THE RELATIONSHIP BETWEEN PSYCHOLOGICAL STRESS DUE TO THE SOCIO-ECONOMIC STATUS (PSSES) OF LEARNERS AND THEIR ACHIEVEMENT IN SCIENCE

Akanksha Jain, Ruchi Shukla and Sunita Farkya

Department of Education in Science and Mathematics,
Department of Educational Psychology and Foundations of Education
E-mail: sunita.farkya@ciet.nic.in

The National Curriculum Framework (NCF), formulated by NCERT in 2005, serves as a guideline for syllabi, textbooks, and teaching practices for schools in India. With many years past its implementation, it becomes imperative to ensure its effectiveness, especially at the rural level and identify areas for improvement. A survey was conducted by visiting a rural school in Delhi with students from predominantly weak socio-economic backgrounds. The researcher interacted with learners and gained insight into the school system, teachers, and learning environment.

One needs to look at science education from a psycho social perspective i.e. factors that intervene in the learning of science. This becomes especially important for the rural students who comprise a major section of school going population. Since these students come from background characteristic of first generation learners, little to no understanding of science education and low nutrition etc. In order to get a first-hand experience of factors affecting the learning process of science directly or indirectly among learners is crucial to ensure its benefits are reaped at grass root level and to find out gaps, if any, for further interventions

This research study investigates the gaps in science learning due to psychological stress in children from weak socio-economic backgrounds and related factors in Indian schools.We found that stress negatively impacts learners' performance in science and an alarmingly high level of learners self-diagnosed with stress and related psychological problems. In addition to this, the relationship of perceived autonomy and self-regulatory behaviour were found to influence science performance positively. It is noteworthy, that in this study we found nutritional habits and family type (joint/nuclear) greatly influence science performance stress levels, perceived autonomy and regulatory behaviours in learners. The paper discusses these factors at the theoretical and policy levels, intending to provide recommendations improve science literacy despite the social background.

Introduction

The idea of getting first-hand experience with curriculum transactions and factors affecting the learning process of science directly or indirectly among learners is crucial after curriculum reformation to ensure its percolation at the grass root level and to find out gaps, if any, for further interventions. After approximately 6-7 years of implementing the new curriculum (NCF, 2005; NCERT, 2006), it is expected to have been fully implemented, with nationwide orientation workshops being conducted for educators and academicians from states/ union territories by NCERT.

The curriculum focuses on a paradigm shift from a teacher-centred to a learner-centric approach to teaching-learning. In this light, the opportunity to visit a rural school in India for three months was utilised. In this endeavour, one of the researchers (Sunita Farkya, Professor DESM, NCERT) visited Sarvodaya Kanya Vidyalaya, a Delhi government rural school in Aaya Nagar, Delhi. The objective of this visit was to interact directly with learners and gain a deep-sighted understanding of the school system, learners, teachers and learning environment. The visit to this rural school was crucial in framing the research framework and developing the

questionnaire/tool to collect feedback about the various interacting factors affecting the teaching-learning process and process of learning science. The school visited has a purely rural background; however, the school is located near a suburban area in Delhi. Most of the children coming to this school belong to a weak socioeconomic family background. The learners hailed from nearby states, including Uttarakhand, Uttar Pradesh, Rajasthan, Haryana, Punjab, Himachal Pradesh, and Madhya Pradesh, thereby bringing in a wide variety of diversity in terms of -cultures, backgrounds and socioeconomic statuses. Both parents are well-versed in agricultural methods and techniques due to their agricultural heartland roots. The parents of learners who have migrated to the city mostly work as labourers on daily wages or plumbers, or carpenters (in the case of fathers), and as domestic help or housewife (in the case of mothers), making the average family income less than INR 20,000.

Socio economic status of the family impacts the well-being of the members in different ways. One important psychological impact is the stress of the members. While parents are anxious in meeting the basic needs and requirements for living the anxiety and stress percolate to other members in the form of frequent arguments, violence, nutritional deficits, malpractices etc., which have a direct bearing on their academic involvement and engagement. Therefore research has understood and acknowledged the impact of social conditions which lead to variations in health and well-being and are also referred to as the social causation perspective.

Apart from the academic reason of curriculum, pedagogy and assessment, science learning is also based on psychosocial aspects like parental orientation, support and motivation. Students coming from lower SES generally miss out on the parental involvement in their formal education. This lack of involvement can be seen in their breakfast habits and nutrition. Only 42.8 per cent of the children ate breakfast regularly which often fails to meet required energy and protein demands(Chitra, et al., 2007). Lack of nutrition compounds the effect of stress and that reflects in their poor academic performance. Further, it is also seen the students coming from lower SES have little to no education support as they are first-generation learners and their parents have no understanding of science and orientation towards it. These factors increase the academic difficulty of students and the academic gap keeps increasing with little to no support from parents either due to their illiteracy or ignorance.

Theoretical Foundation in Literature

When the economic circumstance improves with employment of parents resulting in better family income it shows correlation to decline in behavioural problems amongst children (Costello, et al; 2003) i.e. as the fail stress reduces the children flourish better. Another way family income correlates with children well-being is through the investment that the parent makes in their children. As the family's finances improve the investment of parents in their children by way of education and nutrition also improve (Conger & Conger, 2002, Bradley & Corwyn, 2002; Mayer, 1997). Mistry and her colleagues also showed that the impact of income on child's social and cognitive outcomes through family processes was stronger for poorer families (Mistry, et al; 2004. Further Socio economic status influences parenting behavior and their

educational support for their children which leads to children's better learning habits and therefore positively affect their academic performance.

The children who come to the Indian science classrooms belong to heterogeneous socio-economic-regional and cultural backgrounds. They may or may not continue to pursue science related careers in future still each and every citizen of India needs to be scientifically literate (NCF, 2005). How school science teaching can meet the requirements of all the students? What can one reasonably expect from a student in terms of their understanding of science after learning at upper primary level? These are some of the questions yet to be addressed. The purpose of the research study is to find out the gaps in science learning with respect to psychological stress to children due to socio-economic backgrounds of their families.

Objectives

The objectives of this study were to:

1. assess the level of psychological stress among learnersand its implications on science achievement amongst students of class eight.
2. explore the relationship of Socio-economic status on the stress and achievement in science.

Research Methodology

The Sarvodaya Kanya Vidyalaya, Aaya Nagar, in Delhi purely has a rural background; however, the school is located near a sub-urban area in Delhi. Most of the children coming to this school come from a family background with a labourer father working on daily wages or working as plumber, carpenter or such kind of workers and domestic help or house wife mothers, coming from rural backgrounds from nearby states (Uttarakhand, U.P, Rajasthan, Haryana, Punjab, HP, MP or sometimes from other states) also encompassing a wide variety of cultures, diversity, backgrounds and socioeconomic statuses of learners. Thus both the parents are well versed in agricultural methods and techniques. Most of the learners coming to the school have a poor socioeconomic background.

Research Design: A cross-sectional, questionnaire-based survey was carried out. This survey was based on the Exploratory sequential design by Creswell & Clark (2011).

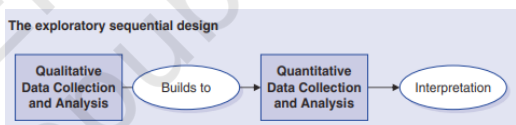

Fig 1: The explanatory sequential design by Creswell & Clark (2011)

Sampling : The sampling technique was purposive. This study was conducted in an 'all girls' government school from a rural region with infused boundaries of urban Delhi. One of the authors carried out this study as part of routine work during the field visit for three months. All the respondents selected for tool administration and data collection were females in the eighth standard and used English as the medium of instruction.

Tools : The students were given seven questionnaires and a science quiz each. They were clearly instructed regarding the procedure to respond, and all of them could answer autonomously without help from peers or teachers. The six questionnaires

were: details of the subject, why I do a thing, stress scale, learning climate questionnaire, and common questionnaire. Each of survey was used as a quantitative and qualitative tool to identify and establish the relationship between psychological stress and socioeconomic status of individual learners and its impact on their achievement in science. A brief description of these tools is given below:

(a) Stress score

The stress scale used for qualitative analysis of stress in the sample population was an adaptation of the Hopkins Symptoms Checklist (HSCL) [Derogatis & Cleary, 1977; Lipman et al., 1979]. It is a Self-Report Symptom Inventory developed for individuals, which gives an understanding of possible psychological symptoms being experienced by the subject under stress. In our study, the stress scale used was a self-rating inventory with a yes or no answer format. The used scale had 30 items drawn from the HSCL measuring 11 reactions to stress. These 11 reactions were reflected in various questions of the study.

The total scores of each item were added to get a final score on stress levels, and the subscale items could be added separately to give sub-scale scores for all the 11 psychological reactions that could further be used for a richer interpretation of the stress of the students.

(b) Perceived autonomy

To assess learners' autonomy in the classroom, the Learning Climate Questionnaire developed by Ryan and Connell (1989) was used. The scale is a measure of autonomy, one of the several variables of Self Determination Theory (SDT). Essentially SDT caters to understanding the quality of social contexts that influence the motivation, performance, and well-being of individuals who operate within them. The climate questionnaire yields a score on a 7-point scale, which shows how the respondents perceive their supervisors/teachers/managers etc., i.e. supportive or non-supportive of autonomy. Higher scores show higher perceived autonomy support. The scores were calculated by averaging the individual item (15 items) scores. However, averaging the item score, item 13 was 'reversed' (i.e. the score of item 13 was subtracted from Item 8 and used). High average scores reflect high-perceived autonomy support.

(c) Self-Regulation

The Academic Self-Regulation Questionnaire (SRQ-A) was used to assess the scale of self-regulation. It is primarily concerned with the reasons as to why students do their school-work. Developed by Ryan and Connell (1989), this scale has four subscales: External Regulation, Introjected Regulation, Identified Regulation, and Integrated Regulation. These behavioural aspects are based on the SDT, and differentiate different types of behavioural regulations in terms of the degree to which they represent autonomous or self-determined (versus controlled) functioning.

The questionnaire had 30 items. The following are the subscales that comprise the questionnaire External Regulation, Introjected Regulation, Identified Regulation and Intrinsic Motivation. Firstly, the subscale scores for each of the four subscales were calculated by averaging the items that make up that subscale. The responses on the 4-point scale were scored as follows Very true is scored

as 4, Sort of true was scored as 3, Not very true was scored as 2, and, Not at all true was scored as 1.

Following this, the Individual subscale score or Relative Autonomy Index (RAI) were calculated and used for analysis. The more controlled the regulatory style represented by a subscale, the larger its negative weight (RAI); and the more autonomous the regulatory style represented by a subscale, the larger its positive weight (RAI). To calculate the RAI, the following formula was used:RAI = (2 x Intrinsic Motivation Score) + (Score on Identified Regulation) – (Score on Introjected Regulation) – (2 x External Regulation Score).

(d) Details of the subject and common questionnaire

These questionnaires were prepared to incorporate questions to understand and analyse the different family backgrounds of learners, family members, the financial status of the family, hobbies they like, career aspirations, routine activities they enjoy like eating, sleeping, and playing etc. Specifically, learners were asked whether they have breakfast before coming to school and the meals they most commonly have for breakfast. Another specific detail was the family type i.e. joint/nuclear, and the number of family members.

(e) Tools for Attainment in Learning of Science (TALS)

A questionnaire that was essentially based on primary and middle school science concepts was developed and validated by experts opinion and field try out. Some questions were multiple choice based, while others were subjective questions. The maximum score that could be obtained was 25.

Statistical analysis: Based on the data collected through the questionnaires, the statistical analysis in this study was performed using R-4.2.2 software. In any statistical study, there can be three variables,namely: -

- Dependent Variable is the variable that is the primary object of research. It is the "effect" that researchers want to study.
- Independent Variable(s) is the variable that causes the phenomenon under study. It is the "cause" that creates the "effect".
- Control Variables are the variables that are not intended to be the primary focus of the "cause" of the "effect", but they also control or influence the "effect".

The objective of this study is to observe the effects of stress, motivation and perceived autonomy among female learners on their learning outcomes in science. Therefore, in this context –

- Dependent Variable: Learning Outcomes, measured by the scores in Science questionnaire.
- Independent Variable: Stress, RAI, and Autonomy Scores
- Control Variables: Breakfast, Family Type

Based on these variables, two types of statistical tests were performed:-

a) Descriptive Statistics

- Histogram and Boxplots depicting the distribution of Independent (Stress, RAI, and Autonomy) and Dependent Variables (Science Quiz Scores)
- Boxplots depicting the distribution of Independent and Dependent Variables

faceting by Control Variables (Breakfast and Family Type)

b) Linear Regression Models

- Model-1: Regression of Score on all Independent and Control Variables (Breakfast, Family Type).
- Model-2: Regression of Score on RAI and Control Variables (Breakfast, Family Type).
- Model-3: Regression of Score on Stress and Control Variables (Breakfast, Family Type).
- Model-4: Regression of Score on Autonomy and Control Variables (Breakfast, Family Type).
- Model-5: Regression of Score on Stress, Breakfast, and accounting for their interaction term.
- Model-6: Regression of Score on Stress, Family Type, and accounting for their interaction term.

RESULTS AND DISCUSSIONS

Stress among learners: The stress of individual learners and the underlying psychological symptoms being experienced due to it were analysed by a stress scale based on the Hopkins Symptoms Checklist (HSCL). The average stress score was 16.8, a distribution of scores as shown in Fig 2.

It was found that a staggering 67.3 per cent were facing despair, while more than 50 per cent could identify themselves facing 10 out of 11 psychological symptoms induced by stress. The psychological symptoms categorised by HSCL and average students (%) facing the symptom and its correlation with their science achievement were analysed as projected in Table A1 (in appendix).

The learners reported a high level of perceived stress. The stress can be an offshoot due to the student's social, emotional, physical, and family problems and may negatively influence their learning ability and academic performance [Shah, M. et al., 2010].

Perceived autonomy among learners: The learning climate questionnaire (LCQ) was used as a scale to measure the perceived autonomy of support by the learners. The scale of score ranges from 1-7, with 7 being the highest perceived autonomy support. The score for more than 30 per cent of students

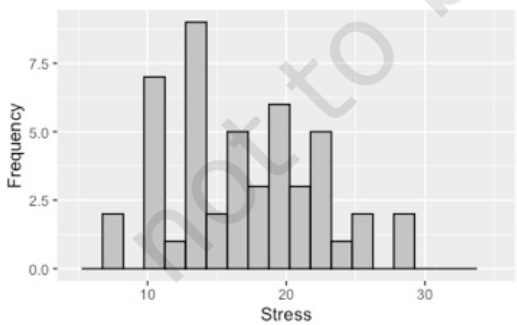

Fig 2: Histogram representation of the range of stress score distribution among learners, 0 being lowest and 30 being maximum.

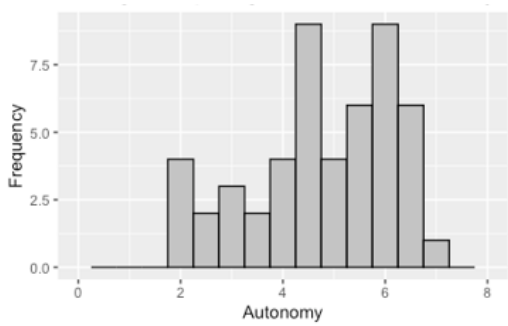

Fig 3: Histogram representation of the range of autonomy score distribution among learners, 0 being lowest and seven being maximum.

lay between 5-6 and nearly 25 per cent of students' scores lay below 4.

Self-Regulation among learners: In order to quantify the perceived autonomy, for determination of intrinsic vs extrinsic motivation among students, Academic Self-Regulation Questionnaire (SRQ) was used. Based on the scores of four subscales, external regulation, introjected regulation, identified regulation and intrinsic motivation, the Regulation autonomy index (RAI) was calculated. As the controlled subscales (external regulation, introjected regulation) are weighed negatively, and autonomous scales (identified regulation: and intrinsic motivation) are weighed positively, a larger negative weight represents a controlled regulatory style. It was found that more than all students had a negative RAI, varying from 0 to -30. More than 50 per cent of students were identified with a highly negative RAI (-15 to -30), indicative of their lack of behavioural freedom and autonomy. It was also noted that 60 per cent of students who had a high-stress score (→15) showed a highly negative RAI score (→-15).

Science score of learners: The students in this study were given a science questionnaire with basic and applicative type of questions related to general science. The answers to which were based on choosing the correct choice among given multiple choices. The average score of class was 14.7 out of 25. The marks distribution of 50 students is as shown in the Fig 5.

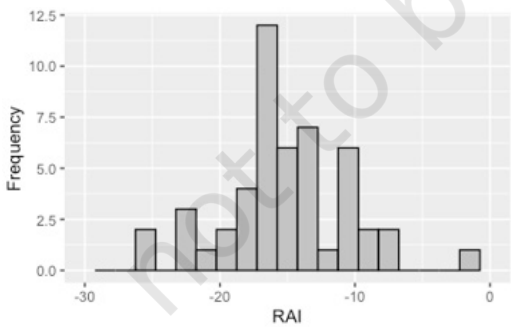

Fig 4: Histogram representation of the range of RAI score distribution among learners, varying from 0 to -30

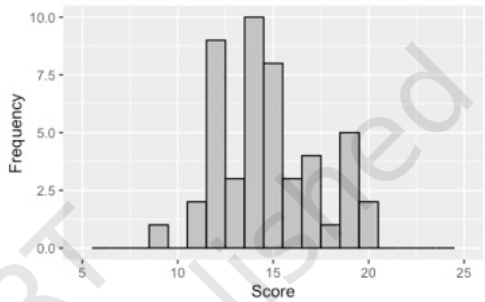

Fig 5: Histogram representation of the range of Science quiz score distribution among learners, varying from 0 to 25

Impact of learners' nutritional habits on their stress, perceived autonomy, self-regulation and science score

The nutritional quantity and quality of learners is an important factors for their physical and mental well-being [Rucklidge, J. et al, 2021]. In a study by Dani and the group, it was found that nutrition also has potent effects on brain function. It was concluded that protein, iron, iodine, and breakfast consumption all impact a child's learning capability and behaviour. The study identified additional, potent roles of micronutrients, such as essential fatty acids, minerals, and vitamins, in preventing learning and behavioural disorders [Dani, J. et al., 2005]. In the survey, we identified whether the learners take breakfast before coming to school or not. We found an interesting trend between the relationship of stress scores and the achievement in science of learners with their breakfast habits. It was found that

learners who regularly had breakfast before school scored higher on the TALS and showed lesser stress levels. While the RAI score was reduced, the perceived autonomy score significantly improved in learners having breakfast. These results are shown in Fig 6 by box plots, where 0= not having breakfast and 1= having breakfast.

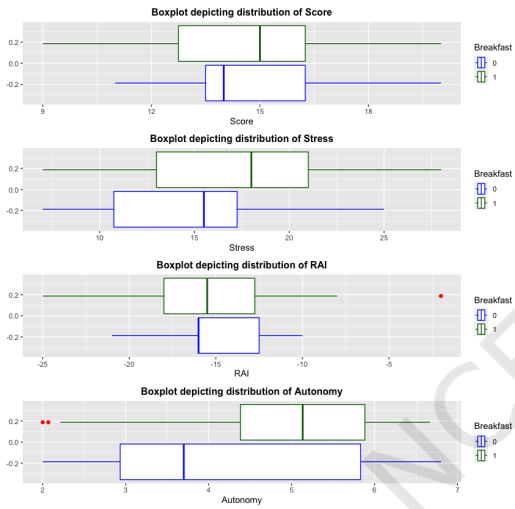

Fig 6: Box plot distribution showing the impact of breakfast on four variables of learners- science score, stress score, RAI, and perceived autonomy.

Impact of learners' family type (joint/ nuclear) in their stress, perceived autonomy, self-regulation and science score

Nowadays, lifestyles are rapidly changing owing to social and cultural changes, rapid urbanisation, and hustle. In such a scenario, the family is an important support system, especially for mental health [Chadda and Deb, 2013]. In our study we found that the 'family type' i.e., joint or nuclear, had a serious correlation with learners' stress. The average stress score for nuclear family learners was higher than that of learners from the joint family system. Similar results were shown in a study by Chadda and Deb, 2013. Additionally, we also found that the science score was improved in students coming from joint family type while the perceived autonomy score was decreased in them. There was no significant change in the RAI based on the family type. These results are shown in Fig7 by box plots, where 0= nuclear family and 1= joint family

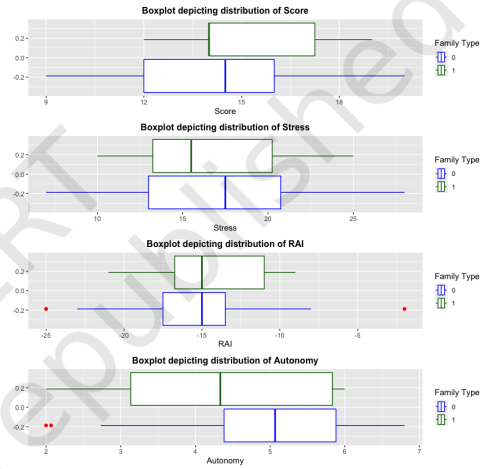

Fig 7: Box plot distribution showing the impact of family type (joint/nuclear) on four variables of learners- science score, stress score, RAI, and perceived autonomy. Note- Family type: 0= nuclear family, 1= joint family

Probable triggers of stress in learners

The learners in our study belonged to economically weak families, a probable stress trigger. The Family Stress Model (FSM) predicts that economic hardship primarily influences the development of children through parents' lives. It is noticed that family economic hardship and pressure are indirectly related to children's adjustment through their influence on parents' behavioural and emotional functioning [Conger and Donnellan, 2007].In

addition to the environment at home, difficult situations in the classroom, such as exams or interpersonal conflicts, can also challenge or exceed the coping strategies or resources available and thus threaten the learner's homeostasis, and inner balance, leading them to feel 'stressed' [Vogel and Lars,2016]. This study found a positive correlation between perceived homework stress and overall stress among learners. While an academic attitude development tool, homework can often be stressful for learners [Katz et al.,2012] if done as a result of extrinsic motivation rather than intrinsic motivation. In this study it was noted that the trend of the perceived autonomy score showed a negative correlation with the stress score. The majority of the students who had higher perceived autonomy scores (between 4-7) had lower stress scores (←15) and vice versa. Additionally, a moderately positive correlation was found between the perceived autonomy score and science achievement. The results are coherent with a Chinese study that suggests that academic stress is a multidimensional construct with four subconstructs: pressures to perform, stress related to teacher expectation, perception of workload and stress related to academic self-perceptions [Zheng et al, 2020].

Impact of stress, perceived autonomy and RAI on Science Learning

In our study, we found that stress and most of its psychological symptoms have a profound negative correlation with learning and achievement in science (as shown in Table 2). It is notable that stress, even in low amounts, can hinder effectively carrying out tasks [Motowidlo SJ et al., 1986] and deeply hampers the cognitive ability to concentrate [Sailer HR et al., 1982]. Additionally, stress has been found to impair memory, diminishing the ability to recall or recognise previously learnt facts and concepts [Schwabe et al., 2010].

The learners in this study belonged to a weaker socioeconomic status [SES]. Many studies have established that SES, inversely related to mental health risks, is a major cause of a lack of self-regulatory behaviour [Blair and Clancy (2010)]. Family stress, relationship with caregivers and financial stress of caregivers has been found to impact the self-regulatory behaviour in learners [Duran et al., 2020]. It was found that learners who perceived higher support from teachers were less stressed and performed better in science. Learners spend a good amount of day in school, and experiences of school can positively or negatively influence their thoughts, mood and perception of self-worth. There is considerable evidence showing that teachers can provide a positive climate in which students can learn to face different challenges and difficulties [Zhang et al. 2021]. Teachers can play a fundamental role in providing autonomy support aimed at satisfying students' need for autonomy by offering students choices, appreciating students' points of view, and encouraging them to develop autonomously [Reeve, 2009]. Teachers can also fulfil students' need for relatedness by developing positive teacher–student relationships by showing affection, dedicating time to students, expressing understanding, and providing support when needed [Stroet et al., 2013]. Thus, both strategies might act as "corrective experiences" that modify students' negative views of themselves or their relationships with others and alleviate students' academic and interpersonal stress [Rhodes et al., 2006]. This study found that 60% of students who had a high-stress score (→15) showed a highly

negative RAI score (→-15), indicative of lack of indicative of their lack of behavioural freedom and autonomy.

Linear Regression Model(s):- Based on the dependent, control and independent variables as mentioned in methods section, six regression models were generated as shown in A2 (mentioned in the appendix). Out of the six generated models, model 1, was found most suitable to our study.

Equation forModel-1:$\widehat{(Score)} = \beta\_0 + \beta\_1 \cdot (Breakfast) + \beta\_2 \cdot (Family\ Type) + \beta\_3 \cdot (Stress) + \beta\_4 \cdot (RAI) + \beta\_5 \cdot (Autonomy)$

From the model it is clear that having breakfast should positively affect children's performance in the Science Quiz ($\beta\_1>0$). The joint family type is also causing a positive increment in the science score ($\beta\_2>0$). As expected, stress bears a negative effect on the performance in the quiz ($\beta\_3<0$). RAI, as a measure of motivation for learning, as expected effects on the performance in the questionnaire positively ($\beta\_4<0$). While the model predicts a negative perceived autonomy enhances the score in science ($\beta\_5<0$).

The model estimations are coherent with the results obtained and arguments provided above. In such a light, this mode can act as a benign beginning to statistical reform of learners' learning achievement.

Recommendations:

Education is a fundamental right that should be accessible to every child, regardless of their socio-economic background. In this regard, it is crucial to address the unique needs and challenges faced by school-going children from socially and economically weaker sections of society. To ensure their holistic development and well-being, various measures can be implemented across different domains. Based on the learnings of this study authors recommend consideration and implementation of the following points for educational institutions and policymakers to create a more inclusive and supportive environment for school-going children from socially and economically weaker sections of society, ultimately enhancing their educational outcomes and overall well-being.

Policy Recommendations:

1. Financial Aid Schemes and Scholarship Programmes: Numerous schemes for the upliftment and empowerment of the girl child have been introduced by the central and state governements that can help girl child financially and with education such as: Beti Bachao Beti Padhao, Sukanya SamriddhiYojna, CBSE Udaan Scheme etc. It is important that educational and public welfare institutes create awareness amongst girls and their guardians from weaker SES about these schemes and help them avail its benefits. Other than existing schemes, educational institutes and states can introduce a range of scholarship programs, including merit-based and need-based scholarships, to incentivize students to pursue higher education and reduce the financial burden on their families.

2. Teacher Training and Sensitisation: Implement specialized capacity building programs to equip educators with strategies for addressing the unique needs of students from low SES backgrounds, including differentiated instruction and classroom management techniques and culturally sensitive and contextual teaching methods. Initiate training and sensitisation of educators to understand initial signs of mental and physical breakdown amongst learners and get them help through counsellors or/and doctors.

3. Nutrition and Health: First and foremost, the mid-day meal program, a significant initiative to promote school attendance, needs to be enhanced. The meals should not only be nutritious but also incorporate traditional and culturally relevant foods to cater to the diverse dietary needs of different regions. Proper nutrition is not only essential for physical health but also plays a critical role in cognitive development. Additionally, it is essential to introduce smaller and more frequent food breaks, especially for pre-primary and primary stage children. This approach ensures that children receive a continuous supply of energy throughout the day, supporting their concentration and overall well-being.

4. Residential hostels: There should be an expansion of residential hostels, specifically for female children coming from low SES groups, to provide safe and conducive learning environments, especially for those who live in remote areas.

5. Academic and Mental health support: Academic support is another critical aspect of ensuring the success of marginalized students. Remedial classes should be made mandatory for students from low socioeconomic status (SES) backgrounds to bridge any educational gaps and reduce the stress associated with academic performance. Moreover, the appointment of counselors or teacher-counselors can provide emotional and academic support to students, helping them overcome stress and anxiety. Mental health initiatives should not be limited to academic stress alone but should encompass the general well-being of students. Such programs can foster resilience and emotional intelligence, essential skills for a child's holistic development. Introduction of traditional practices such as meditation and Yoga can help learners to overcome stress and anxiety.

6. Parent-Teacher Collaboration: Parents are one of the most significant stakeholders of education. Thus, regular parent-teacher meetings and workshops to enhance parents' involvement in their child's education should be facilitated that can provide them with guidance on how to support their child's learning and wellness at home.

Recommendations for Curriculum:

1. Curriculum Framework: The curriculum should be designed to cater to the diverse learning needs of students specifically to the students from SES group.

2. Textbook Development: The implications for textbook development are significant, as textbooks should align with experiential and contextual learning principles.

3. Nutrition Education: Incorporate nutrition education into the curriculum to raise awareness about healthy eating habits and encourage students to make nutritious food choices

4. Meditation and Yoga: These traditional practices have been globally accepted for their benefits in mental and physical well-being. These activities can act as stress buster and help improve cognitive abilities of learners.

Curriculum recommendations:

- The curriculum as suggested by NCF 2005 should be transacted through experiential learning method

Classroom teaching- learning process

- Experiential learning
- Day to day life examples
- Peer learning strategy

- Student councelling and mental health classes.
- Implications for textbooks development
- Teachers' capacity building programme.
- Meditation/ Yoga activities as stress buster

Policy recommendations

- Mid-day-meal timings and quality assurance
- Expansion of facility of residential hostels specifically for female children

Conclusion

The mid-day meal scheme initiated by the government has shown its impact on school attendance, retention and academic performance however it needs to be made more nutritious along with smaller and frequent food breaks to be introduced for pre-primary and primary sections. The schools need to start the practice of two breaks between classes one short break and one long break to ensure that students who do not have breakfast eat something in the initial school hours and then have a longer break where they eat and play so that nutritional and physical food requirements are met to enable them to be better engaged is the academic practices.

Remedial classes that were conceptualised for out of school students under RTI can be extended for students coming from low SES groups. These may be made mandatory as regular assistance in learning would not only reduce the stress of academic performance but also engagement with education.

Mental health initiatives at the state and central government levels can be brought in for general well-being so that the students can develop holistically. Many schools have Counsellor/ teacher counsellor to facilities students in overcoming academic and social stress. These counsellors are also trained in career counselling which would additional go a long way in motivating students for science education by orienting them to various possibilities other than engineering and doctors. This information when shared with parents can also help in bringing about a positive shift in their perception of education specifically science. Administrators and teachers too during parental interaction in SMC's or PTM sensitise and orient parents to the needs of nutrition and breakfast for students. Also efforts are being made by free ration to below poverty line families to ensure their children get proper nutrition to grow well and better engage in education. Further positive parental involvement in child's education through sensitization and orientation programs can also be planned. These however should be more intense at primary levels which is the foundational period and also one where the larger orientation to education therefore impacting dropout.

Limitations- study not statistically significant, but shows worthwhile trends. These may be built with a national level/ larger population (number of subjects to be found from census data) study. Further, government initiatives like the Navodaya Vidlyalaya Samiti(NVS) schools which are residential and cater to lower SES group may be studied to see how nutrition and meals along with 24X7 teacher supervision impacts academic performance and well-being of students. If the study finds impactful effect of residential schools similar schools may be planned by state governments for greater benefit to the children coming from challenged SES.

Conflict of Interest Statement: The authors declare that the research in conducting research there was no commercial or financial relationships.

References

Blair, Clancy. 2010 "Stress and the development of self-regulation in context." *Child development Perspectives* 4, no. 3. 181-188.

Bradley, Robert H., and Robert F. Corwyn. 2002 "Socioeconomic status and child development." *Annual Review of Psychology*, 53, no.1. 371-399.

Chadda, Rakesh K., and Koushik Sinha Deb. 2013 "Indian family systems, collectivistic society and psychotherapy." *Indian Journal of Psychiatry*, 55, no. Suppl 2. S299.

Chitra, Uma, and C. Radha Reddy. 2007 "The role of breakfast in nutrient intake of urban schoolchildren." *Public Health Nutrition,* 10, no. 1. 55-58.

Conger RD, Donnellan MB 2007. An interactionist perspective on the socioeconomic context of human development. *Annual Review of Psychology*. 58. 175–199.

Conger, Rand D., and Katherine J. Conger. 2002 "Resilience in Midwestern families: Selected findings from the first decade of a prospective, longitudinal study." *Journal of Marriage and Family* 64, no. 2. 361-373.

Conger, Rand D., Katherine J. Conger, and Monica J. Martin. 2010 "Socioeconomic status, family processes, and individual development." *Journal of Marriage and Family*. 72, no. 3. 685-704.

Costello, E. Jane, Scott N. Compton, Gordon Keeler, and Adrian Angold. 2003 "Relationships between poverty and psychopathology: A natural experiment." *Jama* 290, no. 15. 2023-2029.

Creswell, John W., and Vicki L. Plano Clark. 2011 "Choosing a mixed methods design." Designing and conducting mixed methods research 2. 53-106.

Dani, Jennifer, Courtney Burrill, and Barbara Demmig-Adams. 2005 "The remarkable role of nutrition in learning and behaviour." *Nutrition & Food Science*.

Derogatis, Leonard R., and Patricia A. Cleary. 1997 "Confirmation of the dimensional structure of the SCL-90: A study in construct validation." *Journal of Clinical Psychology* 33, no. 4. 981-989.

Duran, Chelsea AK, Elizabeth Cottone, Erik A. Ruzek, Andrew J. Mashburn, and David W. Grissmer. 2020 "Family stress processes and children's self-regulation." *Child Development*. 91, no. 2. 577-595.

Katz, Idit, Tamara Buzukashvili, and Liat Feingold. 2012 "Homework stress: Construct validation of a measure." The Journal of Experimental Education 80, no. 4. 405-421

Li, Zhonglu, and ZeqiQiu. "How does family background affect children's educational achievement? Evidence from Contemporary China." *The Journal of Chinese Sociology*. 5, no. 1 (2018): 1-21.

Lipman, Ronald S., Lino Covi, and Arthur K. Shapiro. 1979 "The Hopkins Symptom Checklist

(HSCL): factors derived from the HSCL-90." *Journal of Affective Disorders*. 1, no. 1. 9-24.

Mistry, Rashmita S., Jeremy C. Biesanz, Lorraine C. Taylor, Margaret Burchinal, and Martha J. Cox. 2004. "Family income and its relation to preschool children's adjustment for families in the NICHD Study of Early Child Care." *Developmental Psychology*. 40, no. 5. 727.

Motowidlo SJ, Packard JS, Manning MR J 1986 Appl Psychol. Nov; 71(4):618-29

Reeve, J. 2009. Why teachers adopt a controlling motivating style toward students and how they can become more autonomy supportive. *Educational Psychologist*,44(3), 159–175.

Rhodes, J. E., Spencer, R., Keller, T. E., Liang, B., & Noam, G. 2006. A model for the influence of mentoring relationships on youth development. *Journal of Community Psychology*,34(6), 691–707.

Rucklidge, Julia J., Jeanette M. Johnstone, and Bonnie J. Kaplan. 2021 "Nutrition provides the essential foundation for optimizing mental health." *Evidence-Based Practice in Child and Adolescent Mental Health* 6, no. 1. 131-154.

Ryan, Richard M., and James P Connell. 1989 "Perceived locus of causality and internalization: examining reasons for acting in two domains." *Journal of Personality and Social Psychology*. 57, no. 5. 749.

Sailer HR, Schlacter J, Edwards 1982 MR Personnel. Jul -Aug; 59(4):35-48

Shah, M., Hasan, S., Malik, S. et al. 2010 Perceived Stress, Sources and Severity of Stress among medical undergraduates in a Pakistani Medical School. BMC Med Educ 10, 2

Stroet, K., Opdenakker, M.-C., &Minnaert, A. 2013. Effects of need supportive teaching on early adolescents' motivation and engagement: a review of the literature. *Educational Research Review*,9, 65–87.

Vogel, Susanne, and Lars Schwabe. 2016 "Learning and memory under stress: implications for the classroom." npj *Science of Learning* 1, no. 1. 1-10

Zhang, Danhui, BihuiJin, and Yiran Cui. 2021 "Do Teacher Autonomy Support and Teacher–Student Relationships Influence Students' Depression? A 3-Year Longitudinal Study." *School Mental Health* 1-15.

Zheng, Jiali, Ning Jiang, and Jingtong Dou. 2020 "Autonomy Support and Academic Stress: A Relationship Mediated by Self-Regulated Learning and Mastery Goal Orientation." *New Waves-Educational Research and Development Journal*. 23, 43-63

APPENDIX

Table 1: Brief overview of items/questions in the survey representing the 11 reactions of stress study among learners.

Reaction number	Reaction type	Questions of the survey reflecting the reaction
1	Despair	6, 8, 29
2	Interpersonal reaction	5, 8, 15, 18
3	Somatisation	4, 9, 16, 20, 30
4	Mental weakness	2, 11, 21, 24
5	Anxiety	1, 14, 25, 26
6	Lack of energy	7, 10, 12
7	Depression	13
8	Throat problem	23, 27
9	Apprehension	17
10	Dizziness	3, 19
11	Muscular problem	22

Table A1: Psychological symptoms as categorised by HSCL, average students (%) facing the symptom, and correlation with science questionnaire score.

Psychological Symptom	Students (%) facing the psychological symptom	Relation with science score
Despair	On a scale of 0-3, 0 representing no despair and 3 representing the highest value, 6% of students felt no despair, 16% scored 1, 48% scored 2, and the rest 30% scored 3	Negative correlation
Interpersonal reaction	On a scale of 0-4, 0 being lowest and 4 being highest interpersonal reaction, 22% scored 1, 38% scored 2, 30% scored 3 and rest 10% scored 4.	Negative correlation

Somatization	On a scale of 0-4, 0 being lowest and 4 being highest somatization score, 18% scored 1, 30% scored 2, 30% scored 3 and rest 12% scored 4.	Negative correlation
Mental Weakness	On a scale of 0-4, 0 being lowest and 4 being highest mental weakness, 2% scored 0,8% scored 1 36% scored 2, 42% scored 3 and 12% scored 4.	Negative correlation
Anxiety	On a scale of 0-4, 0 being lowest and 4 being highest anxiety, 12% scored 0, 32% scored 1, 22% scored 2, 26% scored 3 and the rest 8% scored 4.	Negative correlation
Lack of energy	On a scale of 0-3, 0 being lowest and 3 being maximum lack of energy, 20% scored 0, 24% scored 1, 28% scored 2, and the rest 28% scored 3.	Positive correlation
Depression	62% of students felt depressed.	Negative correlation
Throat problem	On a scale of 0-2, 0 being the lowest and 2 being the highest throat problem, 10% scored 0, 52% scored one and rest, 38% scored 2.	No correlation
Apprehension	66% faced apprehension	Positive correlation
Dizziness	On a scale of 0-2, 0 being the lowest and 2 being the highest dizziness score,16% scored 0, 66% scored one and rest, 18% scored 2.	Negative correlation
Muscular problem	28% faced muscular problems	Negative correlation

A 2.1. Linear Regression models

Model-1: Regression of Score on all Independent and Control Variables (Breakfast, Family Type).

Model-2: Regression of Score on RAI and Control Variables (Breakfast, Family Type).

Model-3: Regression of Score on Stress and Control Variables (Breakfast, Family Type).

Model-4: Regression of Score on Autonomy and Control Variables (Breakfast, Family Type).

Model-5: Regression of Score on Stress, Breakfast, and accounting for their interaction term.

Model-6: Regression of Score on Stress, Family Type, and accounting for their interaction term.

In all the models, the equations for estimating science score as a function of other variables are as follows -

Model-1: $(\widehat{\text{Score}}) = \beta\_0 + \beta\_1 \cdot (\text{Breakfast}) + \beta\_2 \cdot (\text{Family Type}) + \beta\_3 \cdot (\text{Stress}) + \beta\_4 \cdot (\text{RAI}) + \beta\_5 \cdot (\text{Autonomy})$

Model-2: $(\widehat{\text{Score}}) = \beta\_0 + \beta\_1 \cdot (\text{Breakfast}) + \beta\_2 \cdot (\text{Family Type}) + \beta\_4 \cdot (\text{RAI})$

Model-3: $(\widehat{\text{Score}}) = \beta\_0 + \beta\_1 \cdot (\text{Breakfast}) + \beta\_2 \cdot (\text{Family Type}) + \beta\_3 \cdot (\text{Stress})$

Model-4: $(\widehat{\text{Score}}) = \beta\_0 + \beta\_1 \cdot (\text{Breakfast}) + \beta\_2 \cdot (\text{Family Type}) + \beta\_5 \cdot (\text{Autonomy})$

Model-5: $(\widehat{\text{Score}}) = \beta\_0 + \beta\_2 \cdot (\text{Family Type}) + \beta\_3 \cdot (\text{Stress}) + \beta\_6 \cdot (\text{Family Type} \times \text{Stress})$

Model-6: $(\widehat{\text{Score}}) = \beta\_0 + \beta\_1 \cdot (\text{Breakfast}) + \beta\_3 \cdot (\text{Stress}) + \beta\_6 \cdot (\text{Breakfast} \times \text{Stress})$

The variable estimates were coded as shown in table 3.

Table A2.2: Regression models (1-6) showing the equation for science wrt other variables, with coded values of the variable.

	Science Score Model – M1	**Science Score Model – M2**	**Science Score Model – M3**	**Science Score Model – M4**	**Science Score Model – M5**	**Science Score Model – M6**
Predictors	Estimates	Estimates	Estimates	Estimates	Estimates	Estimates
(Intercept) β_0	17.64 *** (2.97)	15.87 *** (1.55)	15.72 *** (1.42)	14.68 *** (1.50)	16.06 *** (1.54)	18.90 *** (2.47)
Breakfast β_1 (0= no, 1=yes)	0.59 (1.06)	0.36 (1.00)	0.32 (0.96)	0.16 (0.98)		-4.19 (2.94)
Family Type [linear] β_2 (0=nuclear, 1=joint)	0.36 (0.68)	0.41 (0.66)	0.42 (0.64)	0.42 (0.65)	0.90 (2.17)	

Stress β_3	-0.07 (0.08)		-0.06 (0.08)		-0.07 (0.09)	-0.27 (0.15)
RAI β_4	0.09 (0.09)	0.09 (0.09)				
Autonomy β_5	-0.14 (0.34)			0.02 (0.30)		
Family Type [linear] × Stress					-0.03 (0.13)	
Breakfast × Stress						0.28 (0.18)
Observations	47	47	48	48	48	48
R2 / R2 adjusted	0.050 / -0.065	0.033 / -0.034	0.024 / -0.042	0.009 / -0.058	0.023 / -0.043	0.066 / 0.003
* p<0.05 ** p<0.01 *** p<0.001						