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Development, validation, and feasibility of a school-based short duration integrated classroom yoga module: A pilot study design

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Abstract:

BACKGROUND: The practice of yoga is proven to have physical, cognitive and emotional benefits for school children. Despite this many schools do not include yoga in their daily schedule. The reasons cited are lack of time and resources. To overcome these problems the present study aimed to develop and validate a short duration Integrated classroom yoga module. The design guidelines were that it should be possible to practice in the classroom environment and that it could be led by the class teacher. In this way the module would overcome the problem of both time and resource.

MATERIALS AND METHODS: The study had two main phases. In the first phase, selected ICYM practices based on the literature review were validated by 21 subject matter experts using Lawhse's content validity ratio (CVR) formula. In the second phase, a pilot study using a paired sample prepost measurement design was carried out on 49 high school children. The study was conducted in June 2019. The intervention period was 1 month, and the test variables were physical fitness, cognitive performance, self-esteem, emotional well-being, and personality characteristic. Paired sample *t*-test was the analysis tool and the software used was the Statistical Package for the Social Science version 26.

RESULTS: In the Lawshe's CVR analysis, 17 out of the 24 practices tested were rated by experts as essential as was the overall module (CVR score ≥ 0.429). In the pilot study, there were significant differences in the postmean scores compared to premean scores, for all the 4 EUROFIT physical fitness testing battery tests ($P < 0.02$), all the three scores of the Stroop color-word naming task ($P < 0.001$) and the Rosenberg self-esteem scale ($P < 0.008$).

CONCLUSION: ICYM was validated and found feasible by the present study. It was found to have a statistically significant impact on physical fitness, cognitive performance, and self-esteem variables. However, a randomized control trial with a longer intervention period is needed to strengthen the present study.

Keywords:

Children's cognitive function, children's physical fitness, children's psychosocial well-being, classroom yoga, school-based yoga

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Introduction

Despite awareness of the benefits of school-based yoga, most schools either have not incorporated the practice of yoga in the school curriculum or have done so sub-optimally, usually one class a week. The reasons range from

lack of time, a packed curricular and co-curricular schedule and the need for resources such as yoga rooms, yoga mats, and trained yoga instructors. If a solution can be found to overcome the problems associated with including yoga in the daily school schedule, it will benefit children immensely.

The yogic vision of education is to lay the foundations of character and personality

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based on self-transformation.^[1] Yoga is a system of disciplines for furthering an integrated development of multiple aspects of the individual's personality. Through asanas (physical postures) the body is maintained in a steady and supple state. By the practice of pranayama (breathing exercises) emotional stability, self-confidence and self-control are developed. Through dhyana (meditation) the turbulent mind is stilled. The practice of yoga creates a balance in the personality.^[2]

Over the last three decades, modern research has demonstrated positive results of yoga on children. Serwacki and Cook-Cottone^[3] reviewed 12 preliminary studies of yoga in schools and found that yoga had a positive effect on cognitive performance, emotional well-being, anxiety and negative behavior. Physical fitness was shown to be positively associated with yoga.^[4]

Another factor for considering school-based yoga is its possible role in promoting health literacy. Studies have found a correlation between health literacy and health promotion. A study by Karimi *et al.*, 2019^[5] defined health literacy as the degree to which people are able to choose, understand, process, communicate, and get information for their health. They hypothesized that health literacy aids correct decision making regarding disease prevention, health promotion and for improving quality of life. The authors conducted a randomized controlled study with adolescents where the intervention comprised the dissemination of the PBL health literacy program. They found that the average level of health literacy in the intervention group increased significantly, specifically in the self-efficacy dimension. Another study with adolescents by Bayati *et al.*, 2018^[6] found a direct significant correlation of health literacy with all the dimensions of health-promotion. A study with students found a significant relationship between adopting health promoting lifestyle and aspects of spiritual growth, stress management and general quality of life.^[7] An aspect of school-based yoga is the dissemination of self-care knowledge. Hyde, 2012^[8] says that school-based yoga as critical-emancipatory pedagogy, effectively uses national standards for physical education, health and safety and social-emotional learning to provide self-care knowledge and skills to students and teachers. Hence, yoga may be considered beneficial from the perspective of health literacy too.

The problems of the packed school schedule, time and resources come in the way of incorporating yoga in the daily school schedule. We hypothesize that a short duration integrated classroom yoga module (ICYM) can potentially overcome the problem of time and resources. The short duration would make it possible to be practiced in the first period of the day without impinging materially on the time for academic lessons.

Further, the class-teacher can lead the practice in the limited spaces of the classroom environment. This ensures that no additional resources will be required. Traditional texts of yoga too support its practice in the classroom. Yogabhakti Saraswati says that children enter the class with different states of mind. Yoga in the classroom helps to harmonize their minds and create the right balance between excitement and alertness.^[2] The objective of this study was to develop a validated short duration ICYM and confirm its feasibility and efficacy with a pilot study design.

Materials and Methods

The present study adopted a phased methodology to develop, validate and confirm the feasibility and efficacy of the school-based short duration ICYM. In the first phase, yoga practices were selected based on a review of ancient and contemporary literature on yoga. In the second phase, the content validity of the selected practices was assessed by a panel of 21 subject matter experts. The content validity was calculated using Lawshe's content validity ratio (CVR) formula.^[9] In the third phase, the validated ICYM was developed. In the fourth phase a pilot study was conducted to confirm the feasibility and ascertain the efficacy of the module. Figure 1 shows the four phases adopted in the study. The study was approved by the Institutional ethics committee of S-VYASA University (reference number: RES/IEC-SVYASA/145/2019).

Designing integrated classroom yoga module based on literature review

Ancient and contemporary texts of yoga were reviewed to develop the content of the module. The ancient texts reviewed were Patanjali yoga sutra,^[10] Hatha yoga pradiipika,^[11] Gheranda Samhita,^[12] Siva Samhita,^[13] Svetasvatara Upanishad,^[14] and Brhdaranyaka

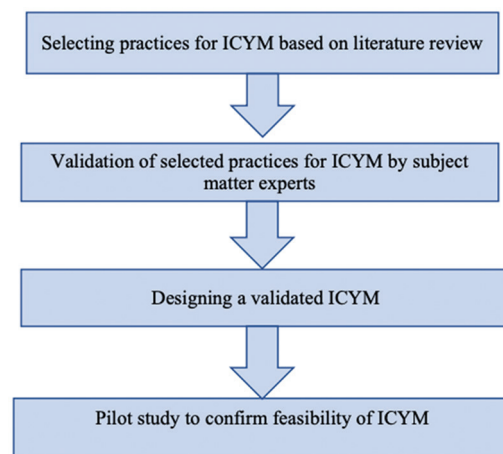


Figure 1: Phases in developing a validated school-based integrated classroom yoga module

Upansidhad.^[15] The contemporary texts reviewed were Light on Yoga,^[16] Asana Pranayama Mudra Bandha^[17] and Integrated yoga therapy for positive health.^[18] At an overall level, these texts make out a compelling case for making yoga integral to children's education.

According to Niranjanananda^[1] the purpose of education is to develop a fully integrated personality by laying the foundations of character and personality. He elaborates on this theme by stating that there are two main ingredients to achieve this objective. The first is the development of discrimination between what is worthy and what is not and the second is the development of a spiritual attitude in order to face life with courage and fortitude. Being self-transformative, yoga aids in the development of discrimination and a spiritual attitude. Satyananda^[2] says that yoga has immense benefits for children. It gently massages the endocrine glands whose proper functioning is critical for growing bodies. Regular practice of yoga brings about emotional stability and enhances self-confidence, self-awareness and self-control.

Patanjali yoga sutra says that only a still mind is capable of concentration and higher perception. It advises constant practice and an attitude of nonattachment to bring the mind under control. Asanas (physical postures) make the body firm and still. It lessens the natural restlessness of the body making it easier for the mind to concentrate. Pranayama (breathing exercises) removes *rajas* (uncontrolled restless activity) and *tamas* (uncontrolled dullness) to make the mind *sattvic* (controlled gentle steadiness). This in turn makes the mind fit for concentration. Dharana (concentration) and Dhyana (meditation) trains the mind to focus on one subject effortlessly.^[10] Hatha yoga pradipika states that asanas (physical postures) steadies the body, makes it supple, induces relaxation and facilitates free flow of prana (vital energy). The practice of pranayama (breathing exercises) increases pranic force and balances the mind. The left and right hemispheres of the brain are balanced to allow both the logical and intuitive faculties to function.^[11] Gheranda Samhita says yoga calms the mind and brings the whole personality under control, moderation and balance.^[12] According to Siva samhita yoga helps to develop an attitude of cheerfulness, enthusiasm and courage.^[13]

Modern research has corroborated many of the claims made by ancient texts of yoga. Studies have shown that yoga had a beneficial effect on physical fitness.^[19] It improved musculoskeletal health.^[20] It impacted cardiopulmonary health positively,^[21-23] and improved neuromuscular health.^[23-25] Studies have associated yoga with significant improvements in memory, attention and executive function.^[26-28] Yoga enhanced self-esteem,^[29,30] and improved self-efficacy,

self-regulation and self-adjustment.^[31-33] Yoga helped improve mood state, depression, anger and anxiety.^[34-36] Ferreira-Vorkapic *et al.*^[37] reviewed nine randomized control trial studies and found positive effects of yoga on mood indicators, tension, anxiety, self-esteem and memory. Yoga had a positive impact on three types of response patterns called *gunas*. A study showed an increase in *sattva* (controlled gentle steadiness) and reduction in *rajas* (uncontrolled restless activity) and *tamas* (uncontrolled dullness).^[38] Om chanting has been shown to activate the neural region, increase oxygenation, give psychological relaxation, relieve stress and provide vigor.^[39,40] Pradhan and Derle^[41] reported that chanting Gayatri mantra improved attention.

The ancient and contemporary literature on yoga were scanned to identify and evaluate practices beneficial for physical fitness, cognitive performance and emotional well-being of children. Only practices that could be performed in the confined spaces of the classroom environment were evaluated. Table 1 lists the selected practices of asanas (physical postures), Table 2 lists the selected practices of pranayama (breathing exercises), and Table 3 lists the selected dhyana (meditation) and mantra (chanting) practices and summarizes their benefits as referred in yoga texts. The literature review found that all 14 asanas selected impacted physical fitness, 11 asanas were associated with cognitive performance and 6 with emotional wellbeing. Of the 7 pranayama practices (breathing exercises) selected, 5 had a positive effect on physical fitness and all 7 were beneficial for cognitive and emotional well-being. The 3 dhyana (meditation) and mantra (chanting) practices were found to promote cognitive performance and emotional well-being.

Validation of Integrated classroom yoga module by subject matter experts

The 24 practices selected from literature review were incorporated in 4 alternate sets of yoga module. These sets were meant to be rotated from 1 day to the next. A questionnaire was prepared for yoga experts. They were required to validate the practices on a three-point scale:

1. Not essential: Has no role in improving physical fitness, cognitive performance, emotional wellbeing or personality characteristics of school children
2. Useful but not essential: Useful but not important in improving physical fitness, cognitive performance, emotional well-being or personality characteristics of school children
3. Essential: Very important for improving physical fitness, cognitive performance, emotional wellbeing or personality characteristics of school children.

The questionnaire further required them to rate the yoga module as a whole on its ability to achieve the objectives

Table 1: Asanas (physical postures) selected from literature review

Asanas (physical postures)	Benefits	Textual references
Sideways bending/twisting		
Katichakrasana	Tones upper body; corrects posture; relieves stress	Asana Pranayama Mudra Bandha. Satyananda (2009)
TirikayaTadasana	Exercises and balances side muscles	Asana Pranayama Mudra Bandha. Satyananda (2009)
ArdhakatiChakrasana	Stimulates sides and spine; improves liver function	Positive Health. Nagarathna and Nagendra (2011)
Parsvakonnasana	Tones lower body; increases peristaltic activity	Light on Yoga. Iyengar (2012)
Forward and backward bending		
Prasarita Padohasthasana + Ardachakrasana	Develops lower body muscles; improves flexibility, increase blood flow to head region	Light on Yoga. Iyengar (2012)
Padahasthasana + Ardachakrasana	Tones abdomen; improves digestive health; improves metabolism, improves concentration	Light on Yoga. Iyengar (2012) Positive Health. Nagarathna and Nagendra (2011) Asana Pranayama Mudra Bandha. Satyananda (2009)
Padahasthasana + Hastauthanasana	Tones abdomen; improves digestive health; improves metabolism, improves concentration	Light on Yoga. Iyengar (2012) Positive Health. Nagarathna and Nagendra (2011) Asana Pranayama Mudra Bandha. Satyananda (2009)
Stretching		
Tadasana	Lightness; mental agility; physical and mental balance; tones nerves	Light on Yoga. Iyengar (2012) Asana Pranayama Mudra Bandha. Satyananda (2009)
ParivrittaTrikonasana	Tones lower body; invigorates abdominal organs; stimulates nervous system	Light on Yoga. Iyengar (2012) Asana Pranayama Mudra Bandha. Satyananda (2009)
Gaumukhasana	Tones upper body; regulates endocrine system; regulates prana flow; steadies body and calms mind, increases energy and awareness	Hatha Yoga Pradipika. Muktibodhananda (1985) Gheranda Samhita. Niranjananda (2012) Light on Yoga. Iyengar (2012) Asana Pranayama Mudra Bandha. Satyananda (2009)
Ardhachandrasana	Strengthens lower body and abdomen; improves digestion; improves balance	Gheranda Samhita. Niranjananda (2012) Light on Yoga. Iyengar (2012) Asana Pranayama Mudra Bandha. Satyananda (2009)
Balancing		
Vrkshasana	Improves balance; strengthens lower body; promotes kidney health	Gheranda Samhita. Niranjananda (2012) Light on Yoga. Iyengar (2012)
Garudasana	Strengthens and loosens body; tones nerves, develops concentration	Gheranda Samhita. Niranjananda (2012) Light on Yoga. Iyengar (2012) Asana Pranayama Mudra Bandha. Satyananda (2009)
Veeerbhadrasana Pose III	Creates harmony and balance; tones abdomen; gives vigour; improves concentration	Light on Yoga. Iyengar (2012) Asana Pranayama Mudra Bandha. Satyananda (2009)

of impacting physical fitness, cognitive performance, emotional wellbeing and personality characteristics of school children. The rating was on a three-point scale.

1. Not at all
2. Moderately
3. Very much.

Open ended suggestions for improvement of the module were also solicited in the questions.

The experts were selected based on convenience sampling. 21 yoga experts responded to the questionnaire. Lawshe's CVR formula was the statistical tool employed to analyze the data.^[9]

Designing a validated integrated classroom yoga module

Definition of Integrated classroom yoga module

The premise worked on was that a short duration yoga module, amenable to be led by the class teacher

and possible to practice in the limited spaces of the classroom environment would encourage schools to incorporate yoga in their daily schedule. ICYM was thus conceived as a 12-min integrated yoga module to be practiced in the limited spaces of the classroom environment. It could be led by the class teacher after a 1-week training in the practice and a working theory of yoga.

The integrated module included different limbs of yoga namely asanas (physical postures), pranayama (breathing exercises), dhyana (meditation) and mantra (chanting). The design was based on three predefined criteria:

1. It should be an integrated yoga module
2. It should be possible to practice the module in the limited spaces of the classroom environment
3. The choice of practices should have the ability to impact physical fitness, cognitive performance, emotional well-being and personality characteristics of school children.

Table 2: Pranayama (Breathing exercises) selected from literature review

Pranayama (breathing exercises)	Benefits	Textual reference
Bhastrika	Stimulates cerebral region; strengthens nervous system; oxygenates blood; stimulates heart; detoxification; unblocks prana movement; stimulates metabolism; lowers stress; induces clarity of thought and improves concentration	Hatha Yoga Pradipika. Muktibodhananda (1985) Gheranda Samhita. Niranjananda (2012) Light on Yoga. Iyengar (2012) Asana Pranayama Mudra Bandha. Satyananda (2009)
Ujjai	Relaxes; develops psychic sensitivity; internalises the senses; calms the mind; promotes cardio and digestive health	Hatha Yoga Pradipika. Muktibodhananda (1985) Gheranda Samhita. Niranjananda (2012) Light on Yoga. Iyengar (2012) Asana Pranayama Mudra Bandha. Satyananda (2009)
Yogic breathing (abdominal)	Relaxed and comfortable breathing; gives vitality and calmness; clarity of thought	Asana Pranayama Mudra Bandha. Satyananda (2009) Positive Health. Nagarathna and Nagendra (2011)
Nadi Shudhi	Purifies nadis; increases prana capacity; eliminates bodily disorders; makes breathing rhythmic; soothes nerves; stills the mind; balances brain hemispheres; improves concentration	Hatha Yoga Pradipika. Muktibodhananda (1985) Gheranda Samhita. Niranjananda (2012) Light on Yoga. Iyengar (2012) Asana Pranayama Mudra Bandha. Satyananda (2009) Positive Health. Nagarathna and Nagendra (2011)
Sheetali and Sadanta	Cools the body and mind; keeps teeth and gums healthy; harmonises the endocrine system; reduces BP; encourages flow of prana; gives vigour; gives inner tranquillity	Hatha Yoga Pradipika. Muktibodhananda (1985) Gheranda Samhita. Niranjananda (2012) Light on Yoga. Iyengar (2012) Asana Pranayama Mudra Bandha. Satyananda (2009) Positive Health. Nagarathna and Nagendra (2011)
Bhramari	Awakens psychic sensitivity; relieves anxiety; alleviates anger; reduces BP; helps in throat ailments; creates healing capacity	Hatha Yoga Pradipika. Muktibodhananda (1985) Gheranda Samhita. Niranjananda (2012) Asana Pranayama Mudra Bandha. Satyananda (2009) Positive Health. Nagarathna and Nagendra (2011)

Table 3: Dhyana (meditation) and mantra (chanting) practices shortlisted from literature review

Meditation/Chanting	Benefits	Textual reference
Dhyana (meditation) Mauna	Control over mind; stillness, one pointedness, continuous awareness; deep relaxation; reduced metabolic rate; light and expansive feeling	Patanjali Yoga Sutra. Vivekananda (1986) Hatha Yoga Pradipika. Muktibodhananda (1985) Gheranda Samhita. Niranjananda (2012) Positive Health. Nagarathna and Nagendra (2011)
Mantra (chanting) OM and Gayatri Mantras	Steadies the senses and quietens the mind; balances the emotions; purifies the mind	Svetasvatara Upanishad. Tejomayananda (2011) Bhadaranyaka Upanishad. Madhavananda (1934) Positive Health. Nagarathna and Nagendra (2011)

Designing a validated Integrated classroom yoga module

The validated practices were incorporated in the ICYM. From the open-ended suggestions given by experts we thought it useful to include a positive affirmation practice. Another suggestion incorporated was to slow down the pace of the practice to ensure that children were not tired. The parameters followed to design the module were:

1. The module duration was 12 min
2. Two sets were to be made meant to be practiced on alternate days to provide variety and derive more benefits
3. The practice was to start with dhyana (meditative silence) to harmonize the mental state of the cohort
4. The asanas (physical postures) that followed would comprise side bending or twisting, forward and backward bending, stretching and balancing to ensure that the whole body was exercised

5. The asanas were to be followed by pranayama (breathing exercises)
6. At the tail end, there was dhyana (meditative silence) and OM chanting to relax the body and mind. The module ended with a positive affirmation.

The ICYM module is presented in Table 4.

Pilot study to confirm the feasibility of integrated classroom yoga module

Design

The aim of the pilot study was to test the feasibility and efficacy of the validated ICYM in a school setting. The design was a paired sample prepost measurement of means of physical fitness, cognitive performance, self-esteem, emotional well-being, and personality characteristic variables.

Table 4: Integrated classroom yoga module: Set 1 and Set 2 practiced on alternate days

Yoga practice	Set 1		Yoga practice	Set 2	
	Time	Description		Time	Description
Dhyana (Meditative silence)	1 min	Sit straight with eyes closed. Attention on breathing. Watch your thoughts flowing	Dhyana (Meditative silence)	1 min	Sit straight with eyes closed. Attention on breathing. Watch your thoughts flowing
Asanas			Asanas		
Katichakrasana	1 min	20 rounds	Ardhakatichakrasana	1 min	Hold for 7 counts on each side
Hastauthanasana/ Padahasthasana	1 min	3 rounds backward-forward bending. On 4 th round hold for 7 counts on backward bend and then on forward bend	Ardhachakrasana/ Padahasthasana	1 min	3 rounds of backward-forward bending. On 4 th round hold for 7 counts on back bend and then
Tadasana	1 min	3 rounds of up and down followed by 1 round of holding for 10 counts	Gaumukhasana (standing)	1 min	Hold on each side to the count of 10
Vrkhsasana	1 min	Hold on each side for 10 counts	Garudasana	1 min	Hold on each side for 10 counts
Pranayama			Pranayama		
Yogic breathing (abdominal)	1 min	10 rounds	Yogic breathing (abdominal)	1 min	10 rounds
Nadi Shudhi	2 min	6 rounds	Nadi Shudhi	2 min	6 rounds
Bhramari	1 min	6 rounds	Bhramari	1 min	6 rounds
OM chanting	1 min	6 rounds	OM chanting	1 min	6 rounds
Dhyana	1 min	Mentally recap the practices. Attention on breathing	Dhyana	1 min	Mentally recap the practices. Attention on breathing
Affirmation			Affirmation		
I am a powerful soul	0.5 min	3 rounds	I am a loveful soul	0.5 min	3 rounds
Closing	0.5 min	Rub palms, massage eyes, face, neck. With a few blinks open eyes	Closing	0.5 min	Rub palms, massage eyes, face, neck. With a few blinks open eyes
Total timing	12 min	Total timing	12 min		

Participants

The participants for the present study were selected from an urban campus of the multi-campus Samsidh Mount Litera Zee School group in Bengaluru, India. The participants were selected randomly from Grades 7–10. A grade-wise quota was predecided, and equal gender ratio was fixed. The selection of participants was made blindly and randomly by drawing from paper slips. The inclusion criteria were: (i) participants must be from Grades 7–10 and (ii) of both genders. The exclusion criteria were: (i) any history of major physical illness or surgery in the past 2 months, (ii) any mental illness and (iii) any condition where physical activity was contraindicated.

Intervention

The intervention period was 1 month, with 5 days a week of practice in the beginning of the first period of the school day. The class teachers were trained by qualified yoga instructors over daily 1 h sessions for 7 days. The training included an overview of the discipline of yoga and its various limbs. The benefits of each practice were conveyed to them. Each yoga exercise was demonstrated and practiced. Teachers had to lead mock sessions. A video of the module was also given to the teachers. Every 2 weeks, there was a top-up training session conducted for the teachers.

Ethics

The study was approved by the Institutional ethics committee of S-VYASA University (reference number: RES/IEC-SVYASA/145/2019). The school administration was briefed in writing and verbally on the details of the study and the intervention. Informed consent was obtained from the school administration.

Assessment

The participants were assessed for physical fitness, cognitive performance, self-esteem, emotional well-being and personality characteristic. Four tests from EUROFIT physical fitness testing battery were conducted.^[42] The Stroop color-word naming task was used to measure cognitive performance.^[43] Rosenberg self-esteem scale^[44] and WHO-5 well-being index^[45] were utilized to measure emotional well-being. Sushruta child personality inventory (SCPI)^[46] was employed to measure child personality characteristic.

EUROFIT physical fitness testing battery

Flamingo balance test

Participants balanced on a narrow wooden bar on their preferred leg. The free leg was flexed at the knee. Number of falls in 60 s was recorded.

Sit and reach flexibility test

Participants were made to sit on the floor with both legs stretched, touching the base of a measuring table with

their spine erect. The table had a measuring scale. The initial reading on the measuring scale was taken at the point where the tip of the longest finger touched. They were then asked to stretch fully without bending their legs. The final reading where the tip of the longest finger reached was taken and the distance of stretch calculated by subtracting the initial (non stretch reading) from the final (full stretch) reading.

Sit ups trunk strength

Participants were required to lie on their back with knees bent; thighs kept at right angle to the torso and feet flat on the ground. Their hands were kept behind their head. Participants performed sit-ups from this position and returned to the initial position. The number of sit-ups in 30 s was recorded. Incomplete sit-ups were not counted.

10 × 5-m shuttle run agility test

Cones were kept at a distance of 10 m. At the word 'Go' the participants ran to the cone 10 m away and back five times without stopping. At the end of the fifth round, the timing was recorded using a stopwatch.

Stroop color-word naming task

The Stroop color-word task measures the executive function involving word, color and an interference naming response. The test consists of three pages. The first page tests how fast the participant can read out words (correct number of words read in 45 s). The second page tests how fast the participant can call out the colors (correct number of colors called in 45 s). The third page tests the speed with which the participant can name the color of the ink and disregard the word printed in that color ink (correct number of ink colors called in 45 s). The test in effect measures the participant's control over neuropsychological functions involved in color and word naming responses.^[39] The test extracts three scores, namely Stroop word score, Stroop color score and Stroop color-word score.

Rosenberg self-esteem scale

The Rosenberg self-esteem scale is a self-report scale. It is a 10-item scale measuring both positive and negative feelings associated with global self-esteem. The instrument uses a 4-point Likert scale.

WHO-5 well-being index

The WHO-5 well-being index is a self-report scale. It has 5 items measuring positive feelings associated with emotional well-being. The instrument uses a 6-point Likert scale.

Sushruta child personality inventory

The SCPI is a self-report scale measuring personality characteristic. It has 54 items and uses a binomial Yes/No scale. The scale is based on the concept that the mind is always in a dynamic equilibrium between three types

of response patterns called *gunas*. The three patterns are *Sattva* (controlled gentle steadiness), *Rajas* (uncontrolled restless activity) and *Tamas* (uncontrolled dullness).^[47] Well-being is disturbed when *Rajas* and *Tamas* become dominant.

The raw data were analyzed using the Statistical Package for the Social Science (SPSS) version 26, IBM, USA.

Results

Results of validation of Integrated classroom yoga module by subject matter experts

The ICYM was evaluated by subject matter experts ($n = 21$). The qualification of the experts was Ph.D., (Yoga) 13, MD (Yoga Therapy) 1, M.Sc., (Yoga) 2, Yoga instructors certification course 5. The mean number of years' experience in teaching yoga was $M = 19.9$ (8.57) and the range was 4–40. The characteristics of the expert panel are given in Table 5. To test content validity of subject matter expert ratings, Lawshe's CVR analysis was undertaken. Tables 6-9 gives the results of content validity for the 24 yoga practices proposed. For a panel size of 21 the CVR_{crit} was calculated at 0.429. A CVR score $\geq CVR_{crit}$ would constitute sufficient evidence to validate that practice. Conversely a CVR score $< CVR_{crit}$ would indicate insufficient evidence to validate that practice. Out of the 14 asanas (physical postures) 12 had a CVR score $\geq CVR_{crit}$. Out of the 7 pranayama practices (breathing exercises), 3 cleared the content validity test with CVR score $\geq CVR_{crit}$. 1 dhyana (meditation) and 1 mantra (chanting) practice cleared the content validity test with a CVR score $\geq CVR_{crit}$. The overall module also cleared the content validity test with a CVR score $\geq CVR_{crit}$ indicating that the overall module was rated by experts as capable of achieving its objectives.

Results of pilot study to confirm feasibility and efficacy of Integrated classroom yoga module

Participants for the pilot study were selected randomly from grades 7–10. The sample size achieved was $N = 49$. The mean age was $M = 13.63$ (1.014), range = 12–16 years and gender ratio B:G = 23:26 [Table 5]. A paired sample *t*-test was conducted to test the hypothesis that yoga

Table 5: Characteristics of subject matter experts (n=21)

Characteristic	Number
Qualification	
Ph.D. (Yoga)	13
M.Sc. (Yoga)	2
MD (Yoga)	1
Yoga instructors certification	5
Experience	
Mean (SD)	19.90 (8.57)
Range	4-40 years

SD=Standard deviation

Table 6: Validated asanas (physical postures) using Lawshe's CVR (n=21)

Asana (physical posture)	n_e	N/2	CVR ($(n_e - N/2)/N/2$)	CVR _{crit}	Select/reject
Katichakrasana	15	10.5	0.810	0.429	Select
TirikayaTadasana	13	10.5	0.429	0.429	Select
Ardhakatichakrasana	17	10.5	0.619	0.429	Select
Parsvakonanasana	15	10.5	0.429	0.429	Select
PrasaritaPadohastasana + ardhachakrasana	14	10.5	0.333	0.429	Reject
Padahastasana + ardhachakrasana	16	10.5	0.524	0.429	Select
Padahastasana + hastauthanasana	18	10.5	0.714	0.429	Select
Tadasana	17	10.5	0.619	0.429	Select
ParivrittaTrikonasana	16	10.5	0.524	0.429	Select
Gaumukhasana	16	10.5	0.524	0.429	Select
Ardhachandrasana	14	10.5	0.333	0.429	Reject
Vrkshasana	19	10.5	0.810	0.429	Select
Garudasana	16	10.5	0.524	0.429	Select
Veerbhadrasana Pose III	16	10.5	0.524	0.429	Select

n =Total number of panellists, n_e =Total number of essentials (2) for each practice, CVR=Content validity ratio, CVR_{crit}=Minimum value for acceptance based on binomial probabilities for panel size

Table 7: Validated pranayama practices (breathing exercises) using Lawshe's content validity ratio (n=21)

Asana (physical posture)	n_e	N/2	CVR ($(n_e - N/2)/N/2$)	CVR _{crit}	Select/Reject
Bhastrika	11	10.5	0.048	0.429	Reject
Ujjai	9	10.5	-0.143	0.429	Reject
Yogic breathing (abdominal)	18	10.5	0.714	0.429	Select
Nadi Shudhi	19	10.5	0.810	0.429	Select
Sheetali	12	10.5	0.143	0.429	Reject
Sadanta	10	10.5	-0.048	0.429	Reject
Bhramari	19	10.5	0.810	0.429	Select

n =Total number of panellists, n_e =Total number of essentials (2) for each practice, CVR=Content validity ratio, CVR_{crit}=Minimum value for acceptance based on binomial probabilities for panel size

Table 8: Validated meditation and chanting practices using Lawshe's content validity ratio (n=21)

Dhyana (Meditation) and Mantra (chanting)	n_e	N/2	CVR ($(n_e - N/2)/N/2$)	CVR _{crit}	Select/reject
Mauna	19	10.5	0.810	0.429	Select
OM mantra	19	10.5	0.810	0.429	Select
Gayatri mantra	12	10.5	0.143	0.429	Reject

n =Total number of panellists, n_e =Total number of essentials (2) for each practice, CVR=Content validity ratio, CVR_{crit}=Minimum value for acceptance based on binomial probabilities for panel size

Table 9: Validation of overall integrated classroom yoga module module (n=21)

Overall rating of Yoga module	n_e	N/2	CVR ($(n_e - N/2)/N/2$)	CVR _{crit}	Will Yoga module achieve objective
Can achieve objective	16	10.5	0.524	0.429	Yes

n =Total number of panellists, n_e =Total number of essentials (2) for each practice, CVR=Content validity ratio, CVR_{crit}=Minimum value for acceptance based on binomial probabilities for panel size

intervention with the validated ICYM would result in statistically significant differences in postintervention means compared to preintervention means for physical fitness, cognitive performance, self-esteem, emotional well-being, and personality characteristic variables. The intervention period was 1 month, with 5 days a week of practice. The preassessment was done in the middle of July 2019 and the postassessment in the middle of August 2019.

EUROFIT physical fitness testing battery

The paired sample *t*-test was associated with statistically significant differences in postintervention means compared to preintervention means with

small-to-medium effect sizes for all four tests, namely balance, flexibility, strength, and agility.

Flamingo balance test: $T(48) = 3.03, P = 0.004$, Cohen's $d = 0.43$.

Sit and reach flexibility test: $T(48) = 2.52, P = 0.015$, Cohen's $d = 0.36$.

Sit ups trunk strength test: $T(48) = 2.55, P = 0.014$, Cohen's $d = 0.36$.

10 × 5 m shuttle run agility test: $T(48) = 2.61, P = 0.012$, Cohen's $d = 0.37$.

Stroop color-word naming task

The paired sample *t*-test was associated with statistically significant differences in postintervention means compared to preintervention means with medium-to-large effect sizes for all three scores namely word, color and color-word.

- Word score: $T(48) = 5.41, P = 0.001, \text{Cohen's } d = 0.77$
- Color score: $T(48) = 4.24, P = 0.001, \text{Cohen's } d = 0.61$
- Color-word score: $T(48) = 4.39, P = 0.001, \text{Cohen's } d = 0.63$.

Rosenberg self-esteem scale

The paired sample *t*-test was associated with a statistically significant difference in postintervention mean compared to preintervention mean with small effect size.

$t(48) = 2.75, P = 0.008, \text{Cohen's } d = 0.39$.

The paired sample *t*-test was associated with statistically insignificant effect for the following variables:

WHO-5 well-being index

- $t(48) = 0.63, P = .532, \text{Cohen's } d = 0.09$.

SCPI:

- *Sattva* score: $T(48) = 0.07, P = 0.947, \text{Cohen's } d = 0.01$
- *Rajas* score: $T(48) = 1.92, P = 0.061, \text{Cohen's } d = 0.27$
- *Tamas* score: $T(48) = 1.88, P = 0.067, \text{Cohen's } d = 0.27$.

Table 10: Age and gender of pilot sample (n=49)

Characteristic	Number
Age (years)	13.63 (1.014)
Age range	12-16
Gender ratio (B:G)	23:26

Age is group mean (SD). SD: Standard deviation

Table 11: Variables of scales tested: Paired sample t-test

Variable	n=49		t	P	Cohen's d
	Pre	Post			
EUROFIT physicalfitness testing battery					
Flamingo balance test	7.37 (6.366)	5.12 (5.270)	3.03	0.004	0.43
Sit and reach flexibility test	13.08 (4.983)	14.94 (6.105)	2.52	0.015	0.36
Sit ups trunk strength test	19.18 (4.777)	21.12 (5.540)	2.55	0.014	0.36
10 x 5 m shuttle run agility test	15.79 (1.964)	16.33 (1.527)	2.61	0.012	0.37
Stroop color - word naming task					
Word score	92.92 (13.156)	98.59 (13.233)	5.41	0.001	0.77
Color score	58.53 (11.616)	65.82 (9.901)	4.24	0.001	0.61
Color - word score	32.14 (10.454)	37.51 (9.520)	4.39	0.001	0.63
Rosenberg self- esteem scale	27.78 (3,454)	29.10 (3.435)	2.75	0.008	0.39
WHO-5 well-being index	16.59 (4.286)	17.00 (3.953)	0.63	0.532	0.09
Sushruta child personality inventory					
<i>Sattva</i> Score	13.63 (2.118)	13.65 (1.877)	0.07	0.947	0.01
<i>Rajas</i> Score	8.82 (2.297)	8.29 (2.000)	1.92	0.061	0.27
<i>Tamas</i> Score	6.94 (2.025)	6.35 (1.964)	1.88	0.067	0.27

Pre- and Post are Group Means (SD). SD=Standard deviation

Summary of results of the pilot study

The yoga intervention with ICYM gave statistically significant differences in means for physical fitness, cognitive performance and self-esteem variables. The effect sizes ranged from small to medium in physical fitness measures, medium to large in the cognitive performance measure and small in the measure of self-esteem. The differences in means for emotional well-being and child personality characteristic variables were insignificant. It can be concluded that ICYM is feasible in improving physical fitness, cognitive performance, and self-esteem [Tables 10 and 11].

Discussion

Traditional literature on yoga makes a compelling case for its inclusion in education. It is seen as self-transformational impacting every facet of the personality to build intelligence, personality, and character. Modern research lends support to the claims made by traditional texts. Despite mounting evidence, yoga finds it difficult to get included in the school curriculum in any meaningful manner. The stated barriers are a paucity of time and need for resources. The aim of this study was to develop a validated short duration (12 min) ICYM for benefiting school children in physical fitness, cognitive performance, self-esteem, emotional well-being and personality characteristic variables. It was hypothesized that a short duration ICYM would solve the problem of time and resource and could potentially be included in the daily school schedule. Current studies on classroom yoga have tested mostly nonstandard yoga module designs, provided limited details of the intervention or suffered from sub-optimal days per week of practice. An uncontrolled pilot study by Butzer *et al.*^[48] used a 30-min classroom yoga module practiced once a week. A study by Chen and Pauwels^[49]

used a 5-15 min yoga-based activity module. Mische Lawson, Cox and Blackwell studied a 10-min yoga-based reflex integration module.^[50] The current research on short-duration classroom yoga is clearly inadequate. There is a need for a methodologically sound study with a validated short duration classroom yoga module.

ICYM was designed based on a thorough review of traditional yoga literature. The module integrated asanas (physical postures), pranayama (breathing exercises), dhyana (meditative practice), and mantra (chanting). The module was validated by yoga experts. The analysis tool used was Lawshe's CVR formula. Only practices rated essential were included in the final module. The entire module was also rated essential by the experts. The methodology used in the module validation phase of this study was consistent with earlier researches on yoga module development and validation. Isha *et al.*,^[51] developed and validated a yoga module for heart disease. A study by Kakde *et al.*,^[52] validated a yoga module on Parkinson's disease. Patil *et al.*^[53] developed and validated a yoga module for chronic lower back pain. A yoga module for children with intellectual disabilities was validated by Pise *et al.*,^[54]

The pilot study was conducted in an urban campus of the multi-campus Samsidh Mount Litera Zee School group in Bengaluru, India ($n = 49$). It found that the module was well accepted by both teachers and students. There was no problem in practicing the module in the limited spaces of the classroom environment. A paired sample *t*-test showed that the differences in postintervention means compared to preintervention means were significant for physical fitness, cognitive performance and self-esteem variables but insignificant for emotional well-being and child personality variables. The effect sizes ranged from small to medium in physical fitness measures, medium to large in the cognitive performance measure and small in the measure of self-esteem. It was concluded that ICYM has a statistically significant impact on physical fitness, cognitive performance and self-esteem measures of school children. These findings corroborate earlier researches on the effect of yoga on physical fitness, cognitive performance and self-esteem although with longer duration yoga modules. Two randomized controlled Indian studies conducted on school children found that integrated yoga practice improved physical fitness as measured by the EUROFIT testing battery. Improved BMI, speed, balance and strength were reported in one study.^[4] Improved balance, reaction time, flexibility, strength, and agility were reported in the other study.^[14] Two Indian studies with school children reported improvement in executive function as a result of yoga intervention. Purohit and Pradhan^[55] reported significant differences in the yoga group for Stroop Color-Word Task, Digit Span Test and part-A of TMT.

A study by Telles *et al.*,^[4] found that yoga intervention improved executive function as measured by the Stroop Color-Word task. Bhardwaj and Agrawal^[29] assessed the effect of yoga on the level of self-esteem in preadolescents school-going children in a randomized controlled study. The scale used was the Indian adaptation of Battle's self-esteem inventory for children. The yoga group showed a significant increase in the level of overall, general and social self-esteem. In another study with school children, Sethi *et al.*,^[56] showed a significant increase in self-esteem scores.

The methodology used in the pilot phase of the study was consistent with earlier researches that tested feasibility of customized yoga modules. Bhat *et al.*,^[57] conducted a pilot study for a yoga module to treat Obsessive compulsive disorder with 17 patients. Patil *et al.*^[53] tested the feasibility of a module for chronic lower back pain with 12 patients. A module for depression was tested with 7 patients.^[58] Hariprasad *et al.*^[59] conducted a pilot study on a module for the elderly with 10 elders.

The present study is unique since it has developed a validated school-based short duration classroom yoga module. The interventions used in earlier studies were nonstandard. The strengths of the study are (i) the ICYM was developed methodically based on ancient and contemporary yoga literature; (ii) it was an integrated module incorporating physical postures, breathing practices, meditative practices, chanting and affirmation; (iii) The selected practices were validated by a sufficient number of subject matter experts and the responses were analyzed using a sound statistical tool; (iv) and importantly the validated module was subjected to a pilot study using a paired sample pre-post measurement design. The pilot study found that the module was efficacious in impacting physical fitness, cognitive performance, and self-esteem variables. The weaknesses of the study were: (i) the sample size of the pilot study was small ($n = 49$); (ii) the period of intervention was 1 month, which is short; (iii) No follow-up study was conducted to ascertain long-term benefits and (iv) the module was tested only with high school children. Its effect on smaller children is thus unknown. Future studies could be undertaken using a randomized control trial design with larger sample size and a longer period of intervention. The module could be tested with smaller children to understand its efficacy across age groups.

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Conflicts of interest

There are no conflicts of interest.

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