



# Longitudinal Evaluation of Superbrain Yoga Practice on Academic Performance among Adolescents

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### Authors

Vinu V.<sup>1</sup> MSc,  
Jois S.N.<sup>\*1</sup> PD,  
Moulyra R.<sup>1</sup> MSc,  
Mphil, Meena M.<sup>1</sup> MA, MBA,  
Nagendra Prasad K.<sup>1</sup> PhD,  
Dsouza L.<sup>2</sup> PhD

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<sup>1</sup>World Pranic Healing Foundation, India-Research Centre, Mysuru, India

<sup>2</sup>Department of Psychology, Maharaja College, University of Mysuru, Mysuru, India

### \*Correspondence

Address: World Pranic Healing Foundation, India- Research Centre # 44, 4th Main Saraswathipuar, Mysuru 570 009

Phone: +91 (821) 2340673

Fax: -

research@pranichealing.co.in

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## ABSTRACT

**Aims** This study aimed to assess the long-term effect of SBY on the academic performance of adolescents and their gender.

**Materials & Methods** Repeated measure design using purposive sampling was adopted and 324 adolescent boys and girls practicing Superbrain Yoga for three years from Mysuru District, India were involved in the study. Academic scores of adolescents from 2013 to 2016 were analyzed using Repeated Measure ANOVA by SPSS 21.

**Findings** A significant increase in academic scores of adolescents in their performance (F=168.324, p=0.001) was noticed. Girls outperformed boys in Science (F=5.263, p=0.006,  $\eta^2=0.02$ ), second language (F=5.832, p=.004,  $\eta^2=0.02$ ), and total performance (F=4.534, p=0.014,  $\eta^2=0.02$ ) with a minimal effect size.

**Conclusion** The long-term practice of Superbrain Yoga showed a positive impact on academic performance among adolescents and the gender difference in academic performance is found minimal. The cognitive enhancement practice of SBY can be implemented in educational settings.

**Keywords** Cognitive Science; Mathematics; Memory; Yoga

## CITATION LINKS

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## Introduction

Academic Performance is one of the important aspects of education, particularly concerning early adolescents. Future orientations to gain personal, and mental developments and harnessing social opportunities depends on academic performance. It is the knowledge gained by the student, evaluated through exams assessments as marks by a teacher, and/or educational goals to be achieved over a specific period [1]. In the educational setup, adolescents deal with difficulties like fear of failure, lack of self-confidence, lack of concentration, confusion due to family situations, and lack of motivation for success along with other psychological issues which affect their academic performance [2]. Rapid physical growth with significant emotional, psychological, and spiritual change also takes part in this period. The cognitive, motivational, and affective dimensions of school students are influential to academic achievement [3]. Children exhibit progression in acquiring executive functions between infancy and adulthood, and it links such an increase to academic achievement [4]. The plasticity of the brain and hormonal changes at this age influence the brain networks as well as cognitive domains and it sways academic scores [5]. Physical activity could enhance academic performance. It includes exercise, yoga, walking, and cycling [6]. Physical activity also supports an interrelationship between cognition and academic performance. Physical activity and higher aerobic fitness nourish basic cognitive functions related to attention, and memory and facilitate learning [7]. These practices help in the enhancement of cognitive abilities, which could lead to more effectiveness in learning activities linked with academic performance [8]. The academic performance of children was influenced by cognitive abilities, and these abilities have a role in individual, social and academic development [9]. Personality, learning approaches including intelligence quotient and involvement in school activities, and commitment to the school mission are important factors in predicting academic performance [10]. Classroom setting, location of the school, learning facilities, school climate, and technological advancement also influence academic performance [11]. Intrinsic and extrinsic motivation and self-regulation strategies for the academic performance of adolescents depend on parental influence, family style, and socio-economical status [12,13]. Superbrain Yoga (SBY) is a physical activity that involves squeezing one's earlobes with the thumb and forefinger in a certain position and squatting 14 times following a prescribed breathing technique. SBY practice boosts the flow of subtle energy or prana in the brain and energizes and activates the brain energy centers including the pineal gland. SBY helps in transferring the trapped energy from the

lower parts of the energy body to the upper part [14, 15]. Functional imaging studies had proven that acupoints or energy centers connected through meridians play a role in activating the brain, auricular therapy also involves the activity of acupoints in the earlobes and it helps in increasing the flow of prana towards the brain area [16, 17]. SBY is also referred to as Thoppukaranam in South India and was commonly used as punishment to slow learners and stubborn and misbehaving students in schools. Even though the exact reason why it was introduced as punishment cannot be traced, it has been passed down and is followed even today in many schools across South India [18]. A study reported an increase in brainwave balancing index (BBI) by 33% and an improvement in short-term memory among 36 participants practicing SBY [19]. Academic Performance, Concentration, short-term memory, selective attention, and confidence in adolescents were found to be enhanced after SBY practice [20, 21]. Adolescents practicing SBY reduced the symptoms of hyperactivity disorder [22]. Siar [23] reported improvement in academic and behavior performance in adolescents practicing SBY.

Nowadays, the application and acceptance of holistic and multicultural approaches like school-based yoga, meditation, and brief exercises in school settings are found useful in managing physical and mental health issues [24]. As a part of eco-psychological interventions, physical activity in a natural setting may arouse creative problem solving and promote academic success and wellbeing among children [25].

Existing works of literature on the effects of SBY on cognitive abilities and academic performance are studied, however, its long-term effect on academic performance needs to be studied. Hence, this study aimed to assess the long-term effect of SBY on the academic performance of adolescents and their gender.

## Materials and Methods

The repeated measure design using the purposive sampling method was adopted. Three hundred and twenty-four adolescents from six rural villages studying in Government schools of Periyapatana Taluk, Mysore District, India took part in this study. Participation was voluntary and their identity was kept confidential. The participants did not receive any incentive to take part in this study, included. Adolescents practicing SBY during school days for 3 years. Adolescents, with the inconsistent practice of SBY due to illness Transferred to other schools, were excluded.

A questionnaire was used to collect data regarding participants' age, and gender. Three years of Annual examination scores of adolescents were recorded. It consisted of a systematic description of academic performance separately for Mathematics, Science,

Social Studies, Language 1 (Kannada), Language 2 (English), and Language 3 (Hindi). Performance scores were converted to a percentage.

Permission was requested and granted by the Deputy Director of Public Instruction, Government of Karnataka, Mysuru to conduct this study. This study was carried out for three years. SBY was introduced to the physical education teachers through a training program. The teachers were from Schools in different villages of Periyapatana taluk, Mysuru District, Karnataka, India. A manual comprising of SBY practice details was also provided to them. Once, these teachers were familiar with SBY, they in turn supervised their students in practicing SBY. A cross-sectional study was carried out on school students practicing SBY for three months. The results showed improvement in academic performance among school students. Hence, longitudinal studies were taken up. 324 adolescents were selected based on the inclusion-exclusion criteria and their consent was also obtained. Teachers supervised the adolescent students, during the entire duration of this study. Parents were informed about this study. At the end of the academic year, the annual academic performance scores of the adolescents, who met the inclusion criteria were collected and analyzed. Superbrain Yoga procedure [15]: Stand facing east direction; Connect the tongue to the palate; Press the right earlobe with the thumb and index finger of the left hand and the left earlobe with the thumb and index finger of the right hand; The right hand should overlap the left hand; While sitting, simultaneously inhale; and while standing, simultaneously exhale; Repeat whole procedure 14 times. The entire exercise can be completed within 2 minutes. Annual academic performance and gender

difference of adolescents were analyzed using repeated measure ANOVA in SPSS 21, and Microsoft Excel.

## Findings

The adolescents were comprised of 148 boys (45.68%) and 176 girls (54.32%) with a mean age of  $12.95 \pm 1.33$  years (Table 1).

**Table 1)** Student demographics results

Villages	Boys		Girls		Total	
	N	%	N	%	N	%
Benagalu	21	6.48	20	6.17	41	12.65
Bylakuppe	37	11.42	37	11.42	74	22.84
Doddabelalu	40	12.35	66	20.37	106	32.72
M.Shettihalli	04	1.23	8	2.47	12	3.7
Doddabelalu	43	13.27	40	12.35	83	25.62
Hadya	03	0.93	5	1.54	8	2.47
<b>Total</b>	<b>148</b>	<b>45.68</b>	<b>176</b>	<b>54.32</b>	<b>324</b>	<b>100</b>

In the case of mathematics, a gain score of 15.00 was observed in three years and the increase in scores was found to be significant. There was a progression in science scores in three years and this was found to be significant with a gain score of 10.63. In social studies, the students witnessed a significant increase with a gain of 14.31 in three years. The increase in achievement scores in three years for languages 1, 2, and 3 were found to be significant with a gain score of 6.44, 6.61, and 13.58 respectively. A significant increase in total score with a gain of 10.38 in three years was also found (Table 2). Among gender differences, an increase in academic scores in science, languages 1, and the total score was found to be significant in three years, while other subjects (mathematics, social studies, second & third language) remained insignificant. Girls outperformed boys with a small effect size ( $\eta_p^2$ ) of 0.02 (Table 2).

**Table 2)** Academic performance of school students in three academic years

Subjects	Gender	Year			Gain	Statistics Overall	G X AP*	$\eta_p^2$
		1	2	3				
Maths	Male	50.64±14.19	57.82±13.64	64.01±13.72	13.38	F=230.55 (2,591.7) p=.001	F=2.58 p=.077	0.01
	Female	52.55±14.62	60.40±12.55	68.92±14.66	16.37			
	Total	51.67±14.43	59.22±13.10	66.68±14.42	15.00			
Science	Male	54.88±13.53	56.28±16.76	64.21±14.07	9.33	F=119.84(2,601.9) p=.001	F=5.26 p=.005	0.02
	Female	56.82±13.71	62.70±16.00	68.55±13.65	11.73			
	Total	55.93±13.64	59.76±16.63	66.56±13.99	10.63			
Social Studies	Male	52.60±15.27	55.97±16.47	65.31±14.08	12.71	F=84.22 (2,478.1) p=.001	F=1.81 p=.164	0.01
	Female	56.30±15.65	63.74±25.56	71.92±14.23	15.62			
	Total	54.63±15.57	60.25±22.25	68.94±14.52	14.31			
First Language (Kannada)	Male	60.24±14.48	61.71±16.51	64.05±15.08	3.81	F=36.62 (2,609) p=.001	F=5.83 p=.003	0.02
	Female	63.94±14.62	68.78±15.67	72.59±15.27	8.65			
	Total	62.25±14.65	65.55±16.42	68.69±15.74	6.44			
Second Language (English)	Male	55.45±15.52	52.73±17.39	60.70±15.92	5.25	F=36.90(2,439.4) p=.001	F=1.76 p=.173	0.01
	Female	57.47±14.31	58.19±16.40	65.24±16.31	7.76			
	Total	56.55±14.89	55.68±17.05	63.16±16.27	6.61			
Third Language (Hindi)	Male	54.96±12.92	53.50±14.14	69.02±19.12	14.06	F=95.83(2,390.2) p=.001	F=1.34 p=.263	0.01
	Female	60.72±14.5	61.98±15.36	73.93±19.08	13.2			
	Total	58.17±14.09	58.22±15.39	71.75±19.21	13.58			
Grand Total	Male	55.57±12.75	57.25±14.14	64.40±12.79	8.83	F=168.32(2,570.2) p=.001	F=4.53 p=.011	0.02
	Female	58.39±12.67	63.15±13.63	70.08±12.96	11.69			
	Total	57.10±12.76	60.46±14.15	67.48±13.17	10.38			

\*G X AP= Gender X Academic Performance

## Discussion

The present longitudinal study brought out the fact that SBY was effective in increasing academic performance. Gender-wise, female adolescents gained more than males in total academic achievement, across the first language and science, and the gender effect was minimal. Cross-sectional outcomes showed a significant improvement in academic performance, enhancement of cognitive functioning, psychological states, and attendance in students upon regular SBY practice [18, 26]. SBY helped adolescents in nourishing cognitive activity and the personality factors with motivation in dealing with the academic demands or related stress in attaining an improvement in performance over the study period. Improvement in cognitive functioning due to the effect of SBY is significant in enhancing academic achievement [27, 28]. Studies also proved the effectiveness of SBY on short-term memory, visuospatial ability, attendance, enhanced concentration, memory, and academic performance of students [29, 21].

Performance in Science and Mathematics among adolescents who practiced SBY for over three years was observed. SBY with behavior modification proved its efficiency in reducing mathematics phobia among students [30]. The positive impact of SBY was more pronounced on components of cognition, like working memory and attention control [31]. Here from the shreds of evidence, SBY practice can be acting as a tool in improving mathematics performance among students, which supports spatial training, and working memory training and helps in reducing mathematics phobia.

The longitudinal study comprised the improvement in achievement scores of social studies in SBY practiced students. Overall academic achievement and social studies achievement depend on fluency and flexibility of thoughts with creativity [32]. Flexibility in creating ideas and images based on problem-solving is rooted in the increase of alpha wave percentage and the alpha wave generation is possible through SBY [33, 34]. Alpha oscillations represent long-term memory (semantic) activity. Long-term memory also influences verbal short-term memory in association with the fastest encoding in children [35, 36].

In this study, adolescents enhanced their academic scores in language subjects for three years. In auditory short-term memory, the left superior temporal gyrus mediates language processing. Putamen and caudate nucleus stimulate the sensory-motor as well as the cognitive-linguistic process, and working memory, and it has a crucial role in spoken language [37]. Age modification and changes in brain dynamics are allied with language performance. Brain activities inspire language tasks through lateralization in early life and later in senescence, it helps in achieving better language performance. The

left hemispheres of brain development are connected with language acquisition during adolescence and the development always relies on the corpus callosum which has a link with the associative cortex [38, 39]. While doing SBY, the energy from the lower part of the body is transferred to chakras located in the upper part of the body, and the stimulation of the earlobes in the squat triggers the energy connection to the left and the right brain [15]. The enhancement of energy levels in the left and right hemispheres of the brain after practicing SBY was apparent and the pranic energy level in the left hemisphere was more [29]. Brain wave dominance and enhancement in short-term memory after practicing SBY were evident [19].

Even the evidence on lateralization results among gender is mixed, males contribute cognitive advantages in spatial level, and females with language. Based on the difficulty of tasks and the type of activity among both the sexes contribute to more neural connection or integration in the brain and made the performance better [40]. Certain developmental stages show sex differences in language performances among children, and the rate of maturational change between the sexes also affects the outcome. The causes of gender differences in brain activation and development owing to hormonal changes and developmental stages are unknown [41]. The current study explores the activity of the brain in enhancing academic performance due to SBY and the gender difference in Science, Social and language showed a small impact. Studies also showcase the evidence that the sex difference in brain function during the performance of spatial, language, and emotion-related tasks are not always consistent [40]. The motivation to excel academically is such a strong drive in students, that factors predicting or contributing to this outcome are pivotal. Behavior regulation and motivation can be a product of the combined effects of the external social system and internal self-influencing factors [42]. Overall improvement in total score and noticeable gain in mathematics score of adolescents through integrating SBY with academics is appreciable.

This study lack a control group. Social factors, family support, school environment, self-regulation strategies may have added to the variance. Students only from the Mysore district, India have participated in this longitudinal study.

## Conclusion

Three years of study on the academic performance of students after regular SBY practice has been effective. Implementing SBY in educational settings helps students in improving academic performance. A detailed investigation of the cognitive process involved in enhancing academic performance in connection with SBY needs to be carried out.

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