

**FACTORS AFFECTING
STUDENT ACHIEVEMENT
AND
RELATED BEHAVIORS**

SUMMARY AND CONCLUSION

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OVERVIEW

This study explores the relationship between yoga participation in schools and the effects on students' academic achievement, general health, personal attributes and relationships.

METHODOLOGY, DESCRIPTION AND DESIGN

Survey research methodology was utilized in this study to determine the effect of yoga on students' academic achievement and related behaviors.

Six survey instruments were created to elicit responses. Two surveys captured reflections from Kindergarten through Grade 2 students before (pre) and after (post) a series of yoga experiences. Two additional surveys captured pre and post data from students in grades 3-5. Teachers and parents/guardians also completed surveys regarding the effect of yoga on participating students.

Table 1 identifies each survey, lists the total number of questions in each survey, the total number of potential responses per survey and the corresponding totals.

*TABLE 1
NUMBER OF QUESTIONS BY SURVEY AND
TOTAL NUMBER OF POTENTIAL RESPONSES*

SURVEY/ CATEGORY	TOTAL NUMBER OF QUESTIONS	TOTAL NUMBER OF POTENTIAL RESPONSES
Grades K-2 Pre-Yoga Instruction	37	74
Grades K-2 Post-Yoga Instruction	49	98
Grades 3-5 Pre-Yoga Instruction	37	148
Grades 3-5 Post-Yoga Instruction	49	196
Teacher's Survey	21	84
Parent's/Guardian's Survey	21	84
TOTAL	214	684

Each survey contained questions related to one of four categories: academic achievement; general health; personal attributes; and relationships. Subcategories are listed next to illustrate topics contained in each of these broad categories.

Academic Achievement – grades, homework, academic challenges, concentration, attention to detail

General Health – stress, posture, absenteeism, nervousness, fitness, energy level

Personal Attributes – self-confidence, behavior, attention span, self-esteem, personal responsibility, general demeanor, personal pride, sense of humor, creativity

Relationships – conflict resolution, taking care of one's own problems, getting along with classmates and teachers

The specific number of questions in each category, by survey, is detailed in Table 2. Responses to open-ended questions provided additional invaluable information.

TABLE 2
NUMBER OF QUESTIONS BY CATEGORY

SURVEY/ CATEGORY	ACADEMIC ACHIEVEMENT	GENERAL HEALTH	PERSONAL ATTRIBUTES	RELATION- SHIPS
Grades K-2 Pre	14	6	12	5
Grades K-2 Post	16	6	20	7
Grades 3-5 Pre-	12	7	13	5
Grades 3-5 Post	17	6	19	7
Teacher's Survey	8	3	7	3
Parent's/Guardian's	8	3	7	3

The Kindergarten through grade 2 surveys asked students to respond *yes* or *no* to a series of statements related to these categories. The grades 3-5 surveys asked students to *strongly agree*, *agree*, *disagree* or *strongly disagree* to categorically related statements. Teachers and parents/guardians were asked to reflect on the effect of yoga on students - *strongly positive effect*, *positive effect*, *negative effect* or *strongly negative effect*.

Teachers, parents/guardians and K-5 students completing the post surveys were also invited to react to an open-ended question about the effect of yoga on academic achievement and related behaviors,

SURVEY RELIABILITY

For each of the areas measured on the survey (academic achievement, general health, personal attributes and relationships), summary data were obtained and reliability analyses were conducted. The reliability analyses are critical to determine whether the same sets of survey items, would elicit similar responses, if the same questions were recast and re-administered to the same respondents. Data derived from these surveys are determined to be reliable only when they provide stable responses over repeated administrations.

Reliability is reported on a scale from 0 to 1.0. A score of 1.0 means the instrument has perfect reliability. Thus, the closer the reliability is to 1.0, the better. By scientific convention, reliability coefficients lower than .60 is common in beginning or exploratory research. A .70 is considered "adequate." A "good scale" is at least .80. Over .80 is considered exceptional.

The reliability coefficient for the student survey was .92. Reliability coefficients for the teacher and parent/guardian surveys were above .83. The surveys in this study yielded, therefore, highly dependable data.

SURVEY RESPONSES

Six schools from the United States and Canada, as listed in Table 3, responded to the surveys. Three of the six schools completed all surveys. All schools completed the four student surveys.

Four hundred seventy-seven surveys were returned from all schools. Table 4 lists the specific number of returns for each survey.

TABLE 3
SCHOOL RESPONDERS BY SURVEY

SCHOOL/SURVEY	K-2 PRE	K-2 POST	3-5 PRE	3-5 POST	TEACHER	PARENT
Cameron Public School North York, Ontario Canada	X	X	X	X	X	X
The Children's House Montessori School - Miami, Florida	X	X	X	X		
PS 187 New York, New York	X	X	X	X		
PS 242 New York, New York	X	X	X	X		
Sand Creek Middle School Albany, New York	X	X	X	X	X	X
Spruce Street Elementary School Sauk City, Wisconsin	X	X	X	X	X	X

TABLE 4
NUMBER OF RETURNS BY SURVEY

SURVEY	NUMBER OF SURVEYS RETURNED
Grades K-2 Pre-Yoga Instruction	169
Grades K-2 Post-Yoga Instruction	45
Grades 3-5 Pre-Yoga Instruction	108
Grades 3-5 Post-Yoga Instruction	81
Teacher's Survey	8
Parent's/Guardian's Survey	66
TOTAL	477

DEMOGRAPHIC INFORMATION

Each survey requested demographic information from respondents. The results are presented in the following tables by responder type – students, teachers and parents/guardians.

DEMOGRAPHIC DATA OF STUDENT RESPONDERS (TABLES 5-7)

The majority of student responders in grades Kindergarten through grade 2 were age 6 for both pre and post surveys. They were appropriately distributed by gender and race. The majority of student responders from grades 3 through 5 were white females. They were somewhat evenly distributed over the age ranges of 8 through 12.

TABLE 5
AGE OF STUDENT RESPONDENTS BY SURVEY (%)

SURVEY/AGE	5	6	7	8	9	10	11	12
Grades K-2 Pre-Yoga Instruction	15	58	17	7	1	0	0	0
Grades K-2 Post-Yoga Instruction	14	49	17	17	2	0	0	0
Grades 3-5 Pre-Yoga Instruction	0	0	0	22	18	14	25	20
Grades 3-5 Post-Yoga Instruction	0	0	0	25	22	10	22	20

TABLE 6
GENDER OF STUDENT RESPONDENTS BY SURVEY (%)

SURVEY/GENDER	MALE	FEMALE
Grades K-2 Pre-Yoga Instruction	45	55
Grades K-2 Post-Yoga Instruction	44	56
Grades 3-5 Pre-Yoga Instruction	39	61
Grades 3-5 Post-Yoga Instruction	37	63

TABLE 7

Race of Student Respondents by Survey – unavailable in this version of study

DEMOGRAPHIC DATA OF TEACHER RESPONDERS (TABLES 8-13)

Teacher responders were overwhelmingly female (87%) and white (75%). (No teacher responders were African-American, Asian or Native-American.) Most (63%) had been teachers for 1 to 9 years, while the remainder had a minimum of 16 years of teaching experience. A majority (63%) had some active engagement with yoga personally.

TABLE 8
YEARS OF TEACHING (%)

1-3	4-9	10-15	16-20	20+
38	25	0	13	25

TABLE 9
HIGHEST EARNED DEGREE (%)

BACHELOR	BACHELOR+	MASTERS	MASTERS+	DOCTORATE
25	38	0	38	0

TABLE 10
GENDER OF TEACHER RESPONDENTS (%)

MALE	FEMALE
13	87

TABLE 11
RACE OF TEACHER RESPONDENTS (%)

WHITE	AFRICAN-AMERICAN	HISPANIC	ASIAN	NATIVE-AMERICAN	OTHER
75	0	13	0	0	12

TABLE 12
YEARS OF ACTIVE ENGAGEMENT WITH YOGA (%)

0	1-2	3-4	5-6	7-8	9+
38	25	25	0	0	12

TABLE 13
PRIOR YOGA EXERCISE IN CLASSROOM WITH STUDENTS PRIOR TO OFFICIAL START (%)

NEVER	ONCE PER WEEK	TWICE PER WEEK	DAILY
0	25	38	37

DEMOGRAPHIC DATA OF PARENT/GUARDIAN RESPONDERS (TABLES 14-18)

Parent/guardian responders were mostly white (80%) females (83%). Thirteen percent have annual family incomes up to \$30,000 and 54% reported annual family income over \$75,000.

Their previous experience with yoga was limited. In fact, 69% had no previous experience and 89% had fewer than two years of experience. Their children, as reported by 90% of the parents/guardians, had no or minimal prior experience with yoga.

TABLE 14
PARENT'S/GUARDIAN'S PREVIOUS
EXPERIENCE WITH YOGA IN YEARS (%)

0	1	2	3	4	5	6	7	8	9	10
69	20	5	3	0	0	0	0	0	0	3

TABLE 15
STUDENTS' PREVIOUS EXPERIENCE WITH YOGA PRIOR TO
THE OFFICIAL START AS REPORTED BY PARENT/GUARDIAN (%)

NONE	MINIMAL	SOME	EXTENSIVE
77	13	10	0

TABLE 16
GENDER OF PARENT/GUARDIAN RESPONDENTS (%)

MALE	FEMALE
17	83

TABLE 17
RACE OF PARENT/GUARDIAN RESPONDENTS (%)

WHITE	AFRICAN-AMERICAN	HISPANIC	ASIAN	NATIVE-AMERICAN	OTHER
80	2	3	11	0	3

TABLE 18
ANNUAL FAMILY INCOME OF PARENT/GUARDIAN RESPONDENTS (%)

0-\$10,000	\$10,000-25,000	\$25,000-35,000	\$35,000-50,000	\$50,000-75,000	\$75,000-100,000	\$100,000+
4	9	2	9	22	24	30

EFFECT OF YOGA INSTRUCTION ON ACADEMIC ACHIEVEMENT, GENERAL HEALTH, PERSONAL ATTRIBUTES AND RELATIONSHIPS

Tables 19-21 display the results of responses from teachers, parents/guardians, and students.

Teacher responders unanimously (100%) agreed on the positive effects of yoga. Parents/guardians responders, while not unanimous, were also overwhelmingly positive. Positive effect responses across all categories were over 90%. Their reflections are impressive.

Responses by students were similar. Positive effect responses were in a range between 75% and 93% across all categories. Again these overwhelming positive reactions are noteworthy.

TABLE 19
THE EFFECT OF YOGA INSTRUCTION ON STUDENTS BY CATEGORIES ACCORDING TO TEACHER RESPONDERS (%)

	ACADEMIC ACHIEVEMENT		GENERAL HEALTH		PERSONAL ATTRIBUTES		RELATIONSHIPS	
EFFECT	+	-	+	-	+	-	+	-
%	100	0	100	0	100	0	100	0

TABLE 20
THE EFFECT OF YOGA INSTRUCTION ON STUDENTS BY CATEGORIES ACCORDING TO PARENT/GUARDIAN RESPONDERS (%)

	ACADEMIC ACHIEVEMENT		GENERAL HEALTH		PERSONAL ATTRIBUTES		RELATIONSHIPS	
EFFECT	+	-	+	-	+	-	+	-
%	90	10	94	6	90	10	94	6

TABLE 21
THE EFFECT OF YOGA INSTRUCTION ON STUDENTS
BY CATEGORIES ACCORDING TO K-2 RESPONDERS (%)

EFFECT	ACADEMIC ACHIEVEMENT		GENERAL HEALTH		PERSONAL ATTRIBUTES		RELATIONSHIPS	
	+	-	+	-	+	-	+	-
PRE (%)	77	23	76	24	85	15	87	13
POST (%)	80	20	87	13	79	21	86	14

TABLE 22
THE EFFECT OF YOGA INSTRUCTION ON STUDENTS
BY CATEGORIES ACCORDING TO 3-5 RESPONDERS (%)

EFFECT	ACADEMIC ACHIEVEMENT		GENERAL HEALTH		PERSONAL ATTRIBUTES		RELATIONSHIPS	
	+	-	+	-	+	-	+	-
PRE (%)	77	23	84	16	82	18	87	13
POST (%)	75	25	85	15	77	23	93	7

In some cases, positive effect responses by students decreased when comparing pre and post yoga data in Tables 21 and 22. This phenomenon is probably due to the fact that different students completed the pre survey and post survey. The differential is statistically insignificant.

NARRATIVE RESPONSES FROM STUDENTS, TEACHERS AND PARENTS/GUARDIANS TO OPEN-ENDED QUESTIONS

All legible responses to the open-ended questions are listed below. Each bullet point is a different responder. Narrative responses are generally positive across all responder groups.

K-2 STUDENTS

Note: Because some children in this age range are unable to write, their comments were written by their teacher. Most spelling and grammatical errors have been corrected.

Open-Ended Question Prompt: *What changes have occurred in your grades, behavior, concentration, self-confidence and attitude since you started yoga? Please provide specific examples.*

- My posture is better.

- I like to do the poses.
- I concentrate more.
- I like the snake pose. I like to ssssss. Yoga is fun and it feels good. I use to fall asleep. Now that I'm 6, I just close my eyes and rest. Sometimes I do yoga at home with my sister. We play down dog down and bark, and my mom says "I thought yoga was quiet time" and we keep barking and barking.
- Yoga helps me feel better.
- It helps me by making me happy and proud and strong!
- I do think yoga has changed my behavior.
- I don't know how yoga helped me.
- I'm better able to concentrate. Better doing my work.
- I think yoga is good because it helps me learn a lot and be healthy.
- I have good grades in school and feel happy when I am in school.
- Help me lose wait [weight].
- Yoga makes me healthy and be strong.
- Yoga makes me feel good about myself. Yoga makes me feel happy and strong.
- Yoga did not help me!
- The flamingo - it is fun to stand on one leg - I like flamingo. Yoga just is fun and relaxing. I like getting the mats out and I even feel asleep.
- I don't see any changes.
- I like the pose because I get strong. It makes me feel happy.
- Lion - bears. I like to roar and it is cool to do that.
- The shake like Jell-O because I like to move around and I like the lemon and I like to wiggle my toes. I like the music. I listen to music at bedtime too.
- It was the breath in, breathe out because it helped me feel better.
- I'm better to calm down. I make me focus. I feel healthy. I feel ok. I feel excited. I feel happy. I feel better. I feel strong.
- I feel no changes.
- I like the lemon toes because I like to drink lemonade when it is hot and wiggle my toes. Yoga is just fun. I like helping my teacher get the mats out and sometimes I help pass out the ducks to put on tummies.
- My behavior has changed.
- No, I am not better.
- The mountain - all you have to do is stand still. Yoga makes me feel good and nice and happy.
- Quiet time and yoga makes me happy. I like the flamingo pose the best.
- The turtle pose. When I say "hello."
- Yoga it likes calms me down and I like the breath s-ahh, it feels good.
- I pay better attention at school when I do yoga and that is nice. I like all the poses. The quiet time makes my brain rest and it feels good.
- I like the butterfly pose and the story.
- Yoga helped me calm down.
- It made me strong.
- I wasn't here that day.
- Yoga makes me feel better and strong.
- Yoga makes me get energy.
- I can calm down and make energy.
- I'm better

- It helps me calm down when I have anger.
- Yoga makes me feel relaxed and it feels good.

3-5 STUDENTS

Open-Ended Question Prompt: *What changes have occurred in your grades, behavior, concentration, self-confidence and attitude since you started yoga? Please provide specific examples.*

- I have become more calm, confident and kind since we have done yoga. Yoga helps me concentrate and it makes me calm. I feel really good after yoga. I really like yoga!
- I think behavior in the class has changed. It has improved after yoga because we are calm, relaxed and ready to learn.
- When I do yoga it makes me calm down and I like it.
- Nothing that I can think of at this moment. But maybe later I can think of something. Also sometimes yoga is relaxing.
- In yoga my grades have gone a little bit better. My behavior changed in a good way. I'm still struggling with my concentration. I don't usually give myself confidence. My attitude has been better with yoga.
- Nothing has changed since I have done yoga that is why I put disagree for all of the yoga questions.
- Nothing has changed because of yoga.
- It has helped me concentrate and pay more attention.
- My grades have risen slightly. I hardly ever get in trouble. I concentrate the same and my self-confidence is high and my attitude is normal.
- I don't think it really changed because I hardly did it.
- Nothing has really changed except that I can concentrate a lot better.
- None
- I have become more confident.
- My problem solving has improved a lot.
- I feel that the class is calm because yoga calms people down.
- I don't just, out of the blue, scream at someone, I stay calm. I am getting better grades and I participate more. It helps me when my teacher made a yoga zone in our room because I can go there during free time and silent reading time to relax and get to know myself and it helps me lower my stress level and I am strong and confident.
- I have got better marks and I am more flexible to do things and I feel better about myself and I can do more things!!!

<u>Before</u>	<u>After</u>
Glum	Happy
Not Flexible	Flexible
Can't think	Can think

- Nothing
- Well my class hasn't been doing that much yoga, but I guess I could say I did change a little. It has made me calmer and less stressed. I wasn't that stressed, but it has made me a little less stressed. I like doing yoga, but it hasn't changed my grades. I feel I am getting somewhat stronger about myself. I hope I will continue doing yoga, because it is really fun!

- Not much, but I do feel better and more relaxed if I do yoga. It kind of helps me out during hard times.
- Not many changes have occurred since taking yoga. However, I do feel more relaxed. Also, I feel like it's easier to study.
- I have noticed absolutely no changes at all! I actually found yoga a waste of time.
- Nothing has changed.
- I have strongly improved my self-confidence to take tests and get good grades since yoga.
- My grades are a little better. Yoga helped me a little in school.
- Yoga helps me concentrate a lot and it makes me feel better about myself and my attitude is fine.
- Nothing has changed.
- No, nothing has changed.
- I have not changed.
- No, I don't think any of this has changed about me.
- I think it got a bit better but still we need more practice because yoga makes me really sleepy and then I don't pay attention. I always have confidence in myself at school. I liked it better before we did yoga.
- I'm more calm. I'm not as stressed when finals/tests come.
- Nothing really has changed.
- The changes I made are in my behavior and self-confidence. Instead of being not so confident in myself, after yoga, I feel like I can do anything.
- My behavior has changed a lot because I use to be a snobby brat. Now, just a little. My self-confidence is much worse. My grades are really the same because I don't show much effort.
- When I started yoga my grade in Spanish has improved. I have also been doing good in gym.
- Honestly, yoga hasn't done anything for me. It doesn't relax me, make me feel stronger or anything. I just enjoy doing yoga. It hasn't helped me.
- I am calm. I am relaxed. I can take a test without being nervous.
- It made me more calm and happy and now I do it before competitions and it makes me feel strong and happy. After learning yoga, I started to encourage my parents and my friends to do it. It brought down their stress levels and made them very calm.
- A little bit because some of the boys did not change. I don't really know about other people but I started liking yoga and teaching it to my mom. When I am tired in class, I really like doing yoga especially outside. My classmates laugh in yoga but after, it seems they calmed down and enjoyed it. I know I did. I would actually like to do more yoga in class!
- When I get stressed out, I right away find a quiet spot and listen to music and then do yoga. It has also made me more calmer and more patient. In school. I find that I am paying attention more and also raising my hand. Yoga has really not changed my life but it has helped my personality. I feel my confident about myself.
- No, nothing happened.
- Nothing has changed.
- I concentrated more at class time. My grades have been improving and I am nice to friends, family and other people around me. I'm very confident about myself. I am proud of myself.
- I think before yoga, the class felt worse than before yoga. Nothing has changed in my grades because I am a good student. I think yoga has helped everyone concentrate.

- Usually, when we have yoga, I get excited and jumpy. Yoga makes me feel confident but I get very excited and it doesn't let me concentrate better. Yoga makes me feel jumpy and excited because when I do yoga it makes me feel like I'm going to laugh because I get twisted.
- Yoga has changed my behavior and my attitude and my concentration on the carpet. I like yoga.
- Nothing has really changed except that is a little bit easier to concentrate. Yoga is sometimes fun and relaxing. I don't really think much has changed for me. It might have changed for other students but not much for me.
- I think the class is better since we started doing yoga.
- It has felt more calm. I also think people are more relaxed, good behavior, not really getting into trouble like before.
- I think yoga made my classroom a better place because before when we did community circle, I said I think it wasn't a very good classroom but after we started yoga, I thought this is a way better classroom and I like it because before people were restless. I think yoga has made my classroom a better place.
- The changes that have occurred are: I have gotten better grades, I have concentrated better on my work, and I feel more confidence. I changed from a B to an A. I have gotten my work done faster. I have gotten more self-confidence that before. I really like yoga.
- Nothing has changed.
- I feel more calm since I started yoga.
- I feel more relaxed.
- The energy is higher. Some people who could not concentrate can.
- In my behavior, I have been more calm than I usually am after doing yoga. I feel less stress during the day after doing yoga.
- Sometimes, we behave better and sometimes not.
- When I started yoga, I thought it was not fun at all because whenever I do a stretch, I always crack something. My behavior is pretty good. But I laugh when somebody laughs. My grades did not change. This year I think nothing has changed.
- I mostly feel relaxed, more confident.
- I feel more relaxed because I like the eagle pose.
- Nothing has really changed except I feel more relaxed when I get out of yoga. I also feel more patient.
- In our school, we don't have grades. I think I have been behaving normally. I always concentrate in the work I do. I think I do stuff well and my attitude is happy.
- My behavior is better and more calm. My self-confidence is much better. I concentrate better and that helps me to my work. My attitude with my classmates is much better but the behavior with my mom, dad and sisters hasn't changed much.
- When I didn't do yoga my grades were low. Now that I'm doing it my grades are getting higher.
- The thing that changed is that my behavior is better than before and my grades are better.

TEACHERS

Open-Ended Question Prompt: *Have you observed significant changes in your students' academic achievement, behavior, self-confidence, stress level, and/or concentration since they began participating in yoga? Please share with us some specific examples of the changes that occurred.*

- Yoga really helped those children that were at risk - emotionally, behavior-wise, ADHD, low academic. It seemed to really help them calm down!
- I used the breathing -"take 5" - for the end of the year assessment I had to do and it really helped the children relax and I think it brought the scores up. At the Kindergarten level, not a lot of testing, but enough to stress the children and the teacher.
- I was a bit amazed how much the children took home [yoga]. Several said that they have to have quiet music and they do the lemon toes and breathe at bedtime.
- You forgot an important section - teacher's stress load! Yoga helped me be a better teacher as it helped calm me down and it helped me have more patience. On the days we did yoga, I always had a better day and it encouraged me to join a yoga class on Saturday mornings.
- They are excited to begin the day now because they enjoy movement. They are proud of their accomplishments.
- The students love the YogaKids program. They ask all the time if we are doing yoga today. It is such a great way to bond with the students. I also use it when there is some negative energy (i.e. fighting, stress) in the room. It is extremely helpful in letting it go. I am very impressed with the effects.
- I found that my students became very relaxed and focused after a session of yoga.
- I noticed that students were able to use the calming exercises when they needed to relax. Before tests, exercises helped students to concentrate and lower stress.
- I have been using yoga in the classroom for two years as an instructional tool. I have noticed that the students enjoy yoga since it brings movement and something different to class. They all respond very positively to yoga in our Spanish class. Some students view it as "play time" and don't always pay attention to learning Spanish in the activities, which can be frustrating. Since this "official" study was limited to six weeks, I feel the results are more limited. Given a longer period of time, I think you would see even better results.

PARENTS/GUARDIANS

Open-Ended Session Prompt: *Have you observed significant changes in your child's academic achievement, behavior, self-confidence, stress level, and/or concentration since he or she began participating in yoga? Please share with us some specific examples of the changes that occurred in your son or daughter.*

- I feel this helped him to deal more with stress. Helping him to deal with that problem also caused a positive effect on his attitude and he was able to focus better.
- Both my girls enjoyed yoga but really were not exposed to it that long.
- My daughter does dance lessons and when she did her recital, she was scared and nervous. She and three of the girls from her class started doing the yoga stuff and stretching and breathing and it calmed them down before the recital. Sometimes she tells her little brother to do some yoga stuff when he is being difficult.
- I do not know of any changes.
- My child enjoys the yoga positions and often shares them with our family. She has used the bunny breathing to relax at home and seems to find yoga a very enjoyable experience.

- She was scared when we had a tornado whistle go off. She was downstairs and while waiting she suggested we use breathing exercises to calm down.
- No, I didn't even know she was taking yoga. She is a positive child but I don't know how much of this can be attributed to yoga.
- I haven't noticed any changes in our child.
- I have not noticed any changes of significance and, if I did, how would I know if there were attributable to yoga when there are so many other outside influences at this point in his life.
- No, I have not observed any significant changes in classroom performance since she began yoga.
- Unfortunately, my child did not tell me when his yoga lessons started or ended, therefore, I was unaware of the time I needed to observe him. Needless to say, I did not notice any changes at all. I did ask him (after I received this survey) how he felt. He said after the class he was more relaxed but was back to his normal self a little while later.
- I have not noticed any change since the beginning of yoga. No impact on my child whatsoever.
- No changes.
- I have not observed any changes in my child's behavior, etc. Nothing stands out.
- Yes, I have. My child is more neat and relaxed and her concentration skills have grown stronger.
- Since the period my child participated in yoga was short (only six lessons), I hardly saw any significant changes in her.
- When he does yoga, his self-confidence improves. He becomes healthier and his attitude and posture changes.
- There have been no significant changes, however, she has been doing her homework more consistently and she attributes this to being more relaxed. She finds the breathing helpful.
- Her participation in the course was not long enough to create any specific changes. This was not a year-long commitment, only six weeks, one day per week.
- I observed that my son was always calmer and kinder after yoga. He was more helpful at home after some breathing.
- I did not see any changes in my child's behavior. It did help him with some flexibility and he did enjoy it.
- She enjoyed it. Thank you for offering it.
- It didn't seem to help my son academically.
- Nothing specific. She just seems more aware of the relationship that yoga has on all areas of her life, including mine.
- Not really. She never told me when yoga started and I really didn't see a lot of change. I saw a little change in her behavior and grades lately.
- I have observed no significant effects. In fact, until this survey, I was not aware that my son had been exposed to yoga in school.
- She always is happy and she shares yoga poses with me. After yoga, she doesn't have any stress and has better concentration. I'm very glad that she is learning yoga.
- In the beginning of the year, he told me school was too hard. He looked forward to the weekends and did not like Mondays. As the year went on, he would come home and get right to his homework. I had to remind him to study for tests, but as time went on, he would study on his own. His grades improved and I could give him a little space and treat him like a teenager instead of an elementary school student.

- She has had significant change in her academic achievement. This is the first year that she has done this well in school.

MAJOR CONCLUSION

The survey data included numerical representations of the effect of yoga on student achievement and related behaviors. Additional useful data emanated from the responders' open-ended responses. All responses were consistently positive.

While numerous conclusions evolve, the major research question posed in this study has been answered in the affirmative. Yoga has a significant positive effect on the academic achievement, general health, personal attributes and relationships of students in Kindergarten through 5th grade.

POSTSCRIPT

The researchers thank everyone who significantly contributed to this study. This research was possible because of their assistance, cooperation, kindness, compassion, professionalism and their overwhelming passion for yoga.

----- END OF 1st RESEARCH DOC -----

IMPROVEMENT IN STATIC MOTOR PERFORMANCE FOLLOWING YOGIC TRAINING OF SCHOOL CHILDREN

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Summary - Two groups of 45 children each, whose ages ranged from 9 to 13 years, were assessed on a steadiness test, at the beginning and again at the end of a 10-day period during which one group received training in yoga, while the other group not. The steadiness test required insertion of and holding for 15 sec. A metal stylus without touching the sides of holes of decreasing sizes in a metal plate. The contacts were counted as errors during the 10-day period, one group (the 'Yoga' group) received training in special physical postures (asanas), voluntary regulation of breathing (Pranayama), maintenance of silence, as well as visual focusing exercises (tratakas) and games to improve the attention span and memory. The other group (control) carried out their usual routine. After 10 days, the 'yoga' group showed a significant (Wilcoxon's paired signed-ranks test) decrease in errors, whereas the 'Control' group showed no change. Certain postures such as that of a diver poised on the high board, immobile just before he springs into the air, require considerable muscular coordination even though the person is not actually mobile. The ability to maintain one's hand extended, yet steady is essential for a wide range of tasks.

Yoga is an ancient Indian tradition which through diverse physical and mental practices the practitioner strives to achieve a state of all around health. The practice of yoga has already been shown to be of therapeutic benefit in cases with psychosomatic ailments such as bronchial asthma (Nagarathna & Nagendra, 1985; Nagendra & Nagarathna, 1986). After 9 months of yogic practice, mentally retarded children also showed improvement in general mental ability, psychomotor coordination, and intelligent and social behaviour (Uma, Nagarathna, Nagendra, Vaidehi, & Seethalakshmi, 1989).

The present study was carried out with the aim of assessing whether Yogic training (for 10 days) would change the static motor performance in 45 school children as compared with an equal number of 'control' subjects, who did not practice Yoga but were also assessed after 10 days.

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METHOD

Subjects

There were two groups, with 45 subjects in each, i.e., the 'Yoga' and the 'control' group. The 'Yoga' group had come to our research foundation in Bangalore to receive intensive training in Yoga for 10 days. Among the 45 there were 34 boys, and the group mean age was 11.3 (SD = 1.6 yr.). The 'control' group of students from a nearby school did not practice Yoga. In this group were 21 boys; the group's mean age was 12.0 (SD = 1.0 yr.). The design was explained to the subjects, and signed informed consent was taken

from their guardians in accord with the ethical principles of the Indian Council of Medical Research, New, Delhi, India.

Testing procedure

Hand steadiness was tested using the simple apparatus conventionally employed (Hunt, 1936; Munn, 1946), which was fabricated by Anand Agencies, Pune, India. This apparatus consists of a metal plate in which are nine holes of graded diameters (the largest diameter being 8 mm and the smallest 2 mm). A metal stylus is connected to the plate in series, with a counter which is activated whenever the stylus makes contact with the metal plate. The subject is instructed to insert about 2 cm of the metal stylus in each hole, keeping his arm extended without support, and then maintain the stylus in the hole for 15 sec. without allowing the stylus to make contact with the side of the hole. Then the stylus is withdrawn also without making contact with the sides. Subjects began the testing procedure with the largest hole first and then proceeded to the smallest one. The number of accidental contacts which the metal stylus made with the metal plate were registered on the electronic counter as the number of errors.

Design

Both groups ('Yoga' and 'control') were assessed initially on the test and again after 10 days. The groups' means were statistically compared using Wilcoxon's paired signed-ranks test. During the 10-day period the 'Yoga' group received training in Yoga whereas the 'control' group received no such training. This comparison was essential to ascertain whether merely repeating the exercise after 10 days would be enough to reduce the number of errors.

Training in Yoga

The 'Yoga' group received Yogic training for approximately 8 hours a day, which was aimed at all around (physical, mental, intellectual, and spiritual) development. The 10-day programme consisted of (1) Yogasanas, specialised physical postures which are meant to increase physical stamina and both physical and mental balance; (2) Pranayama or voluntary regulation and slowing of the breathing which is carried out to achieve a relaxed state of mind and to increase inner awareness; and (3) Kriyas, techniques which bring about cleansing of the internal organs (e.g., respiratory tract, abdominal muscles, and viscera). Among these, what was especially relevant to school children were eye-cleaning techniques (tratakas). The practice of tratakas involves concentration. For example, in some of the practices, the subject sits in a relaxed position, keeping the head straight. The arms are extended in different directions, with the gaze focussed on the tip of the index finger without moving the head. The periods of focussing are interrupted by periods of relaxation so that no visual strain is experienced. In addition to these specialised practices, the training also included games to improve the attention span and memory as well as the telling of meaningful stories to foster a sense of values and feelings of responsibility.

RESULTS

The number of errors made at Test 1 were approximately similar for both groups. The group mean (\pm SEM) for the 'Yoga' group was 221.2 ± 10.0 (errors) and for the 'control'

group 221.0 ± 8.1 (errors). At the end of 10 days, the 'Yoga group' had 183.3 ± 7.1 (errors), and the difference between this and the initial value was statistically significant ($p < .01$, Wilcoxon paired signedranks test, two-tailed). The mean of the 'control' group on Test 2 was 217.8 ± 8.3 ; this difference was not significant on a similar test. These results suggest that 10 days training in Yoga can on immediate retest significantly show improved static motor performance. Our speculation is that learning and practising the different physical postures (asanas) could have improved voluntary control and eye-hand coordination. The special visual concentration exercise (tratakas) might have improved concentration so attention would vary less during the task. Since all Yogic practices have the ultimate goal of calming the mind, the over-all relaxation might have been beneficial. A subsequent follow-up would have been desirable, and other types of control groups could be explored.

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----- END OF 2nd RESEARCH DOC -----

Yoga for children in the mirror of the science: working spectrum and practice fields of the Training of Relaxation with Elements of Yoga for Children

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The latest research work showed a clear increase in stress consequences for younger children related to experience, behaviour and health (among other things, fear to fail and psychosomatic disorders). In contrast, only a few stress handling programmes are available specifically for children; a large part covers stress handling training courses orientated to behaviour and cognition. The aim of the Training of Relaxation with Elements of Yoga for Children technique introduced and evaluated is the communication of self control and relaxation based on experience using breathing exercises, imagination journeys and specifically selected yoga techniques for children. This stress handling programme has been investigated by means of a test/control/group design with 48 pupils of the fifth grade. During a pre/post comparison with three measuring times one could give proof that the training will increase emotional balance in the long term and reduce fears. Feelings of helplessness and aggression were clearly reduced. Beyond this, the participants transferred the learned breathing techniques and self instructions to situations beyond school, in order to relax after the lessons, to improve wellbeing and to control negative feelings. The effects found out here indicate that yoga is suited for children as an independent control method.

Keywords: Yoga for children; Training evaluation; Stress prevention for children.

Introduction

Research has shown an increase in stress related behaviour and experiences of stress in children ([Engel & Hurrelmann, 1989]; [Reißig & Petermann, 1996]). In contrast, only a few stress management programmes have been developed for elementary school children ([Lohaus et al., 1997]). The published stress management programmes for children in Germany ([Lohaus & KleinHeßling, 2000]) are mainly cognitive behaviour therapy oriented. For a long time there was no empirically proved stress management approach for children based primarily on relaxation techniques. Such a stress management approach was developed by Stück [Stück, 1998]; [Stück, 2000], mainly based on elements of yoga and additionally including aspects of stress management training (e.g. drawing, breathing and massage techniques, imagery techniques for children [fantasy journeys], meditation and relaxation by music). The aim and goal

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of this Training of Relaxation with Elements of Yoga for Children (TorweYC) technique is to teach children and adolescents in self regulated strategies to reduce stress and to optimize their reactions related to high psychological demands and pressure in everyday life. During the training, the participants will be confronted with yoga and breathing exercises. They learn to use these exercises before, during and after stress situations, and they are instructed to make homework assignments for self-controlled use of the relaxation techniques. Additionally we developed and evaluated an education for course instructors. This published evaluation of the work of some educated course instructors shows an effect of TorweYC in the practise ([Stück, et al., 2002]). In this article we refer only to the results of the evaluation of the developmental period of TorweYC, which took place between 1994 and 1998 at the Institute of Applied Psychology at Leipzig University. In this study we were interested in the following questions:

1. Is TorweYC suitable to achieve short term as well as long term effects on stabilization of personality and at the same time to reduce stress in school children?
2. Is the training suitable to reduce examination anxiety?
3. Is the employed method attractive to children and adolescents?

Methods

The TorweYC consists of 15 meetings. One exercise lasts 60 minutes and is subdivided into three parts.

(a)*First relaxation.* The aim of this part is to achieve a stronger inner orientation and to prepare for the following yoga exercises. This first relaxation is accomplished by the help of a technique called 'journey through the body', which consists of different concentration tasks on single body parts. Other used first relaxation techniques are breathing techniques from yoga (*ujjayi, nadhi shodana*, alternating breathing).

(b)*Yoga exercises.* During the relaxation training 23 different yoga exercises (based on ShivanandaYoga, Rishikesh/India) are introduced, developed and consolidated. The long term aim is besides the immediate relaxation during the meeting the mastery of *asana* for self relaxation. For independent training, the programme focuses on an individual complex of yoga exercises, which can be built from single yoga exercises. Several complex yoga exercises will be taught. Another variant of this relaxation training is that the participants can develop their own complex yoga exercise by the help of *asana* and the basic principles of yoga. Later, they are asked to introduce the group to their own exercise and instruct everybody else, taking on the role of a yoga teacher. As a result, identification with these yoga exercises, creativity and the ability of selfreflected use of these exercises are to be strengthened (transfer effect).

(c)*Final part.* The final part of a session has rather a game character. It encourages social contact and integration into the group and reinforces the training efforts. Several techniques will be used for that purpose: for example, massage techniques (partner massage, ball massage), meditation (candle meditation), sensory exercises

(discovering of objects by touching and smelling), and interactive exercises ('trust game', 'jumping lotus flower') as well as six different imagery techniques. These specially designed imagery techniques are used to teach the self instruction abilities of the children. Formulas like, for example, 'Stop calm and cool is wonderful' are embedded in the imagery process. The use of imaginary and meditation exercises (candle meditation) was chosen to create a transition from the sensual motor action regulation of the Yoga exercises to a cognitive behavioural and imaginative self regulation process. This connection leads to emotional, regulated inner experience of calmness. The active intrapsychic monitoring or the 'inner view' seems to be very important and helps participants to learn to pay attention to their own emotions and to not only follow external stimuli (e.g. computer games, television).

To prove the effects of the relaxation training, one experimental group (with training) and one control group (without training) were surveyed with the design presented in Table 1.

Group	Pre interview	Post 1 interview (short term effect: immediately after training)	Post 2 interview (long term effect: 3 months after training)
Experimental group	21	21	21
Control group	27	27	27

Table 1: Design of study

The realization of the relaxation training and the data collection took place in the period between August 1994 and March 1996 (four groups, males and females separated). Out of 110 children (age 11-12 years), 48 pupils who showed an abnormal examination anxiety (with the anxiety questionnaire for pupils by Wiczerkowski [Wiczerkowski, 1994]) were selected for the evaluation. The following variables were measured:

- *Process variables* (psychological and physiological variables during training sessions). For example, feeling of relaxation due to sessions, acceptance of session and non-dependent exercising behaviour during session, concentration, general wellbeing (by the estimation of parents and teachers), electro dermal activity during session as a physiological parameter for stress, and relaxation states during sessions.
- *Effect variables* (variables before and after the training in prepost 1 comparison). For example, physical complaints, emotional regulation, control convictions, working motivation, and psycho physiological stress coping abilities.
- *Effect variables* (variables before, immediately after and 3 months after the training in pre post 1post 2 comparison using the pre post-test analysis of Lander [Lander, 1990]).

Results

The results can be summarized in the following theses.

1. For the following effect variables, significant differences ($p \leq .05$) could be proved in Pre Post 1 comparison: aggression (\downarrow)¹, helplessness in school (\downarrow), static balance ability (\uparrow)², physical complaints (\downarrow), psychophysical behaviour while dealing with a stressor in the Stress Relaxation Test (stress-coping abilities) (\uparrow).

2. The hypotheses concerning the improvement (Pre Post 1) of emotional control, of active engaged behaviour and of acceptance by the school fellows could not be verified statistically. Concerning the Pre Post 1 changes in the emotional control, there is only a statistical tendency ($p \leq .10$). This tendency could also be proved descriptively in the Post 1 interviews after the training. Of the subjects, 47.6% stated the improvement of control of emotions (e.g. less rage or anger in stress situations).

3. For the following effect variables (Pre Post 1 Post 2 comparisons) the hypotheses could be verified statistically ($p \leq .05$):

- Pre Post 1 alteration, stable to Post 2 measurement (short term and long term effect): emotional balance (\uparrow), anxiety (\downarrow).
- Pre Post 1 alteration, not stable to Post 2 measurement⁴ (short term effect): feeling of defeat (\downarrow).
- Pre Post 2 and Post 1 Post 2 alterations (long term effect): extroversion (\downarrow).
- Pre Post 2 alterations (long-term effect): shyness in social contact (\downarrow), impulsiveness (\downarrow).

4. The hypothesis concerning the effect variable self efficacy could not be verified statistically ($p > .10$). The efficiency of the relaxation training is not suitable for this personality dimension.

5. Concerning the psychological process variables, the hypotheses could be verified statistically ($p \leq .05$). The parents as well as the teachers estimated that the general wellbeing of the subjects improved due to the training, in contrast to the control group. This result could be proved also descriptively with the interview statements (Post 1) of the parents. They declared to experience their children being more calm and more balanced (71.4%) and less impulsive, aggressive and hot-tempered (38.1%). Besides this they described their children as more concentrated (38.1%) and with less complaint (38.1%).

1 Statistically important decrease of the Post 1 values compared with the pre-measurement on the 5% significance level.

2 Statistically important increase of the Post 1 values compared with the re-measurement moment on the 5% significance level.

3 To verify means to prove a hypothesis. In this case there are no statistically important differences on the 5% significance level.

4 That means, significant deterioration of the Post 2 value compared with the Post 1 value concerning the feeling of defeat, which is located above the level of the pre-measurement moment, however.

5 The rating scales were filled out before and after the sessions.

6. Further results that could not be tested by inference statistics are as follows:

- The Experimental Group shows better results in the concentration test [Brickenkamp, 1994] than the control group.
- The results of the psycho physiological measurements of the electro dermal activity and of the rating scales concerning the subjective feeling of relaxation during the sessions show that the majority of the subjects get relaxed during the sessions. Thus, the presented training programme can legally be called relaxation training.
- In the training and post-training period, yoga as well as breathing exercises (rhythmic breathing, *ujjayi*, *nadhi shodana*) were practiced independently by the subjects (transfer effect). The statements of the subjects concerning the practice were confirmed by the parents in the interviews (Post 1 and Post 2). The intensity of the independent exercising increased during the sessions of TorweYC.
- The subjects applied the learned *asanas*, for example, to relax after school, to improve wellbeing and concentration, and to control anger (especially when there were problems at home). The breathing techniques and the self instruction were used also beyond the training period both in school and outside school to influence the physical emotional reactions in stressful situations, to control anger and for further indications; for example, to better fall asleep and to increase concentration (transfer effect).

7. The intended reduction of examination anxiety by the relaxation training could not be reached; neither short term nor long term was proved [Stück & Lander, 2000].

8. The participants of the training showed a constant good or very good motivation for participation in the sessions. The pleasure in doing the exercises was expressed by an active participation in the training. All 21 subjects carried out the training until the end. The estimations by the subjects about the exercising lessons proved that, in 98% of the cases, the participants found the sessions 'good' or 'very good'. The Post 1 interviews showed that the majority of the subjects and of the parents accepted the relaxation training and appreciated it as a method.

Discussion

The earlier questions (see Introduction) can be answered as follows. As the results for the first question (points 16) show altogether, the relaxation training could stabilize on a higher level in the fields of the personality that are relevant for stress coping. Thus, in the subjects the conditions to cope with demands more efficiently and to reduce stress in school children were created. The intended reduction of examination anxiety by the relaxation training could not be proved (second question). The efficiency values of the Pre Post-test analysis by Lander show that, by extension of the training with examination of anxiety specific components, an interventional effect may be expected. Relevant questions for this consideration (e.g. the analysis and transfer of learning techniques, the focusing of aims, teaching issues and solving processes) were not considered in this concept of the training. These effects failing to appear (also self efficacy, see point 4) show boundaries in the effectual spectrum of the relaxation training. From the descriptive performance of the results concerning the psychological

process variables *acceptance of session* and *readiness for participation*, we can conclude (third question) that the training concept is suited very well for teaching pupils the basic principles of yoga in an appropriate way.

Generally, as the results of the survey show, the utilization of this training as a course after school stood the test and was appreciated by the pupils. Particularly, the integration of the movement oriented and experienced as well as the 'exotic' method of Yoga in the relaxation training proved to be especially effective. The evident exercising effects show that yoga is suited as a relaxation method for children and extends the spectrum of the existing relaxation methods for this age group. The independent application of the learned exercises for 'switching off or over' proves the value of the exercises of yoga for self regulation.

For future research the following suggestions can be given:

- In further surveys, gender specific differences should be explored more intensively concerning the effects of yoga programmes.
- It should be explored whether smaller programmes with four *asanas* and one breathing exercise as well as one self instruction can be exercised with children, so they may apply it independently when they get into stress states.
- A further possibility for teaching relaxation at school is the qualification of teachers. At the moment we prepare moderate relaxation techniques for children that can be used by teachers in the class (breathing meditation, fantasy journeys; altogether five minutes).

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SPATIAL AND VERBAL MEMORY TEST SCORES FOLLOWING YOGA AND FINE ARTS CAMPS FOR SCHOOL CHILDREN

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Abstract : The performance scores of children (aged 11 to 16 years) in verbal and spatial memory tests were compared for two groups (n = 30, each), one attending a yoga camp and the other a fine arts camp. Both groups were assessed on the memory tasks initially and after ten days of their respective interventions. A control group (n = 30) was similarly studied to assess the test – retest effect. At the final assessment the yoga group showed a significant increase of 43% in spatial memory scores (Multivariate analysis, Tukey test), while the fine arts and control groups showed no change. The results suggest that yoga practice, including physical postures, yoga breathing, meditation and guided relaxation improved delayed recall of spatial information.

Key words : yoga fine arts spatial memory verbal memory

INTRODUCTION

The practice of Transcendental Meditation (TM) was shown to improve academic performance in university students (1). While the above study examined how meditation influenced the process of remembering, a subsequent study examined the effects of a combination of yoga practices on hemisphere-specific memory tasks (2). Groups trained in yoga showed a significant increase in spatial test scores at retest, but no change in verbal test scores, suggesting that yoga breathing improved performance in a right hemisphere– specific memory test.

Among other factors which influence right hemisphere performance, both scientific and subjective reports of high achievers in arts, sciences and industry reveal a correlation between creative thinking and right hemisphere specialization (3). Among arts topics, asymmetric electroencephalographic (EEG) changes were obtained as 'method' actors generated emotions, with specific right hemispheric activation related to sexual arousal (4).

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The above mentioned references indicate that both yoga training and even creative activities activate the right hemisphere. If yoga influences memory via this hemisphere, it is also possible that training in fine arts may affect memory positively. The present study investigates this hypothesis.

METHODS

Subjects

The subjects were children with ages between 11 and 16 years, who were attending either yoga or fine arts vacation camps ($n = 30$ each). The two camps were conducted at the same site, at different times during the summer vacation. The group average ages were as follows : (i) Yoga group (mean age \pm SD, 13.8 ± 1.8 years, 13 girls) and (ii) Fine arts group (mean age \pm SD, 13.1 ± 2.3 years, 16 girls). Also, in order to understand the test-retest effect, a control group of 30 children was similarly assessed. This group had no intervention but carried on with their activities during the vacation. The control group average age was : 13.6 ± 1.5 years (14 girls). The hand dominance was determined by using a specific questionnaire and it was found that all the subjects were right hand dominant (5).

Design

All three groups were assessed on Day 1, and after the intervention on the Day 10. Both yoga and fine arts groups were given training in yoga and fine arts activities (such as drama, and dance training), respectively. The control group carried out their routine activities.

Assessment

The verbal and spatial memory tests were assessed for 15 subjects at a time. The test material was projected on a screen, allowing 10 seconds for each slide. After the 10 slides were shown, a mathematical problem (e.g., 3 minus 8 plus 5 minus 2 plus 9 plus 7 minus 4 plus 6) was projected on the screen. Immediately after this, the subjects were asked to recall and write down (or in the case of spatial memory, to draw) within 60 seconds the 10 test items which had been shown to them (2).

To test verbal memory, standard nonsense syllables of three letters, e.g., XOL, were selected from a prepared list (6). Two different sets of 10 nonsense syllables were presented on Days 1 and 10. The test for spatial memory consisted of 10 simple line drawings. Geometrical or other shapes which could be described verbally, e.g., a square or a circle, were not used. The drawings were very simple and easy to reproduce. As described for verbal memory, there were two separate, similar sets of 10 line drawings each for Days 1 and 10. For both verbal and spatial memory tests a correct answer was scored as "1" and a wrong answer was scored "0". The subjects were told that the memory tests were for their self assessment to understand the benefit they derived from the course. They were subsequently given a report, so they were enthusiastic and interested. The control group was also told that the tests were for their self assessment and were also given a report. The informed consent of their guardians was taken.

Analysis

Data were analyzed using the statistical software (SPSS version 10.0). The Day 1 and Day 10 data of all three groups were assessed with the tests for normality distribution using both graphic presentations (box-plot and stem-and-leaf plot) as well as Shapiro-Wilk test. The one – way 'F' test for variance was used to evaluate the variance of the data. A multivariate analysis was performed where the Between Subjects factor was the Groups (Yoga, Art, Control) and the Within subjects factor(s) were Assessments (Verbal: pre and post; Spatial: pre and post; hence giving 4 factors). The Tukey test for multiple comparisons of mean values was used for post-hoc analysis.

TABLE I : Means \pm standard deviations of memory scores of verbal and spatial memory tasks for three groups (n = 30, each) on days 1 and 10.

		Verbal memory		Spatial memory	
		Day 1	Day 10	Day 1	Day 10
Yoga	Mean SD	4.2 \pm 1.5	5.0 \pm 2.0	4.0 \pm 1.9	5.7 \pm 1.9*
Fine arts	Mean SD	4.3 \pm 1.9	4.5 \pm 2.2	4.4 \pm 1.9	5.6 \pm 2.6
Control	Mean SD	3.9 \pm 1.8	4.4 \pm 1.6	3.9 \pm 1.6	4.3 \pm 2.0

*P=.002, two tailed, Tukey test comparing the means of Day 10 versus Day 1 values.

Fine arts camp

The fine arts camp lasted for 8 hours each day, consisting of: drama (240 min) and games, e.g., cricket or volleyball, 60 min. The training also included a special session of creative activities such as dance, singing classical Indian compositions, pottery, painting, sketching, and paper craft (120 min). Each day children were allowed to show individual talent by giving presentations e.g., songs, mimicry, or elocution (60 min).

Yoga camp

The yoga program consisted of training in yoga for approximately 8 hours a day, for 10 days. It included specialized physical postures (yogasanas, 90 min), voluntary regulation and slowing of the breathing (pranayama, 60 min), internal cleansing practices including eye-cleansing techniques (kriyas, 30 min), meditation and devotional sessions (90 min), and guided relaxation (30 min). In addition to these specialized practices, the training also included games (120 min) as well as the telling of meaningful stories (60 min) to foster a sense of values and feelings of responsibility, which is also an essential part of yoga.

RESULTS

The Day 1 and Day 10 data of all three groups were found to be (i) normally distributed and (ii) not of unequal variance. Hence parametric statistics were used for analysis. The multivariate analysis : The test of Between-Subjects effects showed significant difference for the Yoga group [F (3,116) =5.569, P = .001]. For the arts group [F (3,116)

= 2.230, $P = .088$] and the control group [$F(3,116) = 0.727$, $P = .538$] there was no significant difference. Post-hoc analysis using the Tukey test showed a significant difference between the spatial memory test scores of the yoga group on Day 10 versus the scores on Day 1 ($P = .002$). There were no other significant differences. Group mean \pm standard deviation of memory test scores obtained by the three groups for both verbal and spatial memory tests at initial and final assessments are given in Table I.

DISCUSSION

In the present study, the group trained in yoga showed a significant increase in spatial memory test scores, while verbal memory test scores remained the same in all of them. The results resemble those of a previous study (2), which showed that 108 children of a similar age range also showed an increase in spatial memory scores following 10 days of yoga training. Drama requires actors to recall their lines (7), which was shown to be contextual and facilitated by the availability of spatialvisual information. In the present study, the fine arts camp which included 4 hours of drama did not significantly influence the recall of spatial or verbal information. Since the camp activities included 4 hours of other activities (e.g., dance, pottery, extempore presentations), it is possible that these activities did not have the same effect as drama on memory, even though they would be expected to influence right hemispheric function. Also, spatial memory is just one dimension of right hemispheric function and the present study did not examine other functions. It is also possible that a longer duration of training in fine arts may have influenced spatial memory scores, but the present study intended to compare equal durations of the two interventions. Improvement in spatial memory scores following yoga could be related to the fact that reduced anxiety can improve performance on tasks requiring learning and memory (8) and the anxiety reducing effects of meditation are well known (9). While the positive effects of motivation on learning are well known (6), it is not likely that motivation influenced the outcome, as the verbal scores did not change, and it is unlikely that motivation would influence the outcome of one test alone. The lower scores of the control group at baseline may suggest that this group was less motivated than the two intervention groups. The absence of change in the control group shows that retesting after 10 days did not influence the scores.

Hence, the present study suggests that yoga practice, including physical postures, yoga breathing, meditation and guided relaxation improves delayed recall of spatial information.

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