced factors that were uncontrolled in the design and may have influenced the overall anxiety scores.

Sample size of teachers

It is advisable to increase the number of teacher subjects who participated in the study, so that statistical analyses could be performed to examine whether the teachers experienced statistically significant differences with regard to their state and trait anxiety scores. Due to the larger number of electrical devices (i.e., overhead projector, computer CPU, monitor, and printer) near the teacher's work space, and more frequent contact with and increased proximity to such devices, it is plausible to believe that the ClearWave device may have a more pronounced effect on teacher's levels of state anxiety scores than the student's. This may be expected because the students had significantly less consistent exposure to EMFs in the classroom.

Length of study

In reviewing the data, it appears that neither the state nor trait scores reached a plateau. Therefore, it would be advisable to continue this study, or a replication of this study, for an extended duration of both conditions, until such a stabilization becomes more pronounced. In the event that the effect of the ClearWave device is cumulative, one may need to carry out the intervention for twice as long, or longer, as was carried out for this study.

Implications of the results

Within the context of the educational environment

With the increased focus on outcomes using standardized testing in public education, a device that helps reduce anxiety may assist individuals who, in particular, experience performance anxiety on such tests. Reduction in anxiety may affect one's perceptions of his or her environment, thereby reducing feelings of hostility, depression, frustration, isolation, etc. One common trait shared by individuals who have committed acts of violence in schools (i.e., stories of shootings that have been broadcast nationwide) is that the perpetrators generally experienced reportedly high levels of hostility, depression, frustration, and/or isolation. It is possible that prolonged exposure to SRT devices in schools may produce a cascading series of events that may help to lessen these feelings, thereby reducing overall levels of violence (including less severe acts, for example fighting or bullying).

While the above paragraph focuses on student output, it is also possible that the SRT device may impact the ability for information to be more successfully processed and/or assimilated into the student's overall educational schema. If this holds true, students may be more likely to successfully concentrate on presented material within the curriculum, resulting in achieving mastery over the material in a more expeditious fashion.

Within the context of the field of energy medicine

This technology has the potential to assist the transformation and evolution of current medical practices to a level that our society has yet to imagine. For example, one can try to imagine the difference such an SRT device could have in intensive-care-units of hospitals, in which the patients are in seriously compromised states of health. Particularly because patients in such settings are surrounded by high levels of EMFs, and are often connected to multiple electrical devices.

Additionally, as technology for SRT devices is improved, it may be possible to extend the range of effectiveness of an SRT device from around a single individual (as in the QLink) or a classroom (as in the ClearWave) to encompass an entire residential block, or even a city. If used in an environment which is considered to experience higher-than-normal levels of stress (for example an impoverished portion of a town, or the inner city), such technology may help to preventatively reduce factors associated with chronic failure (i.e., violence, addiction, illness, etc.).

Toward the future: The next steps in research with SRT devices

Experimentation with minors in a setting such as a public school may pose a practical problem with regard to obtaining parental consent for students for more invasive measurement protocols. However, examination of electrical brain activity is one method of examining subtle changes in body physiology (Shealy et al., 1998). It would make sense to investigate if similar effects on brain wave activity could be found in such a naturalistic setting, as was reported in Shealy et al. (1998), in which evidence demonstrated that another Clarus SRT device, the QLink, yielded statistically significant findings for helping to regulate brain wave activity for individuals who presented with characteristics of electromagnetic dysthymia.

Another measure for examination could be the level of dehydroepiandrosterone (DHEA) in the body. DHEA is the most abundant hormone in humans, and plays a major role in general levels of well-being and mood. According to Shealy (1996), higher levels of stress, including stress caused by electromagnetic factors, is correlated with lower levels of DHEA in the body. One of the most important metabolic effects of DHEA is its ability to assist the body to return to homeostasis after a stress reaction. "DHEA appears to be a major modulator of the stress reaction in relation to the increase of glucocorticoid or cortisol and in animals, at least, it is felt to be anxiolytic (reduces anxiety)" (Shealy, 1996, p. 36). It may be reasonable to hypothesize that anxiety and stress levels are interrelated. Therefore, since one of the Clarus SRT devices has been found to impact anxiety levels, it is possible that such a device may have an impact on stress levels as well. It is possible that the indirect impact on stress levels could be indirectly measured through the level of DHEA found in the body.

Examining the levels of DHEA present in the body could also be useful, as an indirect measure, in examining states of depression. According to Meaney (2001), depression will be the most common illness on the planet by the year 2010. Shealy (1996) states that DHEA is both an antidepressant and cognition enhancer in individuals with major depression. Two other less-invasive measures which could be utilized to examine the possible presence of depression in individuals are the Zung Depression Status Inventory (Zung, 1965), and the Beck Depression Inventory (Beck, Ward, Mendelson, Mock, & Erbaugh, 1961). While both of these self-assessments may be less invasive than taking levels of DHEA, it is plausible that DHEA levels may be more sensitive, relative to the depression inventories, to changes brought about by alterations in subtle energy fields.

In addition to physiological factors that may be positively affected by an SRT device, it could be studied whether the strengthening of an individual's subtle energies (via an SRT device like the ClearWave or QLink) would impact academic achievement. Public schools have been the recipient of increased pressures over the past decade with regard to documenting increased academic output by their students. To this end, it may be helpful to examine if there are any correlations between lower anxiety levels and increased academic performance. This may be more pronounced in an environment in which individuals are generally under higher levels of stress, for example, in a self-contained classroom for children with behavioral disorders or emotional disturbances. Examining performance on standardized mathematical curriculum over the period of a semester in a treatment and control condition may reveal interesting data relative to such a hypothesis. Should any statistically significant effect(s) be generated from a well-controlled research design investigating such a relationship, the implications and utility for use within the realm of education could be meaningful.

One factor which has not been addressed thus far is the actual mechanism by which the SRT device affects the human system. It may be the case that certain individuals have systems that are in a greater state of ‘coherence’ (Tiller, 1997; Srinivasan, 1999). These individuals may, for whatever reasons, have subtle energy fields that are significantly ‘stronger’ or ‘healthier’ than their peers (or other people), who may have more compromised subtle energy fields. Therefore, further research is necessary to identify devices that are capable of measuring the overall strength, or levels of coherence, of the human subtle energy fields. It may be the case that, in the general population, the effect that an SRT device has on well-being, or perceptions of well-being, may be limited. However, the SRT device may demonstrate a significantly more pronounced effect when research is conducted with subjects who have measurably compromised, or less coherent, subtle energy fields.

Until such a device is developed and/or becomes readily available, one may be able to gather data on large groups of individuals, collecting data on each individual over longer periods of time. This may yield stronger effects for some individuals, but not others. It would be helpful to collect both quantitative and qualitative measures on these subjects (e.g., *Total Life Stress Test*, Shealy, 1996). For those individuals who yield either a strong effect or weaker effect size, one may be able to discern characteristics common to general individual profiles. This may help to narrow the scope of effectiveness, if one exists, as to who can maximally benefit from the presence of an SRT device.

These previously mentioned ideas for research can serve as “food for thought” with respect to potential research topics which are waiting to be conducted within this field. As Becker (1990) presented, the scientific basis for electromagnetic medicine is the emerging paradigm for advancements within then medical field for the next century. Research on SRT devices may serve as some of the building blocks for the emerging knowledge base within this field of study.

<u>Toward the future: The importance of socially-valid research</u>

A common aspect of research is the reliance on ‘scientifically acceptable’ measures at the occasional expense of those that are clinically more relevant to the subject. For example, if the SRT device is able to reduce state anxiety in the general population by only 3 points, but individuals do not report experiencing a benefit until the state anxiety reduction reaches 6 points, then the question has to be asked whether the study is socially valid. This is at the core of the concept of social validity, or whether the intervention impacts the organism in a manner that society, or the organism, deems worthwhile and appropriate. The topic of social validity is an important consideration, as some interventions may, indeed, yield statistically significant findings, but may not help an individual to actually function more successfully within their environment. Research, which is to be maximally helpful to the population, should balance statistically-significant-driven findings with research topics that are considered to be socially valid.

Conclusions

While this study did yield a significant effect of an SRT device on reduction of state-levels of anxiety, a larger contextual question exists. Do such decreases have a meaningful impact on the student's well being (social validity) and, if so, in which dimensions (academic, interpersonal, emotional, biological, spiritual)?

Nevertheless, this data does provide reasonable promise that SRT devices, such as the Clarus QLink ClearWave, may indeed afford some degree of benefit to individuals with regard to anxiety reduction. What this study does not answer is the mechanism by which this reduction occurs, including if the ClearWave device mitigates certain environmental factors (include elevated exposure to EMFs), or if it somehow strengthens compromised coherence within one's subtle energy fields. These questions should be addressed by future research.

While further research has a long road to demonstrate larger effects, this study may serve as an important catalyst for the field in pursuit of the goal to minimize the harmful effects of our EMF-rich environments.

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Figure 1. Diagram of Classroom A, with approximate placements of the ClearWave device, other electrical devices, student seating, and teacher seating.

Figure 2. Diagram of Classroom B, with approximate placements of the ClearWave device, other electrical devices, student seating, and teacher seating.

Figure 3. Diagram of Classroom C, with approximate placements of the ClearWave device, other electrical devices, student seating, and teacher seating.

Figure 4. Diagram of Classroom D, with approximate placements of the ClearWave device, other electrical devices, student seating, and teacher seating.

Figure 5. Diagram of Classroom E, with approximate placements of the ClearWave device, other electrical devices, student seating, and teacher seating.

Figure 6. Diagram of Classroom F, with approximate placements of the ClearWave device, other electrical devices, student seating, and teacher seating.

Figure 7. Diagram of Classroom G, with approximate placements of the ClearWave device, other electrical devices, student seating, and teacher seating.

Figure 8. Diagram of Classroom H, with approximate placements of the ClearWave device, other electrical devices, student seating, and teacher seating.

Figure 9. Average state anxiety scores for conditions, treatment and control, across sessions.

Figure 10. Average trait anxiety scores for conditions, treatment and controls, across sessions.

Appendix A

Letter to Superintendent

Dear [Name]:

I am writing to solicit your help in testing what may become a simple and cost-effective intervention to reduce anxiety in the classroom. Working as a behavioral consultant on a multidisciplinary school support team, I have become increasingly interested in identifying interventions that can increase both the educator's ability to teach and the student's ability to learn. I understand that, for such interventions to be embraced and utilized by the professionals in the classrooms, they will need to be both minimally intrusive as possible and simple to implement.

Over the past decades some research has indicated that certain external environmental stressors, such as electromagnetic frequencies (EMFs), may play a factor in general stress and anxiety. This research has suggested that such fields, even when very weak, can have deleterious effects. The weight of current evidence now comes from other measures of stress, such as headaches, eyestrain, and mental fatigue, particularly for those working in front of computers on a daily basis. This response to stress can result in poor performance and lack of concentration.

I am interested in conducting a study for my dissertation on one device on the market that claims to strengthen a person's natural immunities to EMFs. This, in effect, results in a heightened state of shielding from the negative effects of EMFs. This device, the ClearWave (manufactured by Clarus Products International, L.L.C.), purports to mitigate the negative effects of EMF in one's environment. The ClearWave looks simply like a digital clock (see www.clarus.com for more info.).

As a researcher, I am a healthy skeptic when it comes to devices that make claims that cannot adequately be substantiated by sound research protocols. However, one of the Clarus products, the QLink pendant, has been subjected to several rigorous research protocols and does appear to provide some degree of protection from EMFs (to the individual wearing the QLink pendant) which are generated by all electrical appliances (computers, printers, fluorescent lights, even the electrical wiring in the walls of a classroom). The benefit from the ClearWave is that it has a range of effectiveness of up to 40-feet, so a single unit may be able to effectively mitigate the negative effects of EMFs for an entire classroom.

The purpose of this study is to investigate the effect of the ClearWave on anxiety within the classroom environment. The only perceivable risk may be a heightened level of anxiety that may be a function of completing the survey. I am hoping to recruit approximately 8 (total) 6^{th} grade classes to participate as subjects.

I will be contacting you within the next few days to try to answer any questions you may have and to see if you are willing to assist me with this study.

Sincerely,

David A. Eichler, M.A.

Appendix B

Protocol for Principal

Protocol to test the Clarus ClearWave on levels of anxiety in classrooms

For the experimental design, approximately 8 classes of students will be selected. Half of the classes will be randomly assigned to one of two groups, A or B. One of these groups will be the group receiving the Clarus ClearWave device (intervention group), and the other group will receive an identical-looking but inactive, sham device (control group). The PI will not know which group is the intervention group and which is the control group. Rather, the faculty member in charge will randomly assign each class to a respective group and then will code each of the identical-looking ClearWave devices, state to which classroom each device will go. The PI will then deliver each ClearWave device to their assigned classroom. Therefore, each condition will be comprised of roughly the same number of students, and their respective homeroom teachers.

Each condition will last for 3 months (approximately 60 school days), during which time the ClearWave devices (both intervention and sham) will not be turned off. Each of these devices has a reported range of effectiveness of 40-feet. These devices will therefore be placed at a location within each respective classroom in which the entire physical boundaries of the classroom do not exceed 40 feet from the ClearWave device. In addition, no other classroom being included in this study will be within 40 feet of the ClearWave device.

The dependent measure will include both teacher and student ratings of anxiety. This data will be obtained through weekly administration of the State-Trait Anxiety Inventory (Spielberger, 1973, adult version for teachers, child version for students). This survey will be administered to both students and the classroom teacher (by the classroom teacher) on the middle day of the week, Wednesday, unless school is not in session, in which case it will be administered the following school day. This survey is designed to last between 8 and 12 minutes. The surveys will be collected by the classroom teacher and placed into an envelope, which the researcher will pick up.

At the conclusion of the study, each participating classroom will be given the opportunity to receive a complimentary non-sham ClearWave device.

Appendix C

School Letter to Parents

Dear Parents of Sixth-Grade Students:

The sixth-grade classes of our school has been asked by a doctoral-level graduate student to participate in a study which will examine the effects of certain external environmental stressors, such as electromagnetic frequencies (EMFs), which may play a factor in general stress and anxiety. Current research indicates that this stress can result in poor performance and lack of concentration.

Specifically, the study will look at whether a device (called a ClearWave, manufactured by Clarus Products International, L.L.C.) can help to reduce certain environmental stressors. The ClearWave device looks simply like a digital clock, and does not make any noises. Our school has been informed by Clarus Products International, L.L.C., that this device does not emit any kind of a charge, and poses absolutely no risk to anyone. It is completely passive in nature, according to the manufacturer.

Students who participate in the study will be asked to fill out short surveys (about 5 – 10 minutes) once a week, regarding their perceptions of how anxious they feel.

Having data on whether a simple device like the ClearWave can positively impact a classroom would be helpful to staff and students alike, so we hope to will agree to have your child participate. After reviewing the information provided to the school by both the graduate student in charge of the study, as well as the supporting material from Clarus Products International, L.L.C., I feel the study will have no detrimental effects on the students. If you have any questions, please call me. If you would prefer to not have your child participate in the study, please contact the school no later than Tuesday of this next week and inform them of your decision. If you agree to have your child participate in the study, you need do nothing. Unless we hear from you to the contrary, we will assume that your permission for your child to participate in the study is provided.

Thank you for your help!

Principal

Appendix D

State-Trait Anxiety Inventory

Appendix E

State-Trait Anxiety Inventory for Children

Appendix F

Teacher Consent Form

Holos University supports the practice of protection for human subjects participating in research. The following information is provided for you to decide whether you wish to participate in the present study. You should be aware that even if you agree to participate, you are free to withdraw at any time without penalty.

We are interested in studying the effects of a device that claims to minimize the effects of electromagnetic frequencies (EMFs) which all electronic devices put out. We want to see if there is any effect that this device has on the perceptions people have in their surroundings. If you agree to participate in this study, you will be participating in approximately twelve weeks that will involve filling out a short questionnaire once a week. It is estimated that this will take no more than an average of 5-10 minutes of your time each week.

The content of the questionnaires concerns stress and anxiety in the environment, so there is a chance that you might feel slightly more stressed with the additional work asked of you for this study, being this questionnaire. Although participation will not directly benefit you, we believe that the information will be useful in evaluating the effects of devices that shield people from EMFs and how these devices impact our impressions of our environment.

Your participation is solicited although strictly voluntary. We assure you that your name or classroom will not be associated in any way with the research findings. The information will be identified only by a code number.

If you would like additional information concerning this study before or after it is complete, please feel free to contact me by phone, mail, or email.

Sincerely,

David A. Eichler,
Principal Investigator
1935 Ohio Street
Lawrence, KS 66046-2951
785 841-3550

Robert E. Nunley, Ph.D.,
Faculty Supervisor
Holos University
Box 1086
Lawrence, KS 66044
(785) 864-5544

Signature of subject agreeing to participate

With my signature I affirm that I am at least 18 years of age and have received a copy of this consent form to keep.

Appendix G

Student Assent Form

Holos University supports the practice of protection for human subjects participating in research. The following information is provided for you to decide whether you wish to participate in the present study. You should be aware that even if you agree to participate, you are free to withdraw at any time without penalty.

We are interested in studying the effects of a device which claims to minimize the effects of electromagnetic frequencies (EMFs) which all electronic devices put out. We want to see if there is any effect that this device has on the perceptions people have in their surroundings. If you agree to participate in this study, you will be participating in approximately twelve weeks that will involve filling out a short questionnaire once a week. It is estimated that this will take no more than an average of 5-10 minutes of your time each week.

The content of the questionnaires concerns stress and anxiety in the environment, so there is a chance that you might feel slightly more stressed with the additional work asked of you for this study, specifically filling in this questionnaire. Although participation will not directly benefit you, we believe that the information will be useful in evaluating the effects of devices that shield people from EMFs and how these devices impact our impressions of our environment.

Your participation is solicited although strictly voluntary. If you don't feel like answering any questions, you don't have to, and you can ask to stop participating in the study at anytime and that will be all right. We assure you that your name or classroom will not be associated in any way with the research findings. The information will be identified only by a code number (for the class). Each student will be assigned an ID number by the teacher, however the researchers will not know which student is identified by which ID number.

If you would like additional information concerning this study before or after it is complete, please feel free to contact me by phone, mail, or email.

Sincerely,

David A. Eichler,
Principal Investigator
1935 Ohio Street
Lawrence, KS 66046-2951
785 841-3550

Robert E. Nunley, Ph.D.,
Faculty Supervisor
Holos University
Box 1086
Lawrence, KS 66044
(785) 864-5544

____

Signature of subject agreeing to participate

Printed Name of subject agreeing to participate

With my signature I affirm that I have received a copy of this consent, form to keep.

Appendix H

Instructions for Administering STAI

Instructions to teacher:

Please fill out the "Self-Evaluation Questionnaire" on Tuesday, between Noon and 1:00 P.M., or the school day immediately following if there is no school on a given Tuesday. Please fill in the date on the sheet. It is not necessary to specify your name, age, or gender. When completed, please put it into one of the envelopes provided, collecting one week's worth of questionnaires in each envelope. Please make the class ID# and week are on the envelope.

Appendix I

Instructions for Administering STAIC

Instructions to teacher:

At the beginning of the study, please assign each student a unique one or two digit number, and make record of that number (for reference throughout the study, should the student forget his/her number). At no time will the numbers and corresponding student names be turned over to the principal investigator.

Please give this "How-I-Feel-Questionnaire" (also known as the STAI for Children) to each student on Tuesday, between Noon and 1:00 P.M., or the school day immediately following if there is no school on that given day. Have the student write their ID # in the area where they are to write their name, and have them fill in their age and the date. It is <u>not</u> necessary for the students to fill out the questionnaire with a #2 pencil. Please read the directions aloud to the class (as printed on the questionnaire), while each child reads them silently.

Please emphasize that one of the three phrases that follow the item stem should be checked, not the stem itself. Please ask the students to respond to ALL of the items. Ask the students if they have any questions before beginning the questionnaire. If specific questions arise in the testing session, please respond to such questions in a non-committal manner. Responses such as "Just answer according to how you *generally* feel," or "Answer the way you feel *right now*," will usually suffice. If a child asks the pronunciation or meaning of a particular word, you should read the word to the student but not define it. Please collect the forms when they have been completed and place them all into one of the provided envelopes, marking the class ID# and date on the envelope.

Appendix J

Weekly Cover Letter to Teachers

Dear Teacher:

Thanks, again, for helping out with this study. I am asking if each of the teachers would remind the students, when the surveys are handed out, that the questions on the front of the survey (which is listed as Form C-1 on the front) are to be answered how the student feels **<u>at the very moment</u>** they complete the survey. Conversely, on the back side of the survey (which is listed as Form C-2), the student is to answer the survey based on **<u>how they generally feel</u>**. Please continue to have each student list their unique number and class (A-H) on their survey.

Please remember, if any student chooses to not participate in filling out the survey, or chooses to not fill out the survey mid-way, that is fine. I want to make certain that no student is felt as though they have to fill out a survey if they choose not to do so. Thanks again to all of you who are willing to participate!

Appendix K

Letter from Clarus Representative Indicating Which ClearWave Devices

were Active and which were Inactive