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 pre-post 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

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...
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 pradipika,\(^11\) Gheranda Samhita,\(^12\) Siva Samhita,\(^13\) Svetasvatara Upanishad,\(^14\) and Brhadaranyaka
Upansidhad[13] 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
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 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).

**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) |
| Parsvakononasana           | Tones lower body; increases peristaltic activity | Light on Yoga. Iyengar (2012) |
| Forward and backward bending |        |                    |
| Prasrita Padahastasana +   | Develops lower body muscles; improves flexibility, increase blood flow to head region | Light on Yoga. Iyengar (2012) |
| Ardhachakrasana            | Tones abdomen; improves digestive health; improves metabolism, improves concentration | Light on Yoga. Iyengar (2012) |
| Padahastasana +            | Tones abdomen; improves digestive health; improves metabolism, improves concentration | Light on Yoga. Iyengar (2012) |
| Ardhachakrasana            | Tones abdomen; improves digestive health; improves metabolism, improves concentration | Light on Yoga. Iyengar (2012) |
| Stretching                 |          |                    |
| Tadasana                   | Lightness; mental agility; physical and mental balance; tones nerves | Light on Yoga. Iyengar (2012) |
| ParivrittaTrikonasana      | Tones lower body; invigorates abdominal organs; stimulates nervous system | Light on Yoga. Iyengar (2012) |
| Gaumukhasana               | Tones upper body; regulates endocrine system; regulates prana flow; steadies body and calms mind, increases energy and awareness | Hatha Yoga Pradipika. Muktidhanya (1985) |
| Ardhachandrasana           | Strengthens lower body and abdomen; improves digestion; improves balance | Gheranda Samhita. Niranjana (2012) |
| Balancing                  |          |                    |
| Vrkshasana                 | Improves balance; strengthens lower body; promotes kidney health | Gheranda Samhita. Niranjana (2012) |
| Garudasana                 | Strengthens and loosens body; tones nerves, develops concentration | Gheranda Samhita. Niranjana (2012) |
| Veerbhadrasana Pose III    | Creates harmony and balance; tones abdomen; gives vigour; improves concentration | Gheranda Samhita. Niranjana (2012) |
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.
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.

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

| Yoga practice | Time | Description | Yoga practice | Time | Description |
|---------------|------|-------------|---------------|------|-------------|
| **Set 1**     |      |             | **Set 2**     |      |             |
| 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        |      |             |               |      |             |
| Katichakrasana | 1 min | 20 rounds   | Ardhakatichakrasana | 1 min | Hold for 7 counts on each side |
| Hastauhanasana/Padahastasana | 1 min | 3 rounds backward-forward bending. On 4th round hold for 7 counts on backward bend and then on forward bend | Ardhachakrasana/Padahastasana | 1 min | 3 rounds of backward-forward bending. On 4th 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 |
| Vrkhasana     | 1 min | Hold on each side for 10 counts | Garudasana | 1 min | Hold on each side for 10 counts |
| 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   |      |             |               |      |             |
| I am a powerful soul | 0.5 min | 3 rounds | I am a powerful 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 | **Total timing** | 12 min | Total timing |

**Participants**

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. The Stroop color-word naming task was used to measure cognitive performance. Rosenberg self-esteem scale and WHO-5 well-being index were utilized to measure emotional well-being. Sushruta child personality inventory (SCPI) 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 size was calculated at 0.429. A CVR score ≥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 ≥CVR crit. Out of the 7 pranayama practices (breathing exercises), 3 cleared the content validity test with CVR score ≥CVR crit. 1 dhyana (meditation) and 1 mantra (chanting) practice cleared the content validity test with a CVR score ≥CVR crit. The overall module also cleared the content validity test with a CVR score ≥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
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 $d = 0.37$.

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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| 0.714                  | 0.429    | Select        |
| TirkayaTadasana                    | 13    | 10.5| 0.333                  | 0.429    | Select        |
| ArdhakatiChakrasana                | 17    | 10.5| 0.619                  | 0.429    | Select        |
| Parsvakonasana                     | 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    | Select        |
| 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        |

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    | Select        |
| Sadanta                           | 10    | 10.5| −0.048                 | 0.429    | Reject        |
| Bhramari                          | 19    | 10.5| 0.810                  | 0.429    | Select        |

Table 8: Validated meditation and chanting practices 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 |
|-----------------------------------|-------|-----|------------------------|----------|---------------|
| 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    | Select        |

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                                |
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: \( T(48) = 5.41, P = 0.001 \), Cohen’s \( d = 0.77 \)
- Color score: \( T(48) = 4.24, P = 0.001 \), Cohen’s \( d = 0.61 \)
- Color-word score: \( T(48) = 4.39, P = 0.001 \), 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
- \( t(48) = 0.63, P = .532, \text{Cohen’s } d = 0.09. \)

Discussion

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].

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   |

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

| Variable                          | Pre     | Post    | t       | P       | Cohen’s d |
|-----------------------------------|---------|---------|---------|---------|-----------|
| EUROFIT physical fitness 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 × 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 |         |         |         |         |           |
| Satva score                       | 13.63 (2.118) | 13.65 (1.877) | 0.07     | 0.947   | 0.01      |
| Rajas score                       | 8.82 (2.297) | 8.29 (2.000) | 1.92     | 0.061   | 0.27      |
| Tamas 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
used a 5-15 min yoga-based activity module. Mische Lawson, Cox and Blackwell studied a 10-min yoga-based reflex integration module. 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. developed and validated a yoga module for heart disease. A study by Kakde et al. validated a yoga module for Parkinson’s disease. Patil et al. 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.

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. Improved balance, reaction time, flexibility, strength, and agility were reported in the other study. Two Indian studies with school children reported improvement in executive function as a result of yoga intervention. Purohit and Pradhan 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. found that yoga intervention improved executive function as measured by the Stroop Color-Word task. Bhardwaj and Agrawal 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. 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. conducted a pilot study for a yoga module to treat Obsessive compulsive disorder with 17 patients. Patil et al. tested the feasibility of a module for chronic lower back pain with 12 patients. A module for depression was tested with 7 patients. Hariprasad et al. 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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There are no conflicts of interest.

References

1. Niranjanananda S. Yoga Education for Children. Vol. 2., 2nd ed. Munger, India: Yoga Publication Trust; 2012.
2. Satyanand S. Yoga Education for Children; 1990. Vol. 1., 1st ed. Munger, India: Yoga Publications Trust; 2013.
3. Serwacki ML, Cook-Cottone C. Yoga in the Schools: A systematic review of the literature. Int J Yoga Therap 2012;22:101-10.
4. Telles S, Singh N, Bhardwaj AK, Kumar A, Balkrishna A. Effect of yoga or physical exercise on physical, cognitive and emotional measures in children: A randomized controlled trial. Child Adolesc Psychiatry Ment Health 2013;7:37.
5. Karimi N, Saadat-Gharin S, Tol A, Sadeghi R, Yaseri M, Mohabbi B. A problem-based learning health literacy intervention program on improving health-promoting behaviors among girl students. J Educ Health Promot 2019;8:251.
6. Bayati T, Dehghan A, Bonyadi F, Bazrafkan L. Investigating the effect of education on health literacy and its relation to health-promoting behaviors in health center. J Educ Health Promot 2018;7:127.
7. Tol A, Tavassoli E, Shariferad GR, Shojaezadeh D. Health-promoting lifestyle and quality of life among undergraduate students at school of health, Isfahan University of Medical Sciences. J Educ Health Promot 2013;2:11.
8. Hyde A. The yoga in schools movement: Using standards for educating the whole child and making space for teacher self-care. Countertopoints 2012;425:109-26.
9. Ayre C, Scally AJ. Critical values for Lawshe’s content validity ratio: Revisiting the original methods of calculation. Meas Eval Couns Dev 2014;47:79-86.
10. Vivekananda S. The Complete Works of Swami Vivekananda. Vol. 1., 17th ed. Kolkata, India: Advaita Ashrama; 2012. p. 195-305.
11. Muktitobhadana S. Hathya Yoga Pradipika. 3rd ed. Munger, India: Yoga Publications Trust; 2012.
12. Niranjanananda S. Gheranda Samhita. 1st ed. Munger, India: Yoga Publications Trust; 2012.
13. Vasu SC. Siva Samhita. Varanasi, India: Indian Mind; 2012.
14. Tejomayananda S. Svetsavatara Upanishad. 1st ed. Mumbai, India: Central Chinmaya Mission Trust; 2013.
15. Madhavananda S. Brhadaranyakaya Upanishad. 1st ed. Kolkata, India: Advaita Ashrama; 1934.
16. Iyengar BK. Light on Yoga. 1st ed. Noida, India: HarperCollins Publishers; 2012.
17. Satyanandra S. Asana Pranayama Mudra Bandha. 3rd ed. Munger, India: Yoga Publications Trust; 2009.
18. Nagarathna R, Nagendra HR. Integrated Approach of Yoga Therapy for Positive Health. 1st ed. Bangalore, India: Swami Vivekananda Yoga Prakashana; 2011.
19. Purohit SP, Pradhan B, Nagendra HR. Effect of yoga on EUROFIT physical fitness parameters on adolescents dwelling in an orphan home: A randomized control study. Vulnerable Child Youth Stud 2016;11:33-46.
20. Raghuraj P, Nagarathna R, Nagendra HR, Telles S. Pranayama increases grip strength without lateralized effects. Indian J Physiol Pharmacol 1997;41:129-33.
21. Telles S, Narendran S, Raghuraj P, Nagarathna R, Nagendra HR. Comparison of changes in autonomic and respiratory parameters of girls after yoga and games at a community home. Percept Mot Skills 1997;84:251-7.
22. Shivakumar DP, Suthakar DS, Urs DS. Effect of Selected Yogic Exercises on Cardiovascular Endurance and Lung Capacity of Secondary School Children. Int J Eng Sci Comput 2016;6:7286-9.
23. Kumar S. Effects of suryanamaskar on cardio vascular and respiratory parameters in school students. Recent Research in Science and Technology. 2011;28:3.
24. Dash M, Telles S. Yoga training and motor speed based on a finger tapping task. Indian J Physiol Pharmacol 1999;43:458-62.
25. Shavanani AB, Udupa KA. Acute effect of Mukh bhastrika (a yogic bellows type breathing) on reaction time. Indian J Physiol Pharmacol 2003;47:297-300.
26. Chaya MS, Nagendra H, Selvam S, Karpad A, Srinivasan K. Effect of yoga on cognitive abilities in schoolchildren from a socioeconomically disadvantaged background: A randomized controlled study. J Altern Complement Med 2012;18:1161-7.
27. Verma A, Shete SU, SinGhth AK. The effect of yoga practices on cognitive development in rural residential school children in India. Memory 2014;6:6-24.
28. So KT, Orme-Johnson DW. Three randomized experiments on the longitudinal effects of the Transcendental Meditation technique on cognition. Intelligence 2001;29:419-40.
29. Bhardwaj AK, Agrawal G. Yoga practice enhances the level of self-esteem in pre-adolescent school children. Int J Phys Sci Soc 2013;3:189-99.
30. Randal C, Pratt D, Bucci S. Mindfulness and self-esteem: A systematic review. Mindfulness 2015;6:1366-78.
31. Das M, Deepeshwar S, Subramanya P, Manjunath NK. Influence of yoga-based personality development program on psychomotor performance and self-efficacy in school children. Front Pediatr 2016;4:62.
32. Bergen-Cico D, Razza R, Timmins A. Fostering self-regulation through curriculum infusion of mindful yoga: A pilot study of efficacy and feasibility. J Child Fam Stud 2015;24:3448-61.
33. Bhardwaj PR, Mookherjee R, Bhardwaj AK. Self-adjustment in school going adolescents following three months of comprehensive yoga program. Online J Multidiscip Res 2015;1:14-21.
34. Noggle JJ, Steiner NJ, Minami T, Khalsa SB. Benefits of yoga for psychosocial well-being in a US high school curriculum: A preliminary randomized controlled trial. J Dev Behav Pediatr 2012;33:193-201.
35. Felver JC, Celis-de Hoyos CE, Tezanos K, Singh NN. A systematic review of mindfulness-based interventions for youth in school settings. Mindfulness 2016;7:34-45.
36. Gusain R, Dauneria S. Shannukhi mudra with pranayama has significant effect on anxiety level of children aged 12 to 13 years. Int J Phys Educ Sports Manage Yogic Sci 2016;6:17-21.
37. Ferreira-Vorkapic C, Feitoza JM, Marchioro M, Simões J, Kozaza E, Telles S. Are there benefits from teaching yoga at schools? A systematic review of randomized control trials of yoga-based interventions. Evid Based Complement Alternat Med 2015;2015:345835.
38. Patil SS, Nagendra HR. Effect of yoga personality development camp on the triguna in children. Voice Res 2014;3:19-21.
39. Gurjar AA, Ladhake  SA. Time‑frequency analysis of chanting Sanskrit divine sound “OM” mantra. Int J Compu Comput Sci Netw Secur 2008;8:170-5.
40. Harne BP, Tahseen AA, Hiwale AS, Dhekekar RS. Survey on Om meditation: Its effects on the human body and Om meditation as a tool for stress management. Psychol Thought 2019;12:1-1.
41. Pradhan B, Derle SG. Comparison of effect of Gayatri Mantra and Poem Chanting on Digit Letter Substitution Task. Anc Sci Life 2012;32:89-92.
42. Kemper HC, Van Mechelen W. Physical fitness testing of children: A European perspective. Pediatr Exerc Sci 1996;8:201-14.
43. Jensen AR, Rohwer WD Jr. The Stroop color-word test: A review. Acta Psychol (Amst) 1966;25:36-93.
44. Rosenberg M. Rosenberg self-esteem scale (RSE). Acceptance and commitment therapy. Meas Package 1965;61:18.
45. Topp CW, Østergaard SD, Søndergaard S, Bech P. The WHO-5 well-being index: A systematic review of the literature. Psychother Psychosom 2015;84:167-76.
46. Suchitra SP, Nagendra HR. A Self-Rating Ayurveda Scale to Measure the Manasika Prakrti of the Children. Global Journal of Medical Research 2014.
47. Deshpande S, Nagendra HR, Nagarathna R. A randomized control trial of the effect of yoga on Gunas (personality) and Self esteem in normal healthy volunteers. Int J Yoga 2009;2:13-21.
48. Butzer B, Day D, Potts A, Ryan C, Coulombe S, Davies B, et al. Effects of a classroom-based yoga intervention on cortisol and behavior in second- and third-grade students: A pilot study. J Evid Based Complementary Altern Med 2015;20:41-9.
49. Chen DD, Pauwels L. Perceived benefits of incorporating yoga into classroom teaching: Assessment of the effects of “yoga tools for teachers”. Adv Phys Educ 2014;4:138.
50. Mische Lawson LA, Cox J, Blackwell AL. Yoga as a classroom intervention for pre-schoolers. J Occup Ther Sch Early Interv 2012;5:126-37.
51. Isha S, Deshpande S, Ganpat TS, Nagendra HR. Yoga module for heart disease. J Mahatma Gandhi Inst Med Sci 2015;20:153.
52. Kakde N, Metri KG, Varambally S, Nagarathna R, Nagendra HR. Development and validation of a yoga module for Parkinson disease. Journal of Complementary and Integrative Medicine. 2017;14.
53. Patil NJ, Nagarathna R, Tekur P, Patil DN, Nagendra HR, Subramanya P. Designing, validation, and feasibility of integrated yoga therapy module for chronic low back pain. Int J Yoga 2015;8:103-8.
54. Pise V, Pradhan B, Gharote MM. Validation of yoga module for children with intellectual disabilities. Ind Psychiatry J 2017;26:151-4.
55. Purohit SP, Pradhan B. Effect of yoga program on executive functions of adolescents dwelling in an orphan home: A randomized controlled study. J Tradit Complement Med 2017;7:99-105.
56. Sethi JK, Nagendra HR, Sham Ganpat T. Yoga improves attention and self-esteem in underprivileged girl student. J Educ Health Promot 2013;2:55.
57. Bhat S, Varambally S, Karmani S, Govindaraj R, Gangadhar BN. Designing and validation of a yoga-based intervention for obsessive compulsive disorder. Int Rev Psychiatry 2016;28:327-33.
58. Naveen GH, Rao MG, Vishal V, Thirthalli J, Varambally S, Gangadhar BN. Development and feasibility of yoga therapy module for out-patients with depression in India. Indian J Psychiatry 2013;55:S350-6.
59. Hariprasad VR, Varambally S, Varambally PT, Thirthalli J, Basavaraddi IV, Gangadhar BN. Designing, validation and feasibility of a yoga-based intervention for elderly. Indian J Psychiatry 2013;55:S344-9.