Exploring the Experiential Dimensions of Psychological Stress from the Lens of the Science Student

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Abstract

The present study revisits the world of school science. It looks at the factors leading to stress amongst 11th standard science students and their ways of coping with it. The paper explores varied dimensions of their experience of studying science at the senior secondary level. This includes curricular content and its transaction, vocational aspirations and achievement-related dimensions. The study involved students from a cross section of mainstream schools. The first phase of the research work was rooted in identifying the magnitude of stress, while the second phase focused on the articulation of students' experiences, through open ended interviews. An in-depth analysis of the narratives brings forth compelling implications for rethinking the issues involved in science education, in schools, from the vantage point of the science student.

Keywords:

Theoretical Dimensions

Science is an integral part of our day to day lives. On one hand are the rapidly expanding boundaries of knowledge, represented by research in frontier areas, such as robotics, genetic engineering and artificial intelligence; while on the other hand is the face of science which is visible in every sphere of our life. An effective education in science is essential if one wishes to pursue a career in science and perhaps more importantly, if society hopes to develop an enlightened and empowered commune of people who are capable of understanding the scientific issues of the 21st century and making informed decisions. In this context, Prof. Yashpal (1992), is of the opinion that instead of considering science as an extraneous activity or as a tool for providing the means to a good life, we should treat it as a part of the culture of society - integral to our living and thinking, and connected to the deepest questions we ask in regard to who we are and where we come from. The positivist view of learning assumes that knowledge is received from the teacher and interpreted in the same form by students. On the other hand, there is the view of knowledge acquisition being a constructive process. Learners come into the classroom with their own preconceptions and interpret the classroom experience through their own coloured lens. The result of this, as many researchers (Driver, 1985, 2013) have shown, is that the meaning that students derive from their instruction is different from what the teacher intended. Increasingly theorists like Holton, Karl Popper and Thomas Kuhn have been moving towards fluid conceptualizations of science which emphasize its dynamic nature, rather than seeing it as a static entity of universally validated, objective knowledge. This nature of the discipline needs to be reflected in the manner of its teaching. However, the science taught in schools tends to promote a rigid view of science, leading students to look at the scientific theories they study as the final truth.

A paucity of opportunities in the school to question and discover new horizons of knowledge, diminish the sense of wonder and curiosity that students have about the natural world. Instead, anxiety, fear of science and of under-achievement in science subjects are common issues at the senior secondary level. The article looks at how psychological stress can be understood from the lens of the science student by giving credence to the experiential dimension. Stress is a global phenomenon that includes physiological, psychological and social variables. According to one view, psychological stress involves a particular relationship between a person and their environment, which is appraised by the person as taxing or exceeding his resources or endangering his well-being (Lazarus & Folkman, 1984). Researchers have classified stress in three ways, namely:

a) Stimulus-based definitions of stress, which equate stress with the external force acting on the individual. This finds a parallel in the physical science paradigm.

b) Stress as a response defines stress as the individual's reaction to environmental situations. This may be in the form of emotional or bodily manifestations.

c) The interactionist perspective is concerned with stimuli and reactions, as well as the coping resources which people use as they attempt to combat their difficulties. Stress, from this perspective would mean a significant excess of pressures over coping resources which results in reactions such as anxiety and frustration. The third perspective underlies this study. Thus, the study looks at the subjective evaluation of stress in terms of the manner in which it is perceived and experienced by students of science.

Research Design

The study was designed in two phases. It encompassed quantitative and qualitative aspects which attempted to construct a holistic picture of the phenomenon through triangulation. The first phase of the research work was located in identifying the magnitude of psychological stress among the science student population. After understanding the macro picture, a second phase focused on the articulation of students' experiences through open ended interviews. This phase delved into the nuances of their experience of studying science at the senior secondary level. There was an effort to take cognizance of the students' interface with various components of the school system, their interactions with teachers and peers, their perceptions about science, and future trajectories.

Participants

The focus of the study was senior secondary science; hence 301 students from 11th standard were selected. These students were studying science across various categories of schools, such as, Kendriya Vidyalayas, Government schools, Religious Trusts and Public Schools. Schools were randomly selected from each category and the entire science group of that school was included in the study. For the second phase of the study, eight students were chosen. Four of these students were identified as being highly stressed through the first phase of the study, and the rest as exhibiting low stress.

Research Tools

A questionnaire and open-ended interviews were the main research tools for data collection. The questionnaire was developed by the researcher after consulting the repertoire of psychological testing instruments available. It was finalized with the help of extensive inputs from science students, school teachers, administrators and science educators. This exercise brought forth a number of issues about science education which were of concern to the stakeholders and were thought relevant for inclusion in the questionnaire. The questionnaire was instrumental in mapping the macro-level picture of stress. Open-ended interviews were used in the second phase of the study, in order to understand the dynamics of psychological stress based on the articulation of the lived experiences which science students perceived as stressful.

Thematic Analysis of Narratives

The present section looks at the interpretation of the data. The overall picture that emerged about the magnitude of stress experienced by science students did not show any statistically significant difference across schools. Students were found to be experiencing a moderate level of stress. 122 out of a total of 301 students studied were from the 'high stress' category. The interviews which constituted the basis of the second phase of the study were analyzed so as to delineate the narratives into the form of significant themes. Both the high and low stress groups were studied through a cross-case analysis to identify the factors causing stress. These have been explicated below. The presentation is interspersed with first-person narratives in order to bring forth the vividly rich tapestry which forms the mainstay of the study.

Achievement Related Experiences

An analysis of the narratives revealed that many students felt stressed because of the decline in their performance levels from 10th to 11th standard. This has been attributed to the discontinuity between the 10th and 11th courses, a disproportionate increase in difficulty level, and a lack of awareness about the kind of preparation required in 11th standard. Getting low marks is seen as a major setback in terms of career goals and one's reputation in the eyes of their significant others. Some narratives exemplifying these are given below:

"Coming first in the class is a good feeling, since the family feels happy. It boosts your confidence and the teachers are also impressed by you."

"Suddenly there was so much to do, that I could not understand where I was going wrong and what I needed to do to improve."

Another issue that was foremost in children's minds was the pressure related to achieving high marks in science. The reasons for this were highlighted in their responses. Some of these were regarding the terse and voluminous course, the increased workload, and unrealistic expectations of teachers and parents in terms of achievement. A few responses typifying this are:

"I live in dread of the thought that, what will happen if I do not get good marks."

"The other students get marks for steps and for grammatical mistakes while our marks are deducted because we are expected to be perfect."

A comparison of the two groups revealed an interesting insight into their perceptions and how these result in a greater ability to cope with difficult situations among the low stress group. The highly-stressed students attached considerable importance to coming first in class. The high stress group reported negative reactions due to reasons like the inability to live up to parental expectations, lowering of prestige in class, and a diminished possibility of advent into a "good" career. However, the low stress group had not allowed it to become an overriding concern and showed a more positive perception of the situation. They felt that marks were not the sole indicator of intelligence and potential. Few students from the low stress group articulated this in the following manner:

"I am not concerned about coming first because marks are not everything. You can get more marks by cheating. You might get less marks if you get confused during the exam or if you are expecting an easy question paper but you get a very difficult paper."

"I feel it is unfair to equate brilliance with marks. You might be brilliant in day-to-day application based things but you might not do very well in exams."

"To do well in an exam, you need to do additional brushing up, practice numerical etc. which I did not get time to do. You can study science in two ways:

a. Studying to gain something, by clearly understanding the topic in depth, consulting extra books and doing detailed study.

b. Studying only to score marks by memorizing, without trying to understand the reasons behind things and reproducing it in the exams.

I preferred the first method. But if you study in this way, you start lagging behind in class."

Curriculum and its Transaction

Curricular content and its transaction emerged as stultifying experiences causing stress amongst science students. Students reported an inability to cope with the vastness and difficulty level of the course. They found the course bookish, lacking applicability to the real world and irrelevant in terms of their later life. The unrelated nature of the 10th and 11th courses was another factor leading to non-comprehension and disinterest. School textbooks were perceived as insufficient and reference books along with tuitions, were the norm across both groups of students. Other areas related to subject-specific difficulties, especially in the numerical based and memorization oriented portions of the course. The necessity of using additional reference books was seen as another source of stress. Some narratives are given below:

"I don't understand why the science course is so difficult. Do they feel that today's children are super intelligent?

"Physics is bane of my life. Although people say that it has many uses and is interesting, I cannot understand it. Even if I try and do the theory after spending a lot of time, when it comes to numericals, I get confused."

"Learning scientific names is difficult. They tell us about micro-organisms which we cannot see or feel. So, we have to simply learn their names and characteristics. We have to memorize each and every detail because questions can be asked from the smallest topic."

Pedagogy emerged as a major factor in the causation of stress. Students largely reported negative experiences when asked about their science classes, with a few notable exceptions. Their perceptions about their science class revolved around feelings of boredom and disinterest. Teachers did not alleviate this burden; rather, they were seen as unhelpful and critical. The teaching-learning strategies adopted by most teachers were textbook-oriented with little regard to the exploratory and discovery-related aspects of science. Although practicals were seen as enjoyable, extensive tabulation, documentation, the disconnected nature of theory and practice, and the importance given by teachers to the "expected result", seemed to add to the students' burden. The following comments by students substantiate the above:

"When I took up science in 11th, I thought that we will get an atmosphere to ask our doubts and problems. I felt it will be exiting to know and discover new things but nothing of the sort is happening and it has become a burden."

"I hesitate to ask when I do not understand a point in class. They say that we should ask questions, but when we do we are ridiculed. The teacher usually says, why don't you open your books? If you had revised your notes properly, you would not be facing this problem."

"They think that we should be able to understand whatever they are saying in a minute. But all this is not possible. A child might be intelligent but he is learning a new thing and will definitely have problems sometimes. The teachers want that they should get a 'ready-made', well-read child."

The workload emerged as another area causing excessive stress. This was manifested in daily assignments, practical work and frequent project submissions. The students were distressed by the drastic changes in their lifestyle. Continuous study, to the exclusion of all other activities, was taking its toll. They felt overwhelmed by the quantum of load. Along with the extra work in science, tuitions and entrance exam preparations were perceived as cumulatively leading to stress. Their responses about this aspect are as follows:

"We are preparing for our annual function and everybody except the science students are participating. We ourselves say that we are not interested because if we miss the practical periods, it is our loss, practicals are not repeated."

"I try to complete my practical files in the break, so that at home I can spend time on studying. But the work is so much that despite studying every day, something or the other gets left out."

Ameliorative strategies used by the high stress group center around studying for longer hours while the low stress group focus on a more organized and target-oriented use of time. Thus, the low stress group is seen to use more integrative strategies to combat this situation, in terms of pre-preparation for the class, soliciting the tutor's help, self-study and planned work schedules. A few responses of low stress students regarding this are:

"If we do the topic in the tuition classes before it is taught in school, it helps in understanding the topic easily."

"The teachers in school can't solve the problems of each one of the fifty students. It is much easier to understand in the smaller groups that we have in tuition classes."

Future Trajectories

Future trajectories were uncertain and therefore stress-inducing. Students across both the groups reported feeling stressed because of the dual pressure of the necessity of a vocational pursuit, along with the demands of the school curriculum. The necessity of a vocational pursuit has emerged as another area causing stress due to the stiff competition for admission into medicine or engineering fields. The limited knowledge of students about other feasible career options and the simultaneous need for preparation for the board exams and entrance tests can be stressful. However, the low stress group seemed relatively more flexible in terms of future career options. This is exemplified in the following responses:

"Although we do have a guidance counsellor, she is hardly ever available. I read careers supplements in newspapers and realize that there are many other options available, but I don't know how to go about it."

"After the boards, there will barely be any time to revise before the entrance exams. Simultaneous preparation is essential for achieving the target."

"It won't affect me much, since the main thing is to express myself. It does not matter in which way; whether through medicine, music, dance or social work. If I fail in one, I can do well in some other way."

Discussion

This study helps us to understand the world of science students and constructs an understanding of the phenomenon of psychological stress through their experiences and perceptions. A number of implications for science curriculum planning emerge from the experiences shared by the science students. Content has emerged as a major problem area, both in terms of its quantum, and its relevance. Thus it is important to rationalize the process of curriculum development. The newer advances in science, and future areas of development should be reflected in the curriculum. The burden on the students needs to be reduced. A reduction of irrelevant, outdated material in school textbooks, as well as the incorporation of highly detailed and specialized knowledge at the post-school level, might be helpful. These issues need to be carefully debated in appropriate forums, keeping the practicality of the situation, especially in terms of time constraints, in mind. This is extremely important so as to reduce the pressure faced by science students at the senior secondary level.

As there is a disproportionate increase in the syllabus from 10th to 11thstandard with respect to volume as well as level, hence a construction of better conceptual links of the basic knowledge taught in 9thand 10th standard, with more advanced areas, might be appropriate; with the emphasis being on a gradual gradation from one level to the other. Redistribution of topics to avoid repetition and an identification of topics which lend themselves to integrated teaching, are other possibilities which can be thought about in order to reduce the stress experienced by students. Although the curriculum revision exercise following the publication of the NCF 2005 has tried to address many of the concerns, the ground-level realities need to be taken into account in order to accomplish the paradigm shift from rote learning towards equity, inventiveness, inquiry and creativity.

Other strategies in connection with this area include a greater role for aptitude testing and pre-preparation of the students at the time of opting for different streams. This should not only be in terms of assessing their proclivity but also in terms of reality orientation regarding the nature and amount of work required, so that they can anticipate the time and energy that they will be expected to devote to studies, thereby consciously arriving at a decision.

An upgradation of existing curricular material, as well as an expansion in the range of curricular material available for science teaching and learning, has emerged as another major implication. The NCF 2005 recommends the incorporation of teaching-learning material apart from the school textbook, in the form of encyclopaedias, popular science books and alternative workbooks based on observation and experimentation. This could be done keeping in sight the time available and the abilities of the students, and should include frequent revision of books, incorporation of more real life examples, a more comprehensible and lucid style of presentation, publication of separate books on numericals, practicals etc. and most importantly, inclusion of material based on the criterion of concept clarification rather than only on the provision of information. Other audio-visual material which is in consonance with the students' needs could be provided especially with regard to an improvement in the standards of laboratory equipment.

Although process based interactive pedagogic strategies have been universally accepted as essential for developing problem-solving abilities, providing opportunities for creative expression, and providing a meaningful learning environment for students; they are yet to be used in schools on a continuous, ongoing basis as feasible alternatives to conventional methods. This has implications for both the pre-service and in-service teacher training levels. Perhaps these programs need to be geared towards providing greater practice in innovative techniques. A reduction in the teacher-student ratio in schools is needed to ensure a more fulfilling interaction. This would be helpful in exposing the learners to an inquiry-based environment where they can express their views, opinions and difficulties without fear of reprimand. Learning science might then become an enjoyable experience, rather than the threatening and nightmarish experience that it seems to have become.

An activity-based ethos also implies an increase in the number of practicals as well as a change in their nature. Students need to be given the freedom to "explore" labs and attempt genuine investigation rather than only verification. Project work also needs to be re-thought, with the focus being on projects as a process rather than as a one-time activity. Projects and practicals can provide suitable opportunities for co-operative peer group learning. Extension activities related to science also need to be strengthened and consciously woven into the school science curriculum. These include science clubs, excursions, interactions with scientists etc.

Another implication which emerges forcefully is about the nature of the student-teacher interaction. Instead of having a working relationship with students, teachers should move in the direction of having a more humane relationship. Students are in the developmental stage of late adolescence, where they face a number of challenges. The tasks related to crystallization of identity, goal planning, as well as the resolution of specific subject difficulties, require the presence of an empathic teacher with active listening skills.

The lack of awareness among science students about vocational options other than medicine and engineering, implies the need for provision of counselling from an early stage, aimed at exposing students to a variety of science related professions as well as giving them information about the specifics of various professions i.e. the nature of competition, level of difficulty, a realistic appraisal of the probability of securing admission, the nature of work involved and the kind of jobs available in that area. Also, instead of having a multitude of entrance exams after 12th standard, each requiring a different pattern of preparation, centralized tests could be conducted for different professional courses based on a common syllabus. Science students need to feel included as a part of the school. They should be involved in the various school activities and also be able to take up leadership roles. This is important so that students do not feel marginalized and isolated from the mainstream.

Stress is sometimes portrayed as being only about the personal failure of a few individuals to cope. It is seen as a pathological state where there is something "wrong" with the individual who experiences it. Awareness needs to be generated about the phenomenon of stress as being neither a personal failure nor a pathological state. A positive attitude should be cultivated towards science, which involves looking upon the study of science as a worthwhile pursuit. This can be achieved by positive outlook training and talks organized by guidance and counselling services. It might also be implicitly communicated through the attitudes of science teachers.

Group guidance talks and individual counselling could prove effective in providing an education for healthy, adaptive study habits; for instance, how to deal with the workload, prioritization and time management. These could also help in building self-esteem and provide training in effective coping. This would include training in simple strategies which the students could practice themselves, like disputing irrational beliefs, counting one's blessings, dispelling beliefs that science is very difficult etc. Self-expression group sessions could be organized which might serve a cathartic function for students. Other stress management techniques like relaxation training, yoga and meditation can be included in the school program. The National Curriculum Framework 2005 provides a refreshing insight into the dynamics of science education but an active engagement of all the participants, as well as a critical understanding of the structural hierarchies of the school as an institution, is required to transform the vision into a reality. The upcoming New Education Policy hopes to provide a platform for discussion on such issues. A concerted effort needs to be made by all stakeholders, to initiate a debate at the national level in order to review the existing system of science education.

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