CHAPTER 3

3.0 REVIEW OF SCIENTIFIC LITERATURE

A comprehensive review of the scientific literature was conducted to explore the potential for developing new intervention modalities aimed at enhancing adolescents' learning effectiveness and outcomes. This review included surveys and cross-sectional studies that investigated the prevalence of emotional and behavioral problems among adolescents in various settings. Additionally, exploratory studies examined the impact of socioeconomic status and parenting styles on the academic performance of adolescent students.

Furthermore, correlational studies were included to understand the relationships between learning techniques and academic outcomes, parenting styles and academic performance, the career paths preferred by adolescents, and the relationship between parenting styles and adolescents' well-being and self-control. Several quasi-experimental studies evaluated the effects of yoga and mindfulness on psychological well-being, the impact of inquiry-based instruction on critical thinking, and the influence of peer groups on numeracy and language skills.

Moreover, most researchers in this review utilized randomized controlled designs, ranging from two-arm to four-arm studies, to examine the effects of physical activity and yoga on brain function, academic performance, emotional behavior, psychosocial problems, cognitive functions, physical fitness, and study organizational skills. Systematic reviews and meta-analyses were included to assess the effectiveness of common interventions on variables such as academic performance, cognitive functions, psychosocial behavior, mood, behavior, comparisons of various learning interventions, and the effect of yoga on structural and functional brain changes.

In addition, the review incorporated longitudinal studies on intelligence, psychosocial and adaptive behavior, literacy and mathematical skills, executive function (including attention, working memory, and multitasking), and academic skills (including math, reading, and reasoning skills). These studies also explored the long-term effects of different parenting styles on adolescent academic success. Notably, the review emphasized recent studies conducted within the past five years, alongside seminal works by previous researchers.

The overall findings from this review guide the present research study towards adopting a robust methodology that includes both primary and secondary factors influencing adolescent academic performance and emotional and behavioral problems. Meta-analyses highlighted weaknesses in the methodological approaches, study variables, protocols, and reporting within the yoga domain, leading to inconclusive results. These findings suggest that further studies are necessary to build substantial evidence for school-based intervention programs, particularly those involving yoga.

Table 6: Tabulated Information of Scientific Literature Review

S. No	Reference	Sample	Design	Tools	Intervention	Variables	Results	Conclusion
1.	Chung, 2018	34 studies	Systematic review	PRISMA	Yoga, Meditation	Cognition, AP, Psycho-physiological	Positive effects on outcome variables. Negative findings and adverse effects; False memory with mindfulness	Heterogeneity, risk of bias Methodological flaws. Further evidence was suggested.
2	Singh et al., 2019	58 studies 5 yoga studies	Systematic review	PRISMA, Expert panel	PA, aerobics, yoga	Cognition AP	Inconclusive results of PA on cognition and AP, except for numeracy skills	Expert panel recommendation for casual relationship between PA and cognition
3	Donnelly et al., 2016	64 studies 1 yoga study	Systematic review	PRISMA	PA, aerobics. Yoga	AP, Cognition, Brain function	Improvement in EF, Increase in pre-frontal activities, Positive and mixed interaction between PA and AP	Evidence rating category for cognition – B and for AP – C. PA & PE have neutral effect on AP.
4	Maynard et al., 2017	61 studies	Systematic review Meta-Analysis	Campbell Collaboration	MBIs	AP, Cognition, Behaviour, Socio-emotional	Positive effect on cognition and socio-emotional Non-significant effect on behaviour and AP. Little heterogeneity found	High risk bias reveals further evidence is required. Cost and adverse effects of MBIs should be evaluated before implementing in schools.
5	Ferreira-Vorkapic et al., 2015	9 RCTs	Systematic review Meta-Analysis	PRISMA	Yoga	Anxiety, Memory, Self-esteem, Mood	Overall effect size was non-significant.	Yoga in educational setting seemed uncertain due to methodological and

								statistical limitations.
6	Sember et al., 2020	44 studies	SR Meta-Analysis	PRISMA	PA, PE, Sports	AP, IQ, Cognition	Inconclusive result impact of PA on AP	Quality PA with frequency, intensity monitored for AP
7	Sharma & Kauts, 2009	N = 301, Age 14 to 15 years	Two group pre-post, non-randomized	Bisht Battery of Stress Scale, AP test scores	Yoga for seven weeks, one hour daily	AP test scores for Maths, Science and Social studies	Improvement in AP scores and significant difference in AP scores in IG Vs CG	No limitations reported, Methodological limitations, non-randomized study.
8	Yuvaraj, 2020	N = 45, Age 14 to 26 years	Three arm RCT	Smith's Aggression, Average AP scores Q1, Q2	SKY, Pranayama for eight weeks, three days a week.	Aggression, Average AP Q1 & Q2 scores.	Aggression and AP were significantly improved in SKY group Vs Pranayama and Control.	Confounders such as IQ, Psychological factors, SES, lifestyle and other exposures were not considered.
9	Firth-Clark et al., 2019	94(F = 31)	RCT, four groups	Self-report for self-regulation and self-efficacy, Standardized test for AP, CAT and SAT scores	HRVBF, Sports psychology and focused breathing, Self-affirmation and Cognitive restructuring, Combination of both and Business as usual	AP scores for English, Maths & Science, and their combined scores.	Significant improvement in combined intervention group of sports psychology and Cognitive restructuring in AP scores and self-efficacy.	High dropout rate, skewed data lead to non-parametric analysis, distribution of females was uneven, experimental bias with respect to exposure of trainer to the other group,
10	Dietrichson et al., 2017	101 studies (76 RCTs)	SR Meta-analysis	Standardized test for Maths and Reading	Tutoring, Feedback and progress monitoring, Cooperative learning	AP scores for Maths and Reading	Small effect size (0.22 to 0.36) for all the academic interventions	Substantial variation in effect size within and between components could not be explained by observable study characteristics.

11.	Solberg et al., 2021	Schools (N=29), students [n=2733], Both genders 13-14 years	Three arm cluster RCT	Standardized test for AP, SES, PA levels, Weight	Physical activity with average count per minute. PA approximately 120 min weekly over nine months	ActiGraph accelerometer (GT3X), parent's education Level (SES), SECA (Wt)	Numeracy* and Reading* scores increased in PAL and DWbH groups compared to control group	Dose and intensity of PA is important to assess the AP measures.
12	(Arnaiz-Sánchez et al., 2020b)	N=228, Control (n=130), Experimental (n=98), Age 6-12 years	Non-probabilistic sampling with Quasi-experimental design.	Language and Numeracy	Cooperative, peer, and problem-based learning, 45 minutes, weekly thrice for six months.	Mean AP, language, and numeracy	Significance for Intra and inter-subject show interaction between time with large ES ($\eta^2 =$ 0.246)	Implementation of learning strategies is necessary to promote quality education. Limited subjects were evaluated.
13	Xu et al., 2023	N=163 studies	Scoping review	OSLQ, MLSQ	Motivated Learning Strategy, behavioural coding, cognitive, meta-cognitive, emotional strategies	AP, comparison in learning context online and blended learning	Findings in (n=43) interventional studies SLR strategies positively impacts AP. No intervention had negative effect on AP	SRL strategies will play significant role in the developmental needs of learners across childhood and adolescence.
14	Sahranavard et al., 2018	N=200 female students, Age 18-22 years.	Correlational Study	Academic Self-Regulation Questionnaire (SRQ-A), Durtaj educational performance test.	Not Applicable	Relationship between SRL and educational outcomes.	Relationship between Self-regulation and planning*, cognitive self-regulation and self-efficacy*, lack of control of outcome and motivation*, internal motivation with emotional effects*	Self-regulation enhances planning and future achievements. Internal self-regulation positively impacts self-efficacy and planning. The study results cannot be generalized.

15	Pandey et al., 2018	N=49 RCTs with 23098 participants , Age 2-17 years	SR and Meta-Analysis	BRI, Humphrey Self-control, Devereux Early Childhood Assessment, Social Control, Questions of the Social Skills Rating System, Flanker and reverse Flanker tasks.	Self-regulation-based interventions	AP, social skills, mental health, behavioural issues, conduct disorders, school suspensions, and substance abuse.	Overall pooled effect size (d=0.42) *, Social and personal skills (d=0.64),	(N=17) studies did not produce change in SR. Considerable heterogeneity in the self-reported measure of SR (I^2 = 77%). Effect on distal outcomes such as, academic achievement, mental health, social skills, and frequency of school suspensions. Substantial heterogeneity in reporting, maximum studies conducted in US.
16	Stec et al., 2023	N=105 male students, median age (17.15 ± 1.42) years	Solomon four group RCT. G-I(n=25), G-II (n=25), G-III, (n=27), G-IV (n=27)	Perceived Stress Scale (PSS emotional intelligence quotient assessed through Chadha test.	G-I and G-III Dynamic Surya Namaskar:50 min session, 6 times per week for 12 weeks. G-II and G-IV School curriculum workout.	Perceived stress and Emotional intelligence quotient.	Perceived stress was statistically significant with ES (η^2 =0.198). Emotional intelligence was non-significant with ES ($\eta 2$ = 0.004).	Stress was significantly reduced and there was slight increase in EQ levels in intervention group. Only male students from rural region. More evidence to differentiate between SN with PA. Findings cannot be generalized.
17	McClelland et al., 2015	N=113, Age 8-10 years	One group time series	National curriculum test for reading, writing, and mathematics	Move4Words , 20 minutes daily for 12 weeks	Academic score at baseline and endline. Reading, writing, and mathematics skills	Average reading progress rates for the whole group were statistically significantly faster after the end of the intervention (63%)	Move4Words intervention had large effect on academically low performing students caused due to increased

							increase. Study average progress showed large ES (g=0.91)	embodied cognitive and attention.
18	Gil-Espinosa et al., 2020	N = 403 Adolescents, Mean Age 13.7 ± 1.2	Cross-sectional study	Shuttle-run test (20 m), Standing long jump, Sit and reach, D48 and Raven's Test, and School Grades	None	Cardiorespiratory fitness, muscular strength, flexibility, general intelligence, and academic achievement	Cardiorespiratory fitness was positively associated with intelligence and academic achievement	Adolescents should spend time engaging in physical activities to improve fitness to positively impact intelligence and academic achievement.
19	Meijer et al., 2020	Twenty-six studies with N = 973 children, Age 5 to 12 years	SR and Meta-Analysis	Chronic and acute physical activity	Moderate to vigorous physical activity accelerating the heart rate	Neurophysiological function, brain structure and function, cerebral blood flow, cognitive, and executive function	Significant yet small effect size of chronic effects of physical activity on neurophysiological function	Physical activity can promote neurophysiological, cognitive functioning, and brain development during childhood.
20	Gothe et al., 2019	Eleven studies on heterogenous population	Systematic Review	MRI, fMRI, Single proton emission tomography	Integrated Yoga, Kundalini Yoga, Devotional Yoga, and Hatha Yoga	Cerebral blood flow, structure, and function of brain	Yoga-practitioners exhibited greater cortical thickness in the left prefrontal cortex, volume of left hippocampus, decrease in cerebral blood flow, and changes in functional connectivity of brain function.	Yoga practices may mitigate age-related and neurodegenerative declines
21	Gard et al., 2014	Forty-seven participants, Yoga = 16, Meditation = 16, Control = 15	Cross-sectional study	Raven's advanced progressive matrices, National adult reading test, MMSE and FFMQ	Kripalu Yoga and Vipassana	Fluid, verbal, and crystallized intelligence. Cognitive functioning and mindfulness	Age-related decline in fluid intelligence was lower in yoga practitioners and meditators and greater resilience to simulated damage. Mindfulness was positively related to fluid intelligence.	Mindfulness increases resilience and slow the decline of fluid intelligence and brain functional architecture and plays a mechanistic

								role in the preservation.
22	Kang et al., 2020	Forty adolescents, Age 17 to 18 years, Meditative Movement and Control (N = 20) each	RCT	Dual n-Back Task and EEG	DahnMuDo – Meditative movement with closed eyes	Working memory and Brain waves	Significant improvement in working memory scores in the study group. It stimulates brain activity related to working memory observed at dorsolateral prefrontal cortex	Meditative movement can be suggested for improving working memory and cognition for adolescents
23	Hattie et al., 1996	Fifty-one studies	Meta-analysis	Assessments of multiple-instructional and learning strategies	Task-related skills, Self-management of learning, Affective components such as motivation and self-concept.	Effectiveness of study skill programs	The mean weighted effect size of study skill programs was $g = 0.45$	Unistructural programs are highly effective with all students. Multi-structural approaches were effective, with younger students. Relational programs were highly effective in all domains of performance, study skills, and affect.
24	Tordön et al., 2020	N = 475, Age 6 to 13 years	Two-year Longitudinal study. Data collected at T1 and T2	WISC-IV, SDQ, ABAS-II, Reading Chains, Magne Mathematic Diagnoses	Skolfam (*School effort in Family care*) School-based intervention	Intelligence, Psycho-social and adaptive behaviour, Literacy and Mathematical skills	Improvements in literacy, mathematics, and cognitive performance. No improvement in adaptive behaviour, and mental health symptoms	Higher-order cognitive functions can be developed with appropriate school support
25	UNESCO, 2017	UIS data from more than 160 countries between	Survey and field study	SACMEQ, IEA for PIRLS and TIMSS, PISA	Policy implementation for Sustainable Development	Basic proficiency level and internal assessments for reading and mathematics at	Globally, 617 million children and adolescents worldwide are not achieving minimum proficiency	The problems should be addressed at three levels; access to schools, retain every child in school and keep

		1995 to 2015			al Growth (SDGs)	the primary and secondary levels	levels in reading and mathematics	them on track, impart good quality education
26	DuPaul et al., 2021	N = 186 adolescents, Age (15±0.8)	RCT	Reports from parent, teacher, and students on OS, AP, and achievement tests scores	Challenging Horizons Program (CHP)	Organization skills, homework performance, and academic outcomes	CHP effect on grades was small yet efficacious for organization skills and homework performance	CHP along with academic skills instruction should be implemented beyond one school year to produce desirable effects
27	Ha et al., 2023	N = 7065, 6th graders	Cross-sectional study	MLSQ, Academic achievement in literacy and Math	Cognitive and Behavioural Learning Strategies	Types of learning strategies and school-type as predictors of academic achievement	Cognitive learning strategies predicts literacy and math achievement. schools with higher levels of metacognition achieved higher levels of literacy achievement	Students who review their thinking processes in subject learning may solve problems more effectively and frequent use of help-seeking strategy may decline their math scores
28	Areepattamannil, 2014	HP (*N* = 1,616; Mean age = 15.81 years) TN (*N* = 3,210; Mean age = 15.64 years)	Cross-sectional study	PISA 2009 reading, mathematics, and science assessments.	Memorization, elaboration, and control learning strategies	Reading, Mathematics, and Science skills	Control strategies was significantly positively associated with reading, mathematical, and scientific literacy.	Rote learning negatively influences the learning outcomes in Reading, Mathematics, and Science.
29	Wale & Bishaw, 2020	N = 20 UG-ELF students	Quasi-experimental design	Critical thinking skills rubrics, Student-reflective journal, Group discussion	Inquiry-based instructions	Critical thinking skills	Inquiry-based argumentative essay writing positively affects students' critical thinking skills	Students developed evaluation, interpretation, analysis, inference, and self-regulation skills through IBL, which is necessary for critical thinking

30	Firman et al., 2019	N = 15 studies	Meta-analysis	PISA test scores	Inquiry-based learning	Aptitude for learning science and development of scientific temperament	Pooled ES of 0.45 indicate most studies focussed on learning scientific- concepts through inquiry-based learning	Results indicate inquiry-based learning improve cognitive abilities in learning science compared to traditional learning methods
31	Donoghue & Hattie, 2021	N = 242 studies	Meta-analysis	Effect sizes (*d*) of each learning strategies	No intervention	Academic achievement, literacy, reading and science skills	Distributed Practice and Practice Testing are most effective learning strategies and least effective are Underlining and Summarization	Authors suggest that there is a need develop self-regulation to implement specific learning strategy at different stages of learning
32	Gallen et al., 2023	N = 725 students	Two-year longitudinal study	Adaptive Cognitive Evaluation Classroom (ACE-C) and Academic Assessments Test	No intervention	Executive Function (EF) such as attention, working memory, and multitasking. Academic skills including Math, Reading, and Reasoning skills	Attention was positively related to math and reading comprehension and statewide standardized test scores	Sustained attention is positively linked to academic skills. Educators can design tools enhancing sustained attention to promote student's academic success
33	Sivashankar et al., 2022	N = 1083, Yoga (n = 584) Control (n = 499), Age 13 - 14 years	Non-randomized controlled trial	Strength and Difficulty Questionnaire	Yoga Group - Surya Namaskar, Pranayama, and Meditation. Control Group – Physical Exercise	Emotional, Hyperactivity, Conduct, and Peer problems	Parent, teacher, and students' scores showed significance between groups for all domains except teachers' assessment for emotional symptoms	Yoga improves attention and reduces behavioural symptoms in school-going children, and had a positive effect on student health, confidence, school achievement, and improved family dynamics

34	Sanchez et al., 2022	N = 93 adolescents, Yoga (n = 56) Physical Exercise (n = 37)	Quasi-experimental study	BRUMS and PANAS-C	Yoga and Mindfulness practice, 24 sessions for 12 weeks. Physical exercise for active control	Psychological well-being, anger, depression, fatigue, mood, and affect	Wellness program improved mood and affect in both the groups. Yoga treatment had a larger effect than the PE class for all the sub-scales of BRUMS and PANAS-C.	School-based yoga program supports and cultivates mental skills and socioemotional dispositions in preparing and educating future generations.
35	Bhola et al., 2016	N = 1087 pre-university students, Age (16.40±0.83)	Survey study	Sociodemographic data and Strength and Difficulty Questionnaire	Not applicable	Perceptions of difficulties in family, Emotional symptoms, conduct problems, hyperactivity, peer problems.	High risk internalizing and externalizing found in 10% of the population. Emotional symptoms prominent among girls and peer problem among boys.	Non-representative sample and purposive sampling method. Non-inclusion of Impact factor scores may extrapolate the risk estimates.
36	Bhat & Roopesh, 2022	N = 2016, Mean age 17 years	Survey study	Strength and Difficulty Questionnaire	Not applicable	Emotional, conduct, hyperactivity, peer problems, and pro-social behaviour	Very high-risk prevalence for emotional problem (9.17%), conduct problem (7.22%), hyperactivity (7.21%), peer problem (7.58%).	Cut-off scores on prosocial behaviour was skewed towards low to very low range of prosocial abilities
37	Shekhawat et al., 2019	N = 994 adolescents, age range 11-17 years	Cross-sectional study	Sociodemographic and Strength and Difficulty Questionnaire	Not applicable	Emotional, conduct, hyperactivity, peer problems, prosocial behaviour, and impact on daily activities	More than 8% adolescents indicated mental health disorder. Conduct problem was more prevalent (12%). Impact of total difficulty was higher in 13.78% adolescents	Only urban population was considered, social desirability cannot be ruled out, and dropouts was mostly from participants susceptible to mental disorders.
38	(Nair et al., 2017)	N = 693 rural and urban adolescent	Cross-sectional study.	Sociodemographic, Teenage Screening Questionnaire, and	Not applicable	Mental health status, mental, and psychosocial factors	Around 15% students had high SDQ scores. Girls had more emotional problems	Psychometric properties of SDQ and TSQ were not reported.

		students, age range 13-17 years of both genders		Strength and Difficulty Questionnaire			and rural students had more mental issues. Physical activity and peer association reduced mental issues among adolescents	
39	(Michelson et al., 2020)	N = 281 of both gender, age 12-20 years. ITT done on 98%	RCT (1:1)	Strength and Difficulty Questionnaire and Youth Top Problems	Problem solving program through counsellor and printed material for IG and through printed material for CG.	Mental health symptoms, Idiographic psychosocial problems	Counsellor led problem solving IG group had moderate effect on psychosocial outcomes and mental health issues on IG compared to CG.	Counsellor-delivered intervention is suggested as a suitable first-line intervention in a stepped care approach.
40	(Bryant et al., 2020)	N = 389, with learning difficulties, age range 5-18 years.	Survey study, transdiagnostic data collection	Strength and Difficulty Questionnaire and Revised Children's Anxiety and Depression Scale	Not applicable	Mental health symptoms, anxiety, and depression	Approximately 49% of the sample were rated within the abnormal range, 29% for total anxiety, and 43% within the range of clinical depression.	Emotion sub-scale of parent's version of SDQ can be used to predict symptoms of anxiety and depression. Good friendship and positive behaviour improve low mood among struggling learners.
41	(Peng et al., 2021)	N = 916, age 14.44±1.84	Exploratory survey study	Short Egna Minnen Barndoms Uppfostran, Rosenberg Self-Esteem Scale, Avoidance and Fusion Questionnaire for Youth, Satisfaction with	Not applicable	Parental rearing behaviour, Self-esteem, Psychological inflexibility, mental health, and depression.	Self-esteem plays a mediating role between parenting style and psychological inflexibility. Significant positive direct effect of self-esteem on mental health and negative direct effect on	Self-esteem plays an important role in the influence of parenting style on adolescent mental health.

				Life Scale, and the Depression Subscale of the Youth Self-Report			psychological inflexibility	
42	(Lorence et al., 2019)	N = 449, age 13.65±1.89	Cross-sectional survey study	Inventory of Stressful Life Events, Parental Socialization Scale for Adolescents, Youth Self Report, Multidimensional Self Concept Scale	Not applicable	Stressful experiences, Parental compliance strategies, Behaviour problems, Self-concepts	Parental behaviour was found to be an important predictor of adolescent maladjustment. The effects of different parenting styles are not the same for adolescent with different adjustment profiles.	Diversification of intervention suggested for different risk profiles, in few cases individual intervention was suggested to improve positive parenting style.
43	Levin, 2011	Not applicable	Theoretical framework	Topology with three parenting styles	Not applicable	Authoritarian, authoritative, and permissive parenting style	Authoritarian parents control children's behaviour based on set of standards. Permissive parents are warmer and more autonomy. Authoritative parenting style fall between two extremes	Parenting styles is a typical way parents think and behave in upbringing their child.
44	Sahithya et al., 2019	N = 87 studies on parenting styles	Literature review of longitudinal, cross-sectional, and survey studies	Studies assessed influence of parenting styles on child development	Not applicable	Authoritative, authoritarian, permissive, and neglectful parenting styles	In western countries, authoritative parenting style was found to have positive influence on long-term development of children and uninvolved parenting yields to lesser optimal development.	More accepting and less restrictive parenting among Indian parents tended to have adolescents with higher academic success and competence. Perception of parental warmth also reduced test anxiety in children.
45	(Hayek et al., 2022)	N = 345, age range 15-18 years	Longitudinal study	Socio-demographics, socio-cognitive	Not applicable	Parenting styles, self-efficacy, academic scores	Authoritative parenting was associated with	Authoritative parenting directly-indirectly

				factors, parenting styles, and academic achievement			better academic performance and higher self-efficacy. Self-efficacy mediated the relationship of parenting style and academic achievement	influenced the academic achievement of Children.
46	Diaconu-Gherasim & Măirean, 2016	N= 178, age range 14-18 years	Exploratory study	Perceived parenting style, academic achievement, and goal orientation	Not applicable	Parenting style, academic scores, goal orientation questionnaire	Parenting styles were significantly associated with goal orientations and academic achievement. Goal orientations mediated the relations between perceived parenting styles and AP.	Parenting style plays an important role in the interplay between goal orientations and academic achievement.
47	(Zahed-Zahedani et al., 2016)	N = 310 UG medical students of both genders	Correlational study	Baumrind's Parenting Style and Moqimi's Career Path questionnaires	Not applicable	Parenting styles and career path	Significant relationship between authoritarian parenting style and educational success and significant relationship between firm parenting style and career path of the students.	Right interaction between parents and children was recommended and parents should familiarize their children with the need for employment.
48	(Tsela et al., 2022)	N = 101 parents having at least one child, 61 mothers and 40 fathers.	Correlational study	Parenting practices inventory, parenting-style questionnaire, academic performance	Not applicable	Parenting styles, parenting practices, and academic scores in language, mathematics, and history.	Authoritative parenting styles and school achievement are positively associated. Authoritarian style is negatively associated with school achievement. Additionally, the results indicate that the authoritarian style is a significant predictor of grades.	Parenting style and parenting practices influence children's academic achievements. Thus, parenting has impact on children's development.

49	Kokkinos & Vlavianou, 2021	N = 250 adolescent students of both genders	Correlational study	Parenting style questionnaire, Trait emotional intelligence questionnaire, academic performance	Not applicable	Well-being, self-control, emotionality, sociability, and academic scores in Languages, Mathematics and Science	Behavioural control was positively correlated with language achievement and psychological control was negatively correlated with language and science achievement	Potentially beneficial role of adolescents' trait emotional intelligence in the association of parenting and academic achievement.
50	(Roshin et al., 2020)	N = 858, Indian adolescents , 405 male and 453 female, Mean age = 16.45 (and SD 0.78).	Cross-sectional study with Convenience sampling	Governmental class, Monthly income, Academic Scores, Rosenberg Self-esteem, and Satisfaction with life scale	Not applicable	Category of students, socio-economic status, academic performance, self-esteem, life-satisfaction	Lower class students were associated with low academic performance.	The sample was heterogenous, though represented three governmental classes in each school.
51	(Horanicova et al., 2022)	N = 1127 (M = 52.7%)	Cross-sectional study	Family Affluence Scale, School Satisfaction, School-work support	Not applicable	Socio-economic status, school engagement, and attitude toward education	Adolescents with low SES with low and middle SES without support inside or outside the family felt indifferent toward school and education.	Use of self-reported questionnaires might have caused information bias. Schoolwork support was measured using a single question. Also, the psychological characteristics of the children were not taken into consideration.
52	(Vadivel et al., 2023)	N = 50 children, age 7-18 years and N = 50 one parent from Germany,	Cross-sectional study	Semi-structured interview questionnaire to children and parents	Not applicable	Socio-economic status, educational achievement, and psychological well-being	Children from low socio-economic status perform poorly in academics. They have low attendance, irregularity, and dropout in-between the session	Study limited to rural children and parents. Few data were collected online. Survey limited to 50 sample size across three countries.

		India, and Nigeria						
53	(Sirin, 2005)	N = 101,157 students across 6871 schools	Meta-analysis study	Parental income, education, occupation, free or reduced lunch, academic performance	Not applicable	Socio-economic status, GPA, PIAT, WRAT, CTBS	Moderate association between SES and academic achievement at the student level. The effect of resources at home reflect the effect of social capital on academic achievement.	Studies between 1990–2000 were included. Sample of the study was limited to the US system of schooling. Studies were not eliminated irrespective of the quality.
54	(Li et al., 2020)	N = 345 students, age range 9-17 years, female (52.4%)	Cross-sectional study	Education, occupation, and income of parents. Children and Adolescents Self-Recognition Scale. Score in language and mathematics	Not applicable	Socio-economic status, Self-concept, Academic performance	Self-concept mediated the relationship between SES and performance in Chinese and Mathematics.	Convenience sampling might have ruled out the generalizability of the results. The cross-sectional design may have caused limitations in establishing the causal relationships between variables.
55	(Bapat et al., 2017)	N = 268 school children aged 10–15 years from Pune, India	Cross-sectional study with convenience sampling	Family Affluence Scale, Physical activity, Academic work, Screen-time, Sleep	Not applicable	Socio-economic status, time spent in physical activities, screen-time, sleep and various types of academic work done	Negative relation between SES and Sleep and the relation between SES and sleep time was significantly mediated by screen time and academic work.	Screen time was composite variable. No standard questionnaire for sleep was administered. Findings cannot be generalized.
56	(Culler & Holahan, 1980)	N = 96 College students including n = 65 with high anxiety and n = 31 with	Cross-sectional study	Test Anxiety Scale, GPA scores.	Not applicable	Test Anxiety, Academic performance, and Study Habits	The mean GPA for the low test-anxious group was higher than the high test-anxious group and the high-test anxious students spent more study time than low test-anxious students.	Definite relationship between study skills, study habits, time spent, and attention required to retrieve the information is not

		low anxiety.						analysed and explained.
57	(Achor et al., 2023)	N = 250 secondary school students	Cross-sectional study	Mathematics Text Anxiety Questionnaire (MTAQ) and Mathematics Performance Text (MPT)	Not applicable	Mathematics performance and test anxiety	Students' performance is significantly influenced by test anxiety. Being a key factor, it undermines students' performance.	Number of errors done by the students were not reported. Recommendations or corrective measures to reduce test anxiety are not clearly mentioned.
58	(Theobald et al., 2022)	N = 309 students. Female (71%), mean age = 25.90 years, SD = 3.25 years	Single group pre-test post-test	State and Trait Anxiety, Exam performance score, Working memory	Mock tests on a digital platform over a period of 100 days	Academic Emotions Questionnaire, Survey questionnaire, Objective performance test, numerical-updating task	Test anxiety was associated with academic achievement but did not predict the change in performance from the mock exams to the final exam. Working memory did not moderate between test anxiety and exam performance.	Limited scope of the findings because of a selective sample. The uncontrolled correlations between test anxiety and exam performance because of selective sample.
59	(Jerrim, 2023)	N = 4,914 High School Students	Cross-sectional study	PISA tests, GCSE examinations, and Test anxiety - PISA, Economic and Social Cultural Status - PISA	No intervention was given. The CGSE and PISA tests were conducted six months apart	CGSE examination grades, Reading, English and Mathematics skills, and Socio-economic status	Low evidence of a clear link between test anxiety and GCSE performance and less difference in GCSE outcomes and levels of test anxiety and those who are at the top-end of the test anxiety scale.	Test anxiety measure used five item scale which is used more towards the worry aspect of test anxiety rather than emotionality. Anxiety was tested only once in 11-year-old students. High stakes CGSE exams conducted in atypical setting.
60	(Torrano et al., 2020)	N = 1181 students, 12 to 18 years, M = 14.7 and SD =	Cross-sectional study	Test Anxiety Questionnaire, Academic Scores, Educational Level	No intervention	Test anxiety, Academic performance, Grade, and	In all grades, girls tend to have more anxiety. Students of higher age showed higher level of TA. Also, high degree	Evaluation was limited to questionnaires answered by the student. Lack of

		1.8, n = 569 boys (48.2%) and n = 612 girls (51.8%)				Demographic characteristics.	of self-pressurizing of students with high marks interferes with their performance.	data from parents and teachers. The timing to conduct the assessment during examination period is reported as one of the limitations.

3.1 SUMMARY OF THE SCIENTIFIC LITERATURE

The transitional phase of adolescence significantly influences an individual's multidimensional development, impacting their role as responsible social citizens and contributing to optimal resource and financial value. However, disparities across socio-economic strata, learning facilities, mental and physical health, job opportunities, and education hinder the successful navigation of this phase. The literature review highlights a scarcity of robust studies in India, revealing a need for scientifically rigorous approaches to formulate tailored modalities for adolescents.

Physical activities during adolescence have been associated with positive effects on cognitive function, psycho-physiological aspects, and academic performance. However, critiques raise concerns about methodological flaws in existing studies. The impact of physical activity on academic performance remains inconclusive, with varying results reported in different studies. While some studies show improvements in academic scores and self-efficacy, limitations such as high dropout rates, skewed data, and potential experimental bias are noted.

Research on academic self-regulation (SRL) and educational outcomes suggests positive impacts on planning, cognitive self-regulation, self-efficacy, and motivation. However, caution is needed in generalizing findings. Dynamic Surya Namaskar and Move4Words interventions show positive impacts on perceived stress, emotional intelligence, and academic skills, respectively. Cardiorespiratory fitness is positively associated with intelligence and academic achievement in adolescents.

Studies on learning strategies, including study skill programs, inquiry-based learning, and distributed practice, reveal varying effectiveness. The role of sustained attention in influencing

math and reading comprehension is highlighted. School-based interventions like Skolfam show improvements in literacy, mathematics, and cognitive performance. UNESCO (2017) emphasizes addressing issues related to school access, retention, and delivering quality education to enhance proficiency in reading and mathematics globally.

Mental health studies indicate a prevalence of high-risk internalizing and externalizing issues among adolescents. The impact of emotional, conduct, hyperactivity, and peer problems on prosocial behavior and overall mental health is evident. Interventions such as counsellor-led problem-solving show moderate effects on psychosocial outcomes.

Parenting styles, socio-economic status, and individual factors contribute significantly to academic achievements. Authoritative parenting styles positively correlate with academic success, while authoritarian styles show negative associations. Socio-economic status has a moderate association with academic achievement, emphasizing the role of social capital. Self-esteem mediates the relationship between parenting styles and psychological inflexibility, influencing mental health.

Test anxiety's link to academic performance and study habits reveals that the low test-anxious group had a higher mean GPA, while high test-anxious students spent more time studying. The study lacked a detailed analysis of the relationship between study skills, habits, time spent, and information retrieval attention. Additionally, higher anxiety was observed in girls across grades, increased test anxiety in older students, and self-pressurizing among high-achieving students, impacting performance.

Yoga-based studies revealed mixed results. A meta-analysis by Ferreira-Vorkapic et al. (2015) across nine randomized controlled trials found that while yoga interventions targeted

anxiety, memory, self-esteem, and mood in educational settings, the overall effect size was non-significant due to methodological limitations. Sharma and Kauts (2009) demonstrated that yoga program improved academic performance among adolescents, although the lack of randomization posed methodological concerns. Sivashankar et al. (2022) further supported the positive impact of yoga, showing significant reductions in emotional and behavioral problems, along with enhanced attention and school performance compared to physical exercise

Despite advancements, limitations such as methodological flaws, potential biases, and a lack of generalizability are prevalent in the reviewed studies. Future research should focus on addressing these limitations and employing rigorous methodologies to provide nuanced insights into the complex interplay of factors influencing adolescent development and academic performance.

3.2 LIMITATIONS OF THE REPORTED STUDIES

Methodological flaws indicated in the collated studies include inadequate reporting and inconclusive results (Sember et al., 2020; Singh et al., 2019). Criticisms highlight the omission of confounding factors, high dropout rates, skewed data, uneven gender distribution, and potential experimental bias in physical activity studies (Firth-Clark et al., 2019; N. Sharma & Kauts, 2009). There are challenges in generalizing findings from academic self-regulation studies to broader populations (Pandey et al., 2018; Sahranavard et al., 2018b). The exclusive focus on rural male students in the study on Dynamic Surya Namaskar necessitates further evidence for broader applicability (Stec et al., 2023).

Potential biases and non-representative samples are issues in mental health studies (Bhola et al., 2016; Nair et al., 2017). There is a need for more extensive longitudinal research and consideration of individual psychological characteristics in socio-economic status studies

(Horanicova et al., 2022; Roshin et al., 2020). Challenges in establishing causal relationships in parenting style studies arise due to the correlational nature of the research (Diaconu-Gherasim & Măirean, 2016; Levin, 2011). The limitations of cross-sectional designs and potential biases are noted in studies assessing test anxiety and academic performance (Achor et al., 2023; Culler & Holahan, 1980).

A significant limitation in adolescent research, particularly in studies related to yoga, has been the use of weak methodologies and the generation of inconclusive results. These factors have largely resulted in the classification of such studies as low quality. Additionally, learning interventions have primarily focused on cognitive faculties and learning motivation as the main predictors of academic performance. It is crucial to understand the complex process of learning in terms of human capabilities, which encompasses emotional regulation, motivation, self-regulation, self-efficacy, the effort required to gain knowledge, and being consistent in learning through an attitude of lifelong learning.

3.3 CONCLUSION

While the literature provides valuable insights into the multifaceted factors influencing adolescent development and academic performance, several limitations highlight the need for more rigorous and comprehensive research in this domain. Future studies should prioritize robust study designs, control for confounding variables, and ensure adequate sample sizes to enhance the reliability and validity of findings. Studies need to include diverse populations to ensure the generalizability of results and account for variations across different demographic groups. Long-term, studies are essential for understanding the dynamic nature of adolescent development and academic performance, allowing for the identification of trends and causative factors. More

randomized controlled trials are needed to evaluate the effectiveness of specific interventions in enhancing academic performance and overall well-being.

Future research should adopt approach, which includes interventions addressing the multi-faceted problem during the adolescent phase. The complex interplay of various factors does not limit only to socio-economic status, parenting styles, mental health, and physical activities. Studies should consider intervention modalities which address the problems at physical, emotional, intellectual levels among other non-cognitive factors which significantly contributes to learning efficacy and positive outcomes. Furthermore, for effective learning, training programs to inspire and motivate adolescents to learn irrespective of their social status, learning capabilities, and other psycho-social issues should be promoted.

Intervention programs should focus on mitigating negative influences and promoting positive learning environment and learning efficacy for optimal learning. Furthermore, replication of studies is crucial for validating findings and establishing the robustness of interventions across different cultural and socioeconomic contexts. In conclusion, addressing the complex challenges faced by adolescents requires a holistic and evidence-based approach. By overcoming the identified limitations and building upon existing research, present study can contribute significantly for adolescent development with well-rounded growth and academic success of adolescents.