Influence of Trataka and Pranayama practices on adolescents with extended exposure to Digital Display (computer screen and mobile phones)

by

LATHA VASAN

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VIVEKANANDA YOGA UNIVERSITY

WE HEREBY APPROVE THE THESIS/DISSERTATION OF

LATHA VASAN

CANDIDATE FOR THE DEGREE OF

DEGREE MASTER OF SCIENCE (YOGA) *

COMMITTEE CHAIR

DR. N K MANJUNATH

COMMITTEE MEMBER

DR. APAR SAOJI

DR. SREE KUMAR

DR. MURALI VENKATRAO

DATE OF DEFENSE

<**05/10/22**>

***WE ALSO CERTIFY THAT WRITTEN APPROVAL HAS BEEN OBTAINED FOR ANY PROPRIETARY MATERIAL CONTAINED THEREIN.**

Dedication

I dedicate this Thesis to the memory of my Dad, Mr. M R Srinivasan who was my constant motivator and gave me the courage to push myself beyond my limits. He was very proud of my accomplishments and was my biggest fan!

Acknowledgments

My humble respect to Dr Nagarathna and Dr H R Nagendra (Vice Chancellor of Swami Vivekananda Anusandhana Samsthana: S-VYASA) who through their immense commitment to yoga and several research papers have inspired many of us to continue our Yoga Journey from the first university in the world outside of India, VaYu.

My humble thanks to Dr Sree Sreenath, President of VaYU, whose guidance and commitment throughout the program was extremely valuable and inspiring.

I am grateful to all the VaYU faculty and the knowledge imparted in all subjects. Their guidance, sharing of knowledge and techniques on Yoga, over the last few years is fervently acknowledged.

My sincere thanks to Dr Manjunath, Dr Apar Dr Sreekumar and Mr Murali Venkatrao for their guidance in completing my research in a timely manner and continuous dialogue throughout the semester.

About 100 plus adolescents, age 10 to 19 participated in my study sincerely and I thank them and their parents from the bottom of my heart for their sincere commitment.

Several doctors gave their time and shared their medical knowledge on various illnesses which gave us a deeper and understanding of how Yoga can be integrated into established medical practice for holistic treatment and intervention. My sincere appreciation to all of them for their time.

I sincerely thank Dr Murali Venkatrao , Dr Vijaya Kauvri and Vayu administrative staff for their guidance and support.

My gratitude and respect to all my VYASA-LA and VaYu colleagues who continue to inspire and support me in my endeavors.

I have been fortunate to have a supporting family (husband and two sons), my parents, sister brothers and friends and I want to thank them for encouraging me to pursue my passion for helping others.

All is possible with the blessings of the almighty, to whom we always turn to with reverence.

(Latha)

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TRATAKA AND PRANAYAMA PRACTICES ON ADOLESCENTS WITH EXTENDED EXPOSURE TO DIGITAL DISPLAY

ABSTRACT

Background: A specially designed yoga module consisting of Trataka and Pranayama is considered to improve vision, cognitive functions and reduce anxiety in adolescents of age 10 to 19 years. The premise is that the prevalence of digital display usage is very high among this group, especially during the Covid 19 lock down causing an environment prone to visual stress directly related to extensive time watching screens/phones and social stress due to isolation with digital media dominating the social interactions.

Materials and methods: Children between the ages of 10 to 19 years were recruited for this study and were placed in one of two groups: Intervention Yoga (n=41) and control (n=18). The intervention group underwent a specially designed Yoga module of Trataka (a visual cleansing technique) and Pranayama (voluntarily regulated breathing). This was given for a period of 3 weeks (21 days) via remote sessions using ZOOM. The control group did not undergo this module. The subjects in both groups were assessed before and after the intervention. The assessments were done using Visual Strain surveys, Digit Span Test and Six Letter Cancellation Test (SLCT) to evaluate concentration, and STA (State Trait Anxiety) to measure anxiety.

Results: The intervention group showed statistically significant reductions on the Visual Stress Survey scores ($p<0.003$, mean reduced from16.8 to 14.7) and on STA of positive sentiments (calm, content, relaxed) ($p<0.02$, mean increased from 8.65 to

9.38). The measures on concentration (DLST and SLCT) did not statistically differ before and after the Intervention in the Intervention group. Voluntary Testimonials (n=11) were collected for the intervention group and these showed a perceived positive effect of Trataka practice.

The control group did not have any statistically significant changes in any of the measures ($p>0.05$ for all comparisons).

Conclusions: The practice of Trataka along with Pranayama can alleviate ocular strain and anxiety in adolescents who use digital display units during covid pandemic.

STANDARD INTERNATIONAL TRANSLITERATION CODE USED TO TRANSLITERATE SANSKRIT WORDS

ा	ऽ	अ	व्रा	ऽ	ङ	पा	ऽ	प
ब्र	ऽ	आ	चा	ऽ	च	पहा	ऽ	फ
ि	ऽ	इ	चहा	ऽ	छ	बा	ऽ	ब
रु	ऽ	ई	जा	ऽ	ज	बहा	ऽ	भ
ु	ऽ	उ	जहा	ऽ	झ	मा	ऽ	म
ह्म	ऽ	ऊ	श्र	ऽ	ञ	या	ऽ	य
भ्र	ऽ	ऋ	स्रा	ऽ	ट	रा	ऽ	र
म्र	ऽ	ॠ	स्रहा	ऽ	ठ	ला	ऽ	ल
्	ऽ	ए	ष्टा	ऽ	ड	वा	ऽ	व
ाि	ऽ	ऐ	ष्टहा	ऽ	ढ	म्ना	ऽ	श
ख	ऽ	ओ	न्ना	ऽ	ण	श्वा	ऽ	ष
ु	ऽ	औ	ता	ऽ	त	सा	ऽ	स
प्र	ऽ	अ	तहा	ऽ	थ	हा	ऽ	ह
ह्न	ऽ	अः	दा	ऽ	द	कश्वा	ऽ	क्ष
का	ऽ	क	दहा	ऽ	ध	तर	ऽ	त्र
कहा	ऽ	ख	ना	ऽ	न	जश्रा	ऽ	ज्ञ
गा	ऽ	ग	गहा	ऽ	घ			

Introduction

Adolescents and Screen Time

Adolescence is a period of rapid development and often involves the three main areas: physical, mental and emotional. During this time, the person is intensely curious and involved in their activities. In the past decade, this has resulted in an in-ordinate amount of time with digital display units, including computers, tablets and mobile phones. In the past 2 years, with covid imposed online schooling, the number of hours spent with such media has more than doubled and is estimated to be 9 hours a day currently (Schmidt et al., 2020; Wiederhold, 2020). With a normal awake time of 16 hours, this amounts to 57%. Adolescents' brains develop rapidly and adapt, and an entire generation is adapting to these digital ways. Unfortunately, in this process, the adaptation may not lead to a good outcome in later years. Many scientific studies have indicated adverse consequences including eye problems (Wai WONG et al., 2020), impairments in ability to concentrate, decrease in social interactions, poor physical health all of which lead to loss of quality of life(Smahel et al., 2015).

Physical health of adolescents

The Physical Activity Guidelines for Americans, issued by the US Department of Health and Human Services (Piercy et al., 2018) recommend that children and adolescents aged 6–17 years should have 60 minutes (1 hour) or more of physical activity each day. This criteria is for a Healthy young individual with no major impairments.

Such activity builds strength, coordination and confidence leading to a healthful life. However, in the past two years of Covid19 many opportunities for participation in physical activities have disappeared. Further the effect of this situation is expected to last many years into the future.

Several studies have pointed out eye issues that occur with extended screen time. These eye problems are collectively referred to as ‘computer vision syndrome’ and the symptoms include eye discomfort and fatigue, dry eye, blurry vision, and headaches (Blehm et al., 2005)

Mental health of adolescents

The adolescent years are a vulnerable time for young adults, as they evolve from childhood and adulthood. Adolescents impacted by behavioral health issues think, feel, and act in ways that are confusing to both them and family members. Families may experience breakdowns in communication and functioning, leading both parents and teens to feel hopeless and lost.

Excessive screen use has mental health impacts. It is well known that major categories of screen use include games and social media (facebook, whatsapp, instagram, tiktok etc.). With regard to games comes the small muscle fatigue, eye

issues and the desire for ‘instant gratification’. Often the adolescent is impaired in completing normal tasks, such as self-care.

The problems of Social media are prominent in the current news. They include suicidal thoughts, disconnection with family and isolation (Chancellor & De Choudhury, 2020). In adolescents, there are recognized differences in screen use based on sex, race and ethnicity, and income. The COVID-19 epidemic, as well as following stay-at-home mandates, online learning, and social distancing regulations, has resulted in a growing reliance on digital media (i.e. screens) for practically all aspects of adolescents' life (eg, education, information, socialization, entertainment)(Nagata et al., 2022)

In this study, we have evaluated the influence of Yogic practices which should result in calming the mind, clarity in thinking, and the ability to handle stressful situations in adolescents.

Rationale of the study

There is extensive use of digital displays in the current pandemic era. Also technology has become an integral part of the lives of the youth. This is leading to visual fatigue, anxiety and lack of concentration. It is important to address these issues to improve the performance of the adolescents and to help them maintain healthy eyesight (Gopinathan et al., 2012). We hypothesized that Trataka and Pranayama may have a good impact on vision, mental concentration, and mental wellness based on previous research. Trataka Kriya is a set of simple eye exercises from Yoga, which helps to promote eye health via exercising the eye muscles involved in focus, eye-movement, concentration and relaxing the eye muscles. It prevents eye disease, both muscular and optical when they are practiced regularly. It thus helps in improving your

eyesight and concentration. Pranayama is the main component of Yoga and is practiced for physical and mental wellness. These two practices in combination will address the effect of excessive digital media exposure.

Hathayoga's classical scriptures highlighted the tremendous impact of the six cleaning techniques on numerous elements of one's psyche, which has been supported by actual research (Swathi et al., 2022) (Bodhananda, 1999). Trataka (Visual focus) is one of the purification techniques that has been shown to improve vision and cognitive processes).

The current study is proposed to mitigate the implications of prolonged use of digital displays through the yoga techniques of Trataka and Pranayama.

Teleyoga

In the last few years, tele yoga practice has grown enormously all around the globe(Selman et al., 2015). It is probable that there are more Tele yoga sessions than in person sessions. It is very common for the teacher and practitioner to be in different locations and perhaps in different countries. However for Tele yoga to be conducted properly, it is required to be free of distractions either visual (like advertisements) or auditory (no music) and should interactive.

A yoga session requires strong communication between the teacher and **the student.** Teacher interaction is required to guide, motivate and ensure that the practice is done with focus and concentration. The benefits of yoga are enhanced when done as prescribed. With continuous practice the student will eventually absorb the principles of the practice (namely trust, discipline and controlled motion, relaxation) and do it on their own. This is one of the hopes for results of this yogic

intervention i.e. the adolescent participants will know of the yogic tools to enhance their wellbeing, and how to use them,

Literature Review

Ancient literature review

Six cleansing techniques are described in the ancient Indian yoga literature Hatha Yoga Pradipika (Muktibodhananda, 1999). The goal of cleaning techniques is to cleanse and prepare the body for yoga postures, breathing exercises, and meditation. Yogic visual concentration technique (trataka) is one of these techniques.

धौतिर्बस्तिस्तथा नेतिस्त्राटकं नौलिकं तथा |dhauti

कपाल-भातिश्छैतानि षहट-कर्माणि परछक्षहते || २२ ||

“dhautirbastistathā netistrāṭakaṃ naulikaṃ tathā |

kapāla-bhātiśchaitāni ṣhaṭ-karmāṇi prachakṣhate || 22 ||”

The six categories of cleansing techniques are Dhauti, Basti, Neti, Trataka, Nauli, and Kapâla Bhâti.

कर्म षहट्कमिदं गोप्यं घट-शोधन-कारकम |

विछित्र-गुण-सन्धाय पूज्यते योगि-पुणगवैः || २३ ||

“karma ṣhaṭkamidaṃ ghopyaṃ ghaṭa-śodhana-kārakam |

vichitra-ghuṇa-sandhāya pūjyate yoghi-pungghavaiḥ || 23 ||”

These cleansing actions should be kept under wraps. They produce exceptional qualities when carried out sincerely by the best Yogîs.

Yoga Sutra

शौच संतोष तपः स्वाध्यायेश्वरप्रणिधानानि नियमाः ॥३२॥

śauca-saṃtoṣa-tapaḥ svādhyāya-īśvara-praṇidhānāni niyamāḥ ||32||

Cleanliness, contentment, self-discipline, self-study and dedication to the lord are the observances.

Nadi Shodhana pranayama

“prāṇaṃ chediḍayā pibenniyamitaṃ bhūyo|anyathā rechayet

pītvā pingghalayā samīraṇamatho baddhvā tyajedvāmayā |

sūrya-chandramasoranena vidhinābhyāsaṃ sadā tanvatāṃ

śuddhā nāḍi-ghaṇā bhavanti yamināṃ māsa-trayādūrdhvataḥ || 10 ||”

If inhaling via one nostril, it should be exhaled through the other ie: air inhaled via the right nostril, it should be exhaled through the left nostril. After 3 months of practicie, through each nostril in turn, the entire collection of the nâdîs of the yamîs (practices) is clean, i.e. all impurities are removed.

अथ भरामरी वेगाद्घोष्हं पूरकं भृङ्ग-नादं

भृङ्गी-नादं रेछकं मन्द-मन्दम |

योगीन्द्राणमेवमभ्यास-योगाछ छित्ते जाता काछिदानन्द-लीला || ६८ ||

“atha bhrāmarī

veghādghoṣhaṃ pūrakaṃ bhṛnggha-nādaṃ

bhṛngghī-nādaṃ rechakaṃ manda-mandam |

yoghīndrāṇamevamabhyāsa-yoghāch

chitte jātā kāchidānanda-līlā || 68 ||”

This technique induces ecstasy in the minds of yogis by inhaling forcefully, generating a noise like a Bhringi (bee), then gently expelling it.

Scientific Literature Review

Sl. No.	Author & Year of Publication	Sample Size	Design	Intervention	Assessment Tools	Results	Conclusion
1	Jason M. Nagata, MD, Catherine A. Cortez,Chloe J. Cattle,2022 (Nagata et al., 2022)	5412	Cross Sectional	Observational study	Surveys	Higher screen use- Poor mental health Lower screen use -coping behaviors	Excessive use of social media was the cause of poor mental health
2	Jason M. Nagata; Catherine A. Cortez; Chloe J. Cattle (Nagata et al., 2022)	273	Single arm, pre-post design	Pragnya yoga		The mean scores for Recognition and Immediate recall improved significantly	Pragna yoga was effective in memory recall
3	J Ida Sherlee, Anita David (Sherlee & David, 2020)		True Experimental study design		Stroop test using word color as used in the Hamilton anxiety scale	Significant improvement in the yoga group Yogic visual concentration (Trataka) has a greater impact on cognitive function and anxiety in adolescent students.	Yogic visual concentration (Trataka) has a greater impact on cognitive function and anxiety in adolescent students.

4	Shirley Telles, K V Naveen, Manoj Dash, Rajendra Deginal, N K Manjunath (Telles et al., 2006)	291	2 groups - yoga group and weight list control grp	Yoga	Visual discomfort standard questionnaire	The YG group had a substantially lower score than the WL group, which had a significantly higher score.	The findings suggest that yoga practice reduced ocular pain, whereas the control group (WL) was more in discomfort at the end of sixty days.
5	P S Swathi, Raghavendra Bhat, Apar Avinash Saoji (Swathi et al., 2021)	41	Pre-post assessment	Trataka		Trataka is better that eye exercises for CBTT	Trataka sessions appear to increase spatial memory, spatial attention, and working memory according to the findings.
6	Ravishankar Tejvani, Kashinath G Metri, Jyotsna Agrawal, H R Nagendra, (Tejvani et al., 2016)	34	Pre-post assessment	Yogic activities include Pranayama (Yogic breathing practices), Asana (Yogic postures), and Dharana-Dhyana (Yogic meditation) (Yogic relaxation techniques)	Pilot study	At the end of the two-week Yoga intervention, a statistically significant reduction (P = 0.001) in anxiety and sadness, as well as a significant improvement (P = 0.001) in self-esteem.	This study indicated that two weeks of Yoga sessions lessened depression and anxiety among orphanage adolescents and young adults, as well as enhanced self-esteem.
7	G Shathirapathiy, A Mooventhan, N Mangaiarkarasi, S A Sangavi, V	29	Pre- post assessment	Trataka- 45 minutes for 10 days	Insomnia, ISI (Severity Index) and The PSQI -	After the intervention, the ISI and PSQI global	Trataka could be used to help persons with insomnia reduce

	Shanmugapriya, B Deenadayalan, A Gayathri, (Shathirapathiy et al., 2020)				Pittsburgh Sleep Quality Index, respectively.	scores, as well as their corresponding subscale scores, were significantly lower, with the exception of sleep medication ratings.	their symptoms and improve their quality of life.
8	Komal Krishna Tiwari, Rahul Shaik, B Aparna, Rajesh Brundavanam (Tiwari et al., 2018)	24	2 groups - pre-post	Trataka Yoga Kriya and Bates eye exercise therapy	Eye test	Both Trataka Yoga Kriya and Bates exercises were shown to be ineffective in lowering refractive errors and enhancing visual acuity, according to the findings.	Non-pharmacological treatments such as Trataka Yoga Kriya and eye exercises, according to this study, have no effect on myopia.

Materials and Methods

Overview:

The main reason of this study was to investigate whether a Yoga module consisting of Trataka and Pranayama aimed at promoting yogic vision and respiratory practices could reduce children's eye strain while undergoing homeschooling during covid 19 pandemic. This study will also evaluate the improvement in memory, concentration and anxiety due to these practices.

The participants in this study were divided into two groups: Intervention and Control. The Intervention group received a 3 week Yoga intervention while the Control group did not. Both groups were subject to assessments (surveys and tests) before and after the intervention and the results evaluated.

Ethical consideration

A written parental consent was availed before recruiting adolescents (youth) for this project. There are no known harmful effects due to the practice of Yoga techniques used here, and that will be disclosed. Participation was voluntary, and the required documentation was collected and archived. Participants were required to indicate that they participate fully in the intervention, however they can opt out at will.

Study constraints due to Ethical considerations

Due to ethical constraints and practicality (limited sample size) this study is NOT a study of a random subgroup of the population. As such generalization of the results is precluded.

The inclusion criteria of voluntary consent and participation has biased the study population almost exclusively to participants of Indian background. Further participation in the Intervention or Control group is voluntary. This precludes a statistically valid comparison between groups of random participants. However, a comparison of results between the groups helps in identifying the presence of confounding factors.

Intervention and Control groups:

Both groups were recruited using the following inclusion criteria:

Inclusion Criteria for study:

1. Adolescents between Age 10 to 19 years.
2. Parental consent.
3. Child consent.
4. Participants in general good health with ability to commit to 3 weeks of daily yoga sessions.

Formation of groups

The initial recruitment for the study provided a pool of 120 participants. About half of the pool dropped out due to inability to commit to the length of the study. The remainder (58) were placed in the Intervention or the Control group as per their preference. As expected, the majority preferred the Intervention group due to their desire to experience Yoga. Practical considerations prevented the random assignment to groups. Therefore, this study strictly allows only pre-post comparisons within each group.

Sample Size

The sample sizes in this study were:

Intervention group: 41

Control group: 18

These numbers are comparable to other studies of this nature (Gopinathan et al., 2012; Talwadkar et al., 2014). Using sample size calculations on a general population this works out to a confidence level of 70%. The study constraints (see ethical constraints above) however do not allow generalization. Therefor the sample sizes are determined by practical considerations and are in-line with similar published studies.

Assessment Tools

Assessment was divided into three categories. Table 1 below indicates the tools used:

Category	Tool	Description
Visual Strain	Vision Stress Survey	A nine-question survey participant rating of their eye stress level
Anxiety/Wellbeing	STA (State trait anxiety)	A six-question survey of participating on positive and negative mental/emotional states
Memory and concentration	SLCT (Six letter cancellation test)	This is a test/game in which participants 'cancel' letters from a collection of letters, which belong to a group of six randomly selected letters. The participant score is the number of letters that they cancel correctly
Memory and concentration	DLST (Digit letter substitution test)	This is a test/game in which participants substitute numbers for letters based on random set of letters with corresponding numbers. The participant score is the number of correct substitutions

The complete description of each Tool is in Appendix II

Intervention

The Yoga module designed focuses on Vision, memory/concentration and stress. Trataka, Pranayama and meditation are the practices. At the time of this study, due to covid restrictions, the only suitable way was to conduct the intervention online. This is ironic, since we are trying to mitigate the ill effects of excessive online time! The modules will however adhere strictly to how these practices are to be carried out, and the process is the same as for in-person learning.

The online sessions will be free of disturbances (no ads, recordings) and will involve interactive participation of a Yoga Teacher and the team of adolescent practitioners for the duration of each session.

Trataka

improving eyesight, specifically strengthening the focusing muscles, and eye-movement muscles and nerves to make the eyes more responsive, and hence acuity and responsiveness to vision.

Pranayama

Breathing consists of balancing the breath, full yogic breathing and brahmari. These are practices to improve respiratory health, focus on well being and control via balancing the inspiration and expiration. The discipline that is inculcated by these practices also help calm the mind, resulting in better mental health.

Relaxation

The participants were given deep relaxation for 3 minutes at the conclusion. They were told to lie still and relax their muscles and joints.

Sessions

Total 25 minutes of practices for 3 weeks on a daily basis divided as follows:

Practice	Minutes
Trataka	13
Pranayama and Relaxation	12
Opening and Closing Prayers	3

The detailed steps in each practice is in Appendix I

Results

The intervention group shows statistically significant reductions on the scores of Visual Stress Survey ($p<0.003$, mean reduced from 16.8 to 14.7) and on STA of positive sentiments (calm, content, relaxed) ($p<0.02$, mean increased from 8.65 to 9.38). The measures on concentration (DLST and SLCT) did not statistically differ

The results are summarized in the table below:

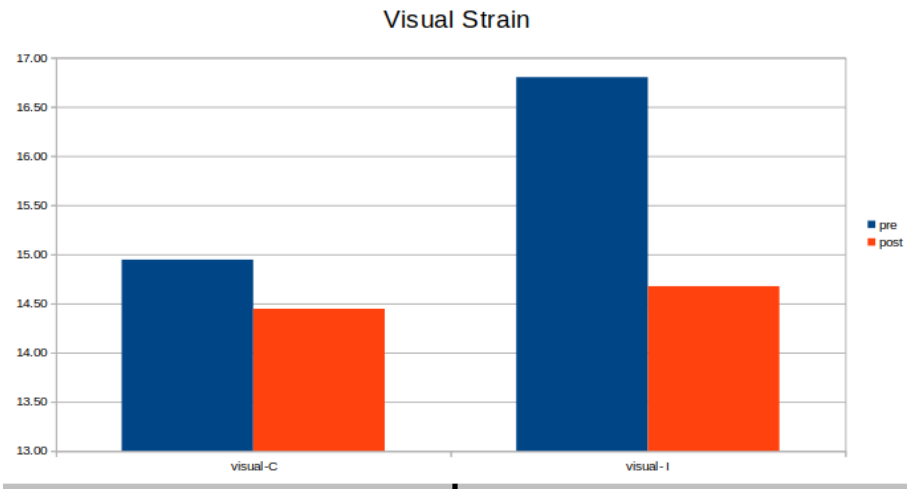
Intervention Group (n=41) result table

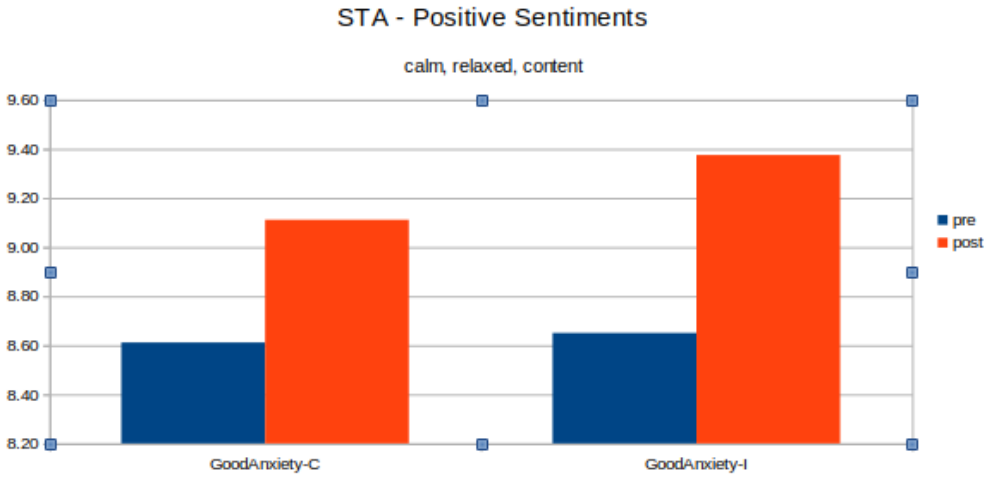
Survey	Pre: mean	Post: mean	P-Value (one tail)
Visual Stress	16.8	14.675	**0.0026**
STA-positive	8.65	9.375	**0.0155**
STA-Negative	5.225	4.875	0.1137
DLST	53.775	57.15	0.2705
SLCT	22.7	27.45	0.0609

Control Group (n=18) result table

Survey	Pre: mean	Post: mean	P-Value (one tail)
Visual Stress	14.94	14.44	0.2271
STA-positive	8.611	9.111	0.1382
STA-Negative	5.611	5.555	0.4693
DLST	67.666	69.722	0.3902
SLCT	30.22	29.666	0.4484

The Visual Stress and the STA-positive measures which are the only statistically significant results are shown as charts below:





Other charts are in Appendix IV, which also refers to the XL sheet attachment that contains all data obtained in the Study.

Discussion of Results

The module included Pranayama, which has an effect of calming the mind (Novaes et al., 2020; Saoji et al., 2018))

This study reinforces this finding thru the STA-positive sentiment results. The impact of the Intervention is statistically significant at $p<0.05$.

The results of the DLST and SLCT tests, which measure concentration ability did not produce statistically significant positive results as expected. These tests were conducted remotely for practical reasons. The presentation of these measures to the participants was in 'game' context. This was thought to be suitable as a 'game' would motivate adolescents. It was noted that most of the participants played these 'games' multiple times and presented their best scores. Hence the results of these surveys are suspect because of the way they were conducted. The lesson here is to conduct the DLST and SLCT in an in-person setting with strict supervision and not allow re-taking.

The constraints of this study, namely allowing the participants to choose their group, and the small sample sizes (41 and 18) do not allow the generalization of the findings and inter-group comparisons. These constraints were necessary for practical reasons.

It is expected that Trataka which includes several simple eye exercises that target the eye focus muscles (ciliary muscles), and eye movement muscles (orbit related muscles) (Kumar et al., 2022) will have a positive effect on vision. The exercises of Trataka overlap with many modern eye exercises which are known to reduce eye strain and improve eye functions.

One major problem with digital display, is that the focus is 'fixated' at the distance from the screen to the eye for long periods of time. The eyeball movement is mostly absent. This is not natural and causes various eye issues collectively called the computer vision syndrome (Blehm et al., 2005)

Trataka helps relieving the computer vision syndrome (Swathi et al., 2022).

The Intervention group had a higher Vision Strain at the pre intervention stage. The most likely reason is that the participants could choose to be in the intervention group, and participants with visual stress chose intervention with the expectation of improvement. Fortunately, this was borne out, as this group got the maximum reduction in eye strain.

Beyond testing of hypotheses (that Trataka and Pranayama have a beneficial effect on visual strain and mental wellbeing), the goal of this study was to teach adolescents about yoga and teach them how to practice it. In that the success of this study was demonstrated by the Testimonials received. Voluntary Testimonials(n=11) were also collected for the Intervention group and these are shown in Appendix III. All the testimonials show a strong perception of the positive effect of Trataka and Pranayama practice.

These are presented in Appendix III.

Appendix I – Session Practice detail

	PROTOCOL- TRATAKA /PRANAYAMA- RESEARCH STUDY	all 7 days		Start Feb 6 - Feb 27

	Screen adjustment /Basic instructions	**Tips**	**time (mins)**	**rounds**
1	opening prayer	3 oms	1	
2	Blinking 2 to 3 times- followed by simple palming	Blink 10 times fast - 10 sec rest - SIMPLE	1	2 times
3	Preparatory - eye loosening	relaxed eye movements	2	all up down left right and diagonal
4	vama Jatru trataka	left - using thumb - 2	1	
5	dakshina Jatru Trataka	right - using thumb -2	1	
6	Palming	SIMPLE	1	
7	Urdhwamukha jatru	up - using thumb - 2 both hands	1	
8	Adhomukha jatru	down - using thumb -2 both hands	1	
9	Palming	PRESS AND RELEASE - 2	1	
10	Eye rotation with thumb	Round - both sides - ONE TIME	1	
11	Palming	PRESS AND RELEASE	1	
12	Bhrumadya - palming - CONSTANT with Bhramari	between the brows - 2 - 5 secs wait	1	
13	Nasikagriha - palming - CONSTANT with Bhramari	nose tip - 2 - 5 secs wait	1	
14	Ubhaya Jatru Trataka	focussing defocussing - using both thumb -2	1	
15	Palming	CONSTANT with Bhramari	1	

16	Vibhagya swasana- all lobes	with 4 mudras (chin, chinmaya, adi, bhrama	2	1X4
17	Nadishudhi pranayama	5 rounds	2	
18	Bhramari	3 rounds	1	
19	Shavasana (DRT)	LYING DOWN (count down from 10 with inhalation and exhalation	3	
20	Closing prayer	Three oms	1	

Trataka :

Trataka is a yoga kriya (hygiene practice) composed of the following (The Yoga Institite, 2022):

Begin with sitting in a meditative pose, crossed legged (sukhasana)or on your knees with the butt on your heels(vajrasana). The body is upright, with the head looking straight ahead with down-facing palms, with the thighs or knees resting on the floor**.** If you cannot sit on the floor, be comfortable in a chair. .

The eyes are one of our body's most delicate and precious features. Imagine our life without eyes. As a result, blink whenever you feel uncomfortable. This means not staring without blinking at any external object over an long period of time. Children while using computers are not aware of this strain.

It is important to remember that eye movements should not be fast, jerky, or excessive. Removal of Eye glasses is encouraged.

Trataka is a Sanskrit word that means "to look." It's a Kriya with a lot of advantages. Yogis have practices this for improving their concentration besides improving their eyesight.

Yogic Eye Practice

Dakshina /Vama Jatru Trataka

Raise your hand to the shoulder level and keep your eyes on your right thumb. Slowly, with head steady, move the eyeballs in a gradually to the right. For a few seconds, fix your focus on your right thumb without blinking (Dakshina Jatru) and gently move your gaze to the center, then to the left shoulder (Vama Jatru). Return your sight to center.

Urdhwa muka/Adho muka jatru trataka:

Move your eyeballs upwards from the middle with your hand and thumb, stay without blinking for a few seconds. Return your gaze to the center and lower your gaze while maintaining your head still. Bring your sight back to the center.

Nasikagriha Trataka

At one time, keep your eyes open and look straight ahead. Bring your index finger up close to her brow. Fix your gaze on the tip of your nose with both eyes. Continue gazing for a few seconds before closing your eyes.

Brumadhya (eyebrows)

Keep your eyes open and, at one point, point your index finger straight ahead. Bring your index finger between your eyebrows. Focus both eyes on the space between your brows (Brumadhya). Before closing your eyes, continue gazing for a few seconds.

Rotation of eyeball.

Keep your eyes open and make a point with your index finger pointing straight ahead. Both eyes should be focused on the space between your brows (Brumadhya). Close your eyes and continue gazing for a few seconds.

Ubhaya Jatru Trataka: Side or Peripheral vision.

Maintaining your eyes open, look straight at both the thumbs pointing forward. Try to 'see' the sides, both left,right at the same time with your gaze forward. Bring your hands and your focus back to the center.

Blinking: Blink a few times after opening your eyes. Open your eyes wide and gradually close them.

Palming the Eyes:

After completing the Trataka technique, do the palming of the eyes. It's a technique for calming the eyes after they've moved. It's also done prior to opening the eyes following meditation. Gently rub the palms together to generate heat, then place the palms over the eyes, forming a 'cup' so as not to press on the eyes. For 5 to 10 seconds, stay in this position. The frequency with which this activity is repeated is determined by the need. Once or twice, though, is sufficient.

There are three types of palming.

Simple , Press and release and Constant.

Constant palming is done with chanting.

Pranayama Practices:

Sectional breathing (Abdominal breathing/Chest and Shoulder breathing)

In chin mudra – abdominal breathing

In Chinmaya mudra – Chest breathing

In adi mudra -Shoulder breathing

In bhrama mudra- Full yogic breathing

Nadi Shodhana Pranayama (Alternate Nostril Breathing). This is a very relaxing breathing practices that balances the nervous system by breathing through one nostril and exhaling through the other.

Bhramari Pranayama (Bee sound). Soothes the nervous systems and energizes the body and mind.

Relaxation: Deep relaxation technique where the muscles and joints are relaxed with autosuggestions.

Appendix II – Assessment Tools

Visual Strain

Visual strain is evaluated using a self-reporting survey that is shown below. Each symptom is rated on a scale of 1 to 5 with 1 being absence of the symptom and 5 being always present. The rating scale is presented as:

1 – "NEVER", 2 – "RARELY", 3 – "OCCASIONALLY", 4 – "OFTEN",5 - "NEARLY ALWAYS"

The details of the symptom and rating as as below:

Symptom	Rating
1. Dry eye	1-5
2. Tired eye	1-5
3. Sore/aching eye	1-5
4. Irritated eye	1-5
5. Watery Eye	1-5
6. Burning eye	1-5
7. Eye strain	1-5
8. Blurred vision	1-5
9. Difficulty in focusing	1-5

Anxiety

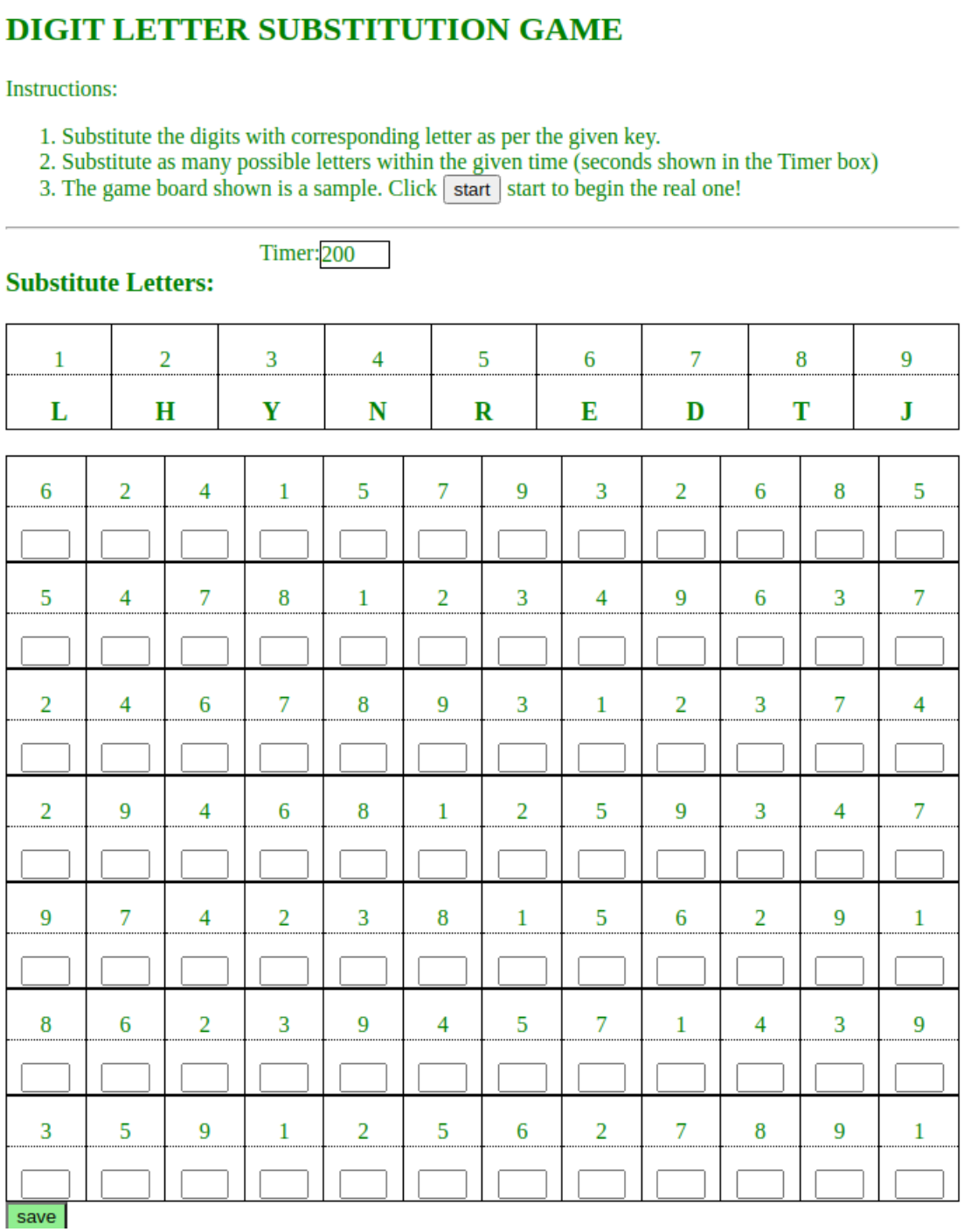
Mental well-being was assessed using a self-reported STA (State Trait Anxiety) survey. The survey had 3 sentiments on which a high score was related to positive wellbeing and 3 related to negative well-being. The ratings were on a scale of 1-4 with 1 being the absence of the measure, and 4 being the strong presence. The rating scale is presented as:

1 - "Not at all", 2 – "Somewhat", 3 – "Moderately", 4 - "Very much"

Sentiment	Rating	Positive/Negative
1. I feel calm	1-4	Positive
2. I am tense	1-4	Negative
3. I feel upset	1-4	Negative
4. I am relaxed	1-4	Positive
5. I feel content	1-4	Positive
6. I am worried	1-4	Negative

Memory and Concentration

DLST: The participant has to fill in each blank square with the Letter that corresponds to the digit above it. The score is the number of letters filled correctly . The key is shown at the top. The time limit is 200 seconds.



DIGIT LETTER SUBSTITUTION GAME

Instructions:

1. Substitute the digits with corresponding letter as per the given key.
2. Substitute as many possible letters within the given time (seconds shown in the Timer box)
3. The game board shown is a sample. Click start start to begin the real one!

Timer:200

Substitute Letters:

1	2	3	4	5	6	7	8	9
L	H	Y	N	R	E	D	T	J

6	2	4	1	5	7	9	3	2	6	8	5
5	4	7	8	1	2	3	4	9	6	3	7
2	4	6	7	8	9	3	1	2	3	7	4
2	9	4	6	8	1	2	5	9	3	4	7
9	7	4	2	3	8	1	5	6	2	9	1
8	6	2	3	9	4	5	7	1	4	3	9
3	5	9	1	2	5	6	2	7	8	9	1

save

SLCT: The participant has to click on each square if it contains one of the Target letters which ‘cancels’ that letter. The number of correct cancellations is the score. The time limit is 100 seconds.

SIX LETTER CANCELLATON GAME

Instructions:

1. Search out the target letters given below and mark them out by clicking on them.
2. Mark as many as possible within the given time.
3. The game board shown is a sample. Click [start] start to begin the real one!

Target Letters: J T K M U F

Timer: 100

J	G	Y	L	S	E	T	B	L	U	V	G	K	H	A	W	U	J	M	K	R	B
X	N	O	D	F	C	K	N	E	H	W	Z	L	J	S	D	Q	L	N	H	U	O
U	K	W	A	I	M	P	G	Q	X	M	F	Y	B	I	R	X	G	F	P	J	K
Z	V	B	H	J	S	Y	D	K	O	S	Q	T	M	P	O	E	I	A	T	L	E
T	L	Y	R	O	Z	L	F	A	U	I	N	Z	G	W	T	J	K	D	R	Y	A
D	S	Q	C	E	T	R	W	Z	J	A	E	H	L	U	Y	V	Z	S	O	N	X
E	W	K	F	H	M	N	C	P	X	R	O	K	I	C	R	F	G	P	I	K	S
G	U	A	P	S	V	I	O	B	D	C	S	F	X	E	H	W	Q	M	L	O	R
H	T	Y	G	D	L	U	Q	G	Y	W	A	B	Z	D	Y	V	U	A	E	Q	P
L	V	O	E	J	Z	F	T	L	E	M	H	Q	J	A	X	R	D	B	Z	N	J
S	W	N	Q	K	H	C	A	Z	N	O	I	S	M	L	E	J	S	H	G	T	F
A	P	F	X	O	R	I	J	B	D	P	K	W	I	J	K	O	R	I	B	Z	A
R	T	Y	B	V	D	X	S	U	F	R	X	O	Q	B	T	B	X	W	D	S	Z
M	I	G	U	W	K	O	C	E	N	V	T	H	Z	M	N	C	U	Y	P	K	E

save

Appendix III – Testimonials

The following testimonials were received from some particpants in the Intervention group:

Hi Latha Aunty,
I really enjoy your classes, they are very soothing and help me relax. I also feel like these classes improved my concentration. All things considered, your classes have helped me so much. Thank you very much!
Have a Great Day!

With Gratitude,
Shruthika Geejula

==========

Hello Latha Aunty,

This is Parsmi here!
These are my thoughts on the eye yoga classes we had:

Over the past 21 days of eye yoga, I felt not only benefits regarding my eyes but also with my mind. I felt peaceful and calm during the 20-30 minute sessions, and it was a really well-needed break/meditation time for me during weekdays. Latha Aunty also taught us in a very peaceful, patient, and thorough way, making me love the classes even more. I have felt my eyes getting better too, as they do not get foggy/blurry as much and I think my peripheral vision expanded more/I became aware of it. My experience with the eye yoga classes and Latha Aunty as my teacher has been very pleasing, and I am happy that I was a part of these classes!

I hope my feedback will be helpful for your results!

Best,
Parsmi Rajput

==========

Dear Latha Ji,
This is Pranav Alapati. I had a wonderful experience these few weeks. I could see some improvement in my focus and less stress on my eye. Overall, it was a very fun experience and I am glad I participated in the study.
Thank you.

Regards,
Pranav Alapati

==========

Hi Latha auntie,

I feel really calm after the sessions, which has helped me especially during this week when I had a lot of exams. I am unsure if the yoga has helped with my eyesight because of my eye contacts, but I do notice that my peripheral vision has gotten better.

Sriya:
I felt very peaceful during every class, mainly during the ending and the meditation. I noticed my eyes don’t feel tired as fast and I noticed I am sleeping better than before. I also observed that I am

able to see more due to the rotation exercise. Overall, this was very helpful and enjoying and I would continue this practice even after the program has ended.

Thank you for teaching us,
Sritha and Sriya Sthothrabhashyam
==========
Hello Latha Aunty,

I have been going through long haul covid and part of my symptoms are eye strain, difficulty focusing, brain fog, and headaches. Although I am not completely normal yet I have noticed a huge improvement since the start of class. Before I could not look at a screen for more than 5 minutes without my head hurting terribly. I can last a lot longer now. While I have been engaging in multiple programs to help with this, I do feel that your eye program has helped a lot! If I could make any suggestion it would be to conduct a longer study for maybe about 6 months and possibly expand the target of the study to anyone suffering from headaches or eye related problems.

Thank you for the class I really enjoyed it!
Shreya Sthothra Bhashyam
==========
Hi Latha Aunty,
I really enjoy your classes, they are very soothing and help me relax. I also feel like these classes improved my concentration. All things considered, your classes have helped me so much. Thank you very much!
Have a Great Day!

With Gratitude,
Shruthika Geejula
==========

Dear Latha Aunty,

I hope all is well. Here is my testimonial:

My name is Swetha C. Ganesh, and I have some experience with general yoga and none with eye-yoga practices until this study. Personally, within these three weeks, I have noticed that my eyes are less watery and irritable. I have learned techniques for relaxing my eyes and even can tell that I am straining my eyes less. I appreciate and am thankful for being a part of this study and will carry these lessons forth with me throughout my life. Thank you.

Sincerely,
Swetha Chidambara Ganesh

==========

Hi, This is your student Dhruvil Talati
The yoga classes help me a lot to concentrate and focus on anything that I do. After I started attending the yoga classes My eyes felt much better and they stopped watering.
==========
Hi, this is Ishita...
I would like to appreciate your hard work and the efforts you're putting for us! This meditation really helped me a lot like it helped me concentrate more and made my eyes more relaxed than it usually is ! It helped me release my stress and made my day!:)

Anushka Gupta

==========
Hi Latha Aunty, this is Anushka.

The eye and breathing exercises have helped me a lot. The eye rotations and eye movement exercises have helped me with preventing eye strains when I am on a device, and I have seen so much improvement in my eyes over these few weeks.
The breathing exercises, especially the alternate nostril breathing, has calmed me down a lot. It is working really well!
Thanks for taking the time to teach us these methods!

Aarna Biradar

==========

Hi Latha Aunty,
Your yoga classes are very relaxing and I have enjoyed every minute of it. My concentration is improving every day. Before joining this class, I would get an irritated eye frequently. But joining this class has resulted in a difference. Thank you very much for organizing these classes for us.

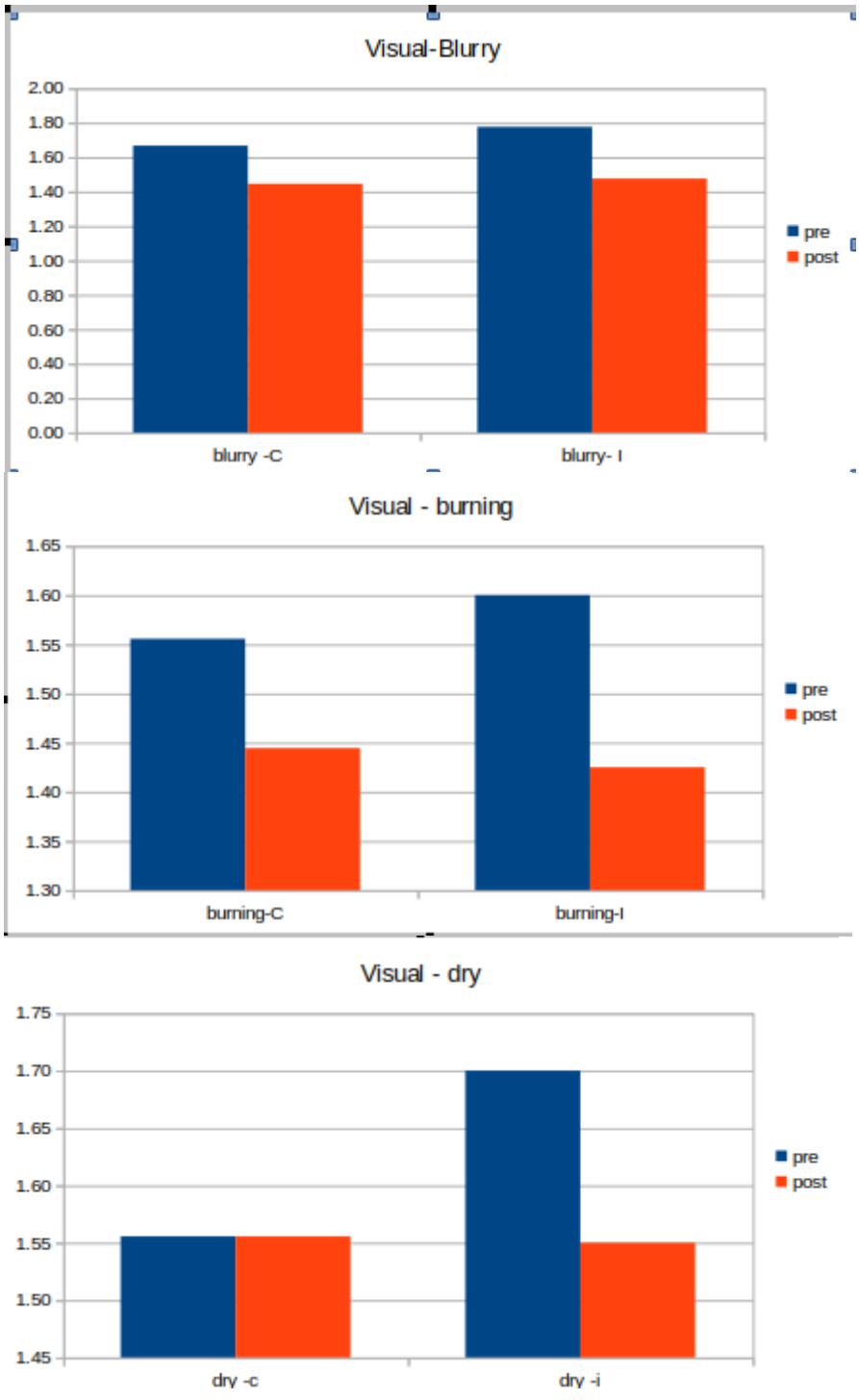
In Ronan's words, "The classes have been extremely beneficial! I can tell that my vision is improving. I also feel calm before bed and am sleeping better. Latha aunty has been engaging and helpful during lessons. She is also very motivating."

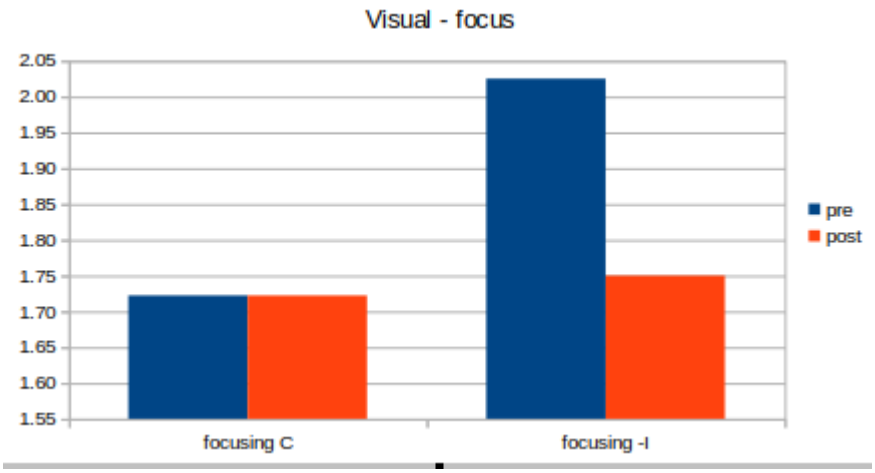
==========

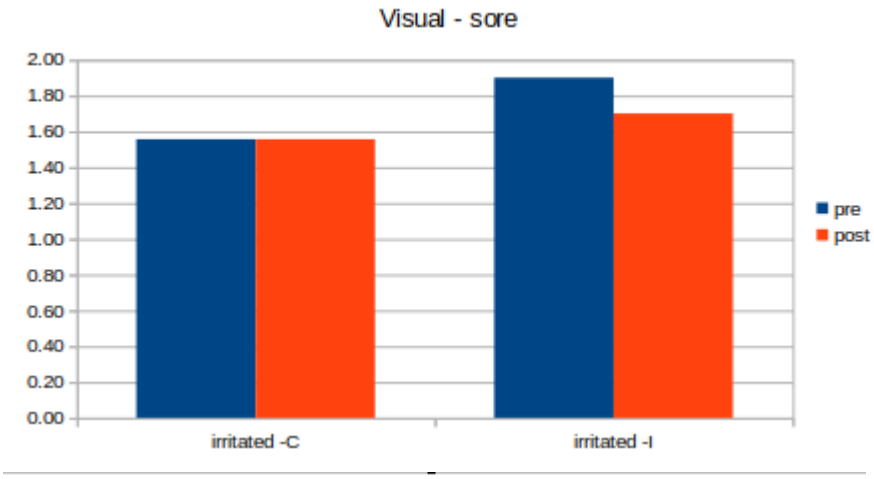
Appendix IV – Raw results and charts

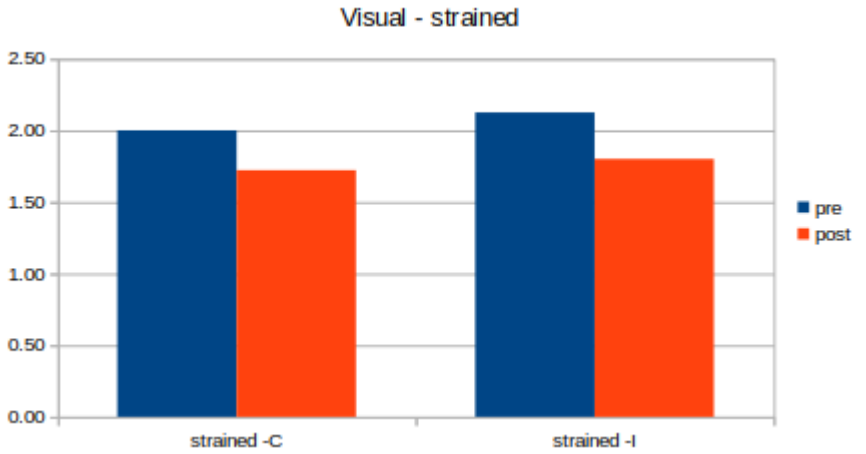
The data collected is in the attached excel workbook. It has serveral tabs. The complete data is in the 'AllData' tab, the calculations in the 'data calculations' tab. A 'glossary' tab is also included to explain some terms. The other tabs are work tabs which contain intermediate data.

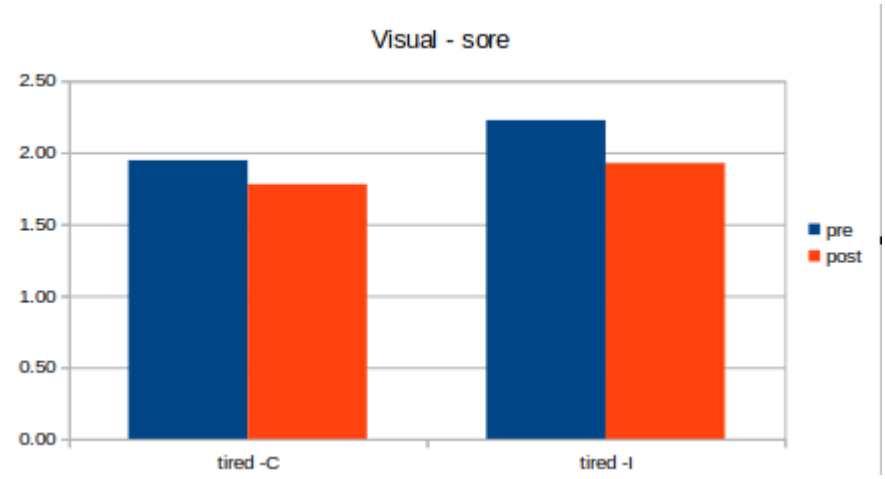
Charts: - Visual

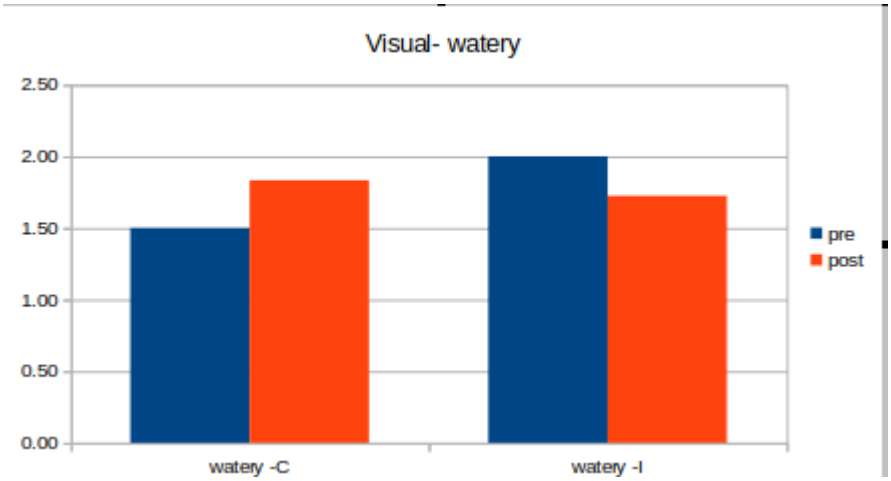



Visual - focus
2.05
2.00
1.95
1.90
1.85
1.80
1.75
1.70
1.65
1.60
1.55
focusing C
focusing -I
pre
post

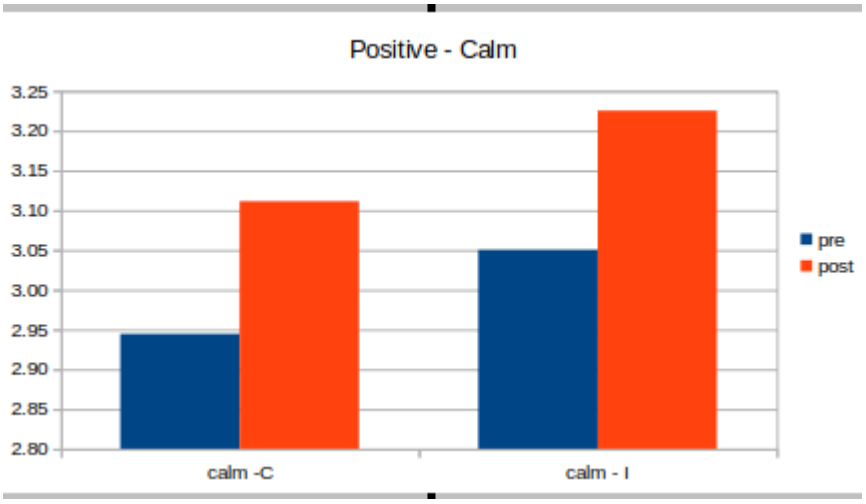

Visual - sore
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
irritated -C
irritated -I
pre
post

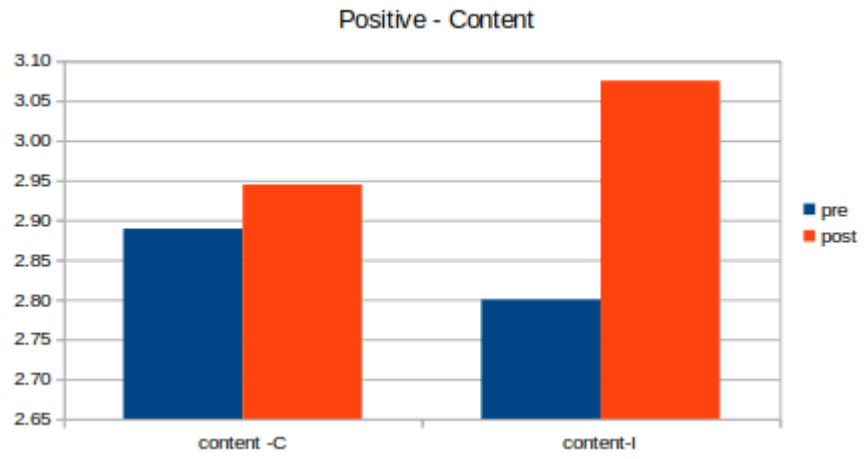

Visual - strained
2.50
2.00
1.50
1.00
0.50
0.00
strained -C
strained -I
pre
post

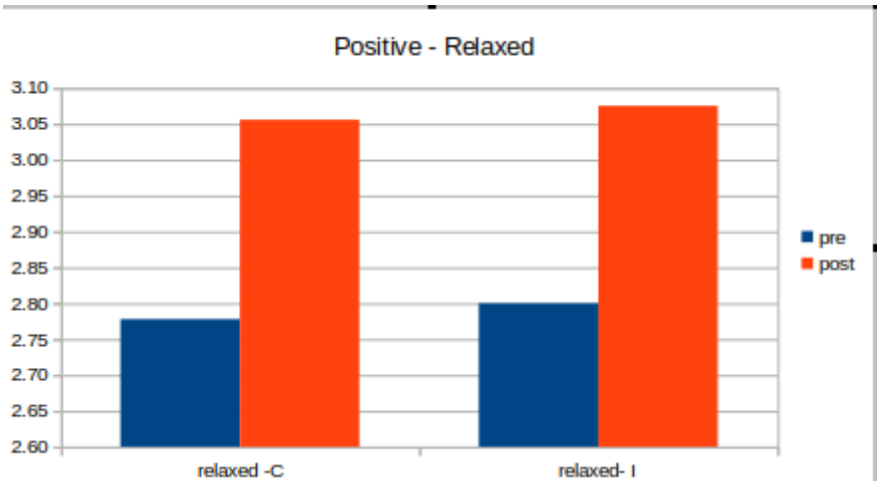

Visual - sore
2.50
2.00
1.50
1.00
0.50
0.00
tired -C
tired -I
pre
post


Visual- watery
2.50
2.00
1.50
1.00
0.50
0.00
watery -C
watery -I
pre
post

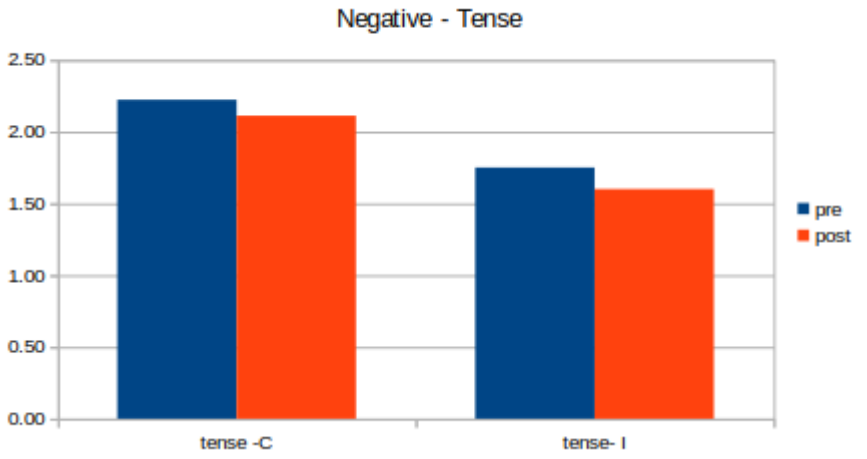
Charts – STA Positive Sentiments

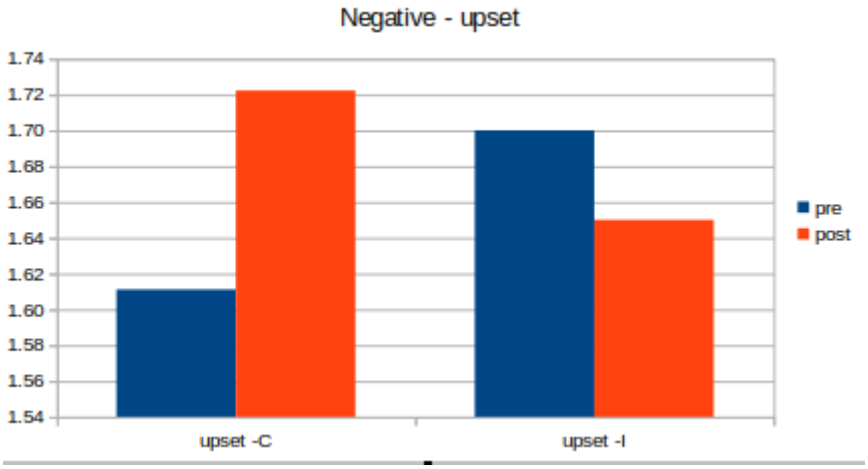


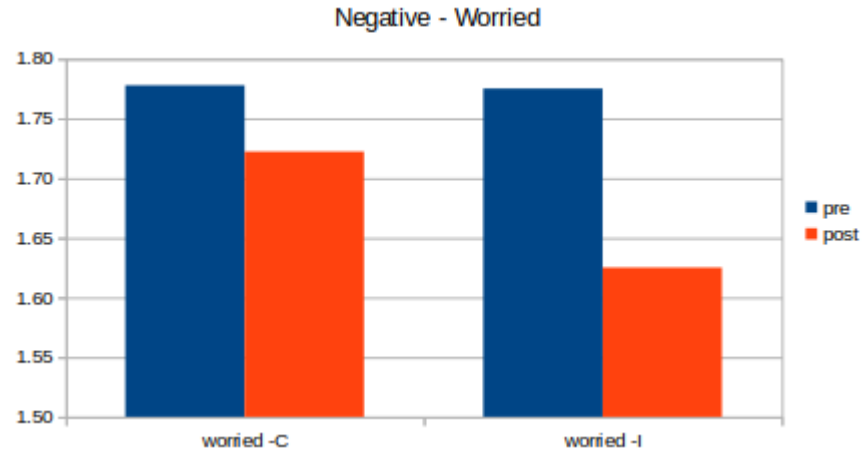




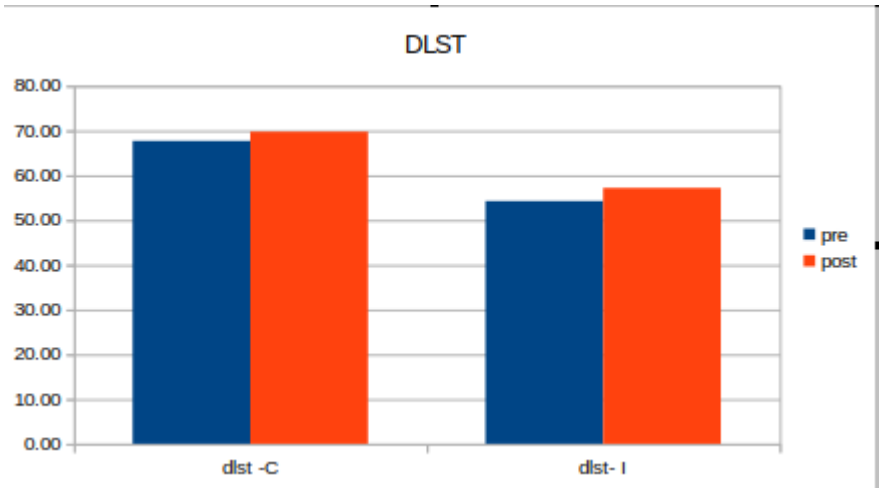
Charts – STA Negative Sentiments



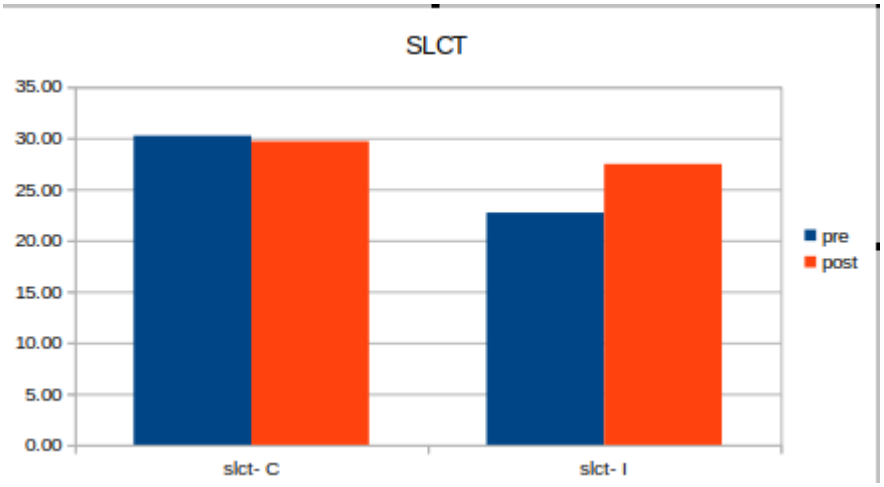




Charts – DLST



Charts – SLCT



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