CHAPTER - I

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Education has a pivotal role in the development of a nation, and educational institutions are the major mediums for dissemination of education, meaning that the child's journey through school life plays a significant role in shaping him/her and prepares him/her to face the world. We all know the moments when we felt safe (or unsafe) at school, with a caring adult (or a threat), and where we were engaged in meaningful learning (or not). The climate, (inside and outside the school) influences student learning and development. But the school environment is more than just individual experiences. According to Hoy & Sabo (1998), Freiberg & Stein (1999), and Hoy & Miskel (2001), school climate is a factor not only for the positive functioning of the whole school but also makes changes in their operations more effective. The school climate is the sum of values, culture, safety principles, and organisational structure (based on Freiberg & Stein 1999) within the school and ways of instruction/diversity. principal-teacher connection teacher-teacher connection parent-teacher relationships pupil-teacher connection, and we need to know what kind of school climate helps students do that.

Other than school, help done by the parents also plays a crucial role in the student's performance. We also need parents who can let kids make their own decisions and give their children a little space and autonomy. Adolescence is characterised by social and cognitive growth also associated with a strong development of autonomy, making it one of the most critical psychosocial challenges during this life stage and highlighting its proximity to adulthood (Van Petegam et al., 2019). High autonomy support is when parents display behaviours in a category that enable exploration and choice and encourage the independent decision-making process that are consistent with preferences and values. However, children with opportunities to take initiatives perform well in academic settings (Deci & Ryan, 1985).

Besides academic records, individual traits like the procrastination tendency & scientific reasoning also play a role in evaluating a student's academic success. They do not grow up to be experts in the art of procrastination. It refers to a kind of procrastination or delay in performing any academic task, like preparing for the

examination, preparing phrase papers, handling administrative matters associated with college, and fulfilling the responsibility of attendance duty house assignments, etc. (Solomon & Rothblum, 1984). It is a task that some students put off doing until the final moment, while others simply do not do it. In this light, Ackerman and Gross (2005) suggested that procrastination is inherently related to an individual's behaviour patterns like motivation, self-regulation, locus of control, perfectionism concerning task completion and organisational and time management skills. Likewise, Tice & Baummeister (1997) found significantly worse paper and examination grades in procrastinating subjects compared to non-procrastinating subjects.

Scientific reasoning, however, requires understanding concepts and direct inquiry skills. Scientific reasoning is based on some fundamental logic, involving two different reasoning processes applied to two types of declarative knowledge (Schunn & Anderson, 1999). One kind of knowledge concerns the nature of a given scientific problem and how to solve it, based on the protocols and findings of specific experiments: it is called declarative knowledge. What is the other type of declarative knowledge accessible to domain experts? Some techniques of scientific reasoning will be domain-specific, and others domain-general. Scientific reasoning refers to the ability to formulate problems, interpret results logically, and adapt deductive and inductive logic. The complexity of scientific reasoning itself explains in part why there is so little research on it: Scientific reasoning comprises a collection of cognitive activities, not just one cognitive process. Scientific reasoning includes inquiry skills and concept understanding (Kuhn & Franklin, 2006). Scientific reasoning includes the logical and problem-solving skills that are vital for forming, testing and modifying hypotheses or theories, along with the self-reflective processes of knowledge building and transforming which are a part of higher order inquiry and post inquiry-based activities (Feist, 2006).

NEP 2020 proposes an integral, multi-dimensional vision for education and includes some of the key variables such as school climate, scientific reasoning, procrastination tendency, parental autonomy supportive parenting, which indeed play a role in moulding academic baseline for students. A positive school climate — defined by inclusive relationships, collaborative learning, emotional safety, and growth — is fundamental to nurturing inquiry, critical thinking, and experiential learning, particularly in physics and other subjects. Through its emphasis on interdisciplinary

approaches, hands-on learning and competency-based evaluation, National Policy on Education aims to transform the system, focusing less on a rote learning and on conceptual clarity and problem-solving skills instead. Furthermore, it recognizes that an element of parental autonomy support is necessary in the upbringing of self-regulated, intrinsically motivated learners, which are crucial in embracing the complexity inherent to physics concepts. To mitigate procrastination, NEP 2020 proposes active pedagogical methods such as project-based and peer learning, aligning learning objectives with students' interests. Such pedagogical transformations can be studied in terms of their effect on the promotion of students' scientific reasoning, reduction of procrastination, and improvement of physics academic performance. Contextualising NEP 2020 also requires a holistic framework identifying the interplay of environmental and intrapersonal variables contributing to learning, focusing on the dimensions of personalized learning, critical thinking and collaborative environments that Carrie Rothstein-Fisch and colleagues (2019) have put forward in their transformative model of learning that can further this discourse for educators, policymakers and parents looking at positively impacting children's learning outcomes today.

1.1 Education in Himachal Pradesh: Knowledge Land

Over the years, school education in Himachal Pradesh experienced various developments and followed national trends while accommodating specific regional requirements. And Himachal Pradesh has made steady and transformative progress in education infrastructure and performance as we distinguish ourselves with a paradigm shift towards inclusivity, quality, and availability. This is an attempt to explore the current status of the school education in Himachal Pradesh based on latest census data (2011), credible educational resources.

Himachal Pradesh is a hilly state in Northern India. It consists of 12 districts; each district has its own geographical and demographic composition. The literacy rate in the state is approximately 83.8%, per the Census of India 2011. Initially the state has made significant progress regarding the academic development in here. In the year 2023, there are a total of 15,787 schools in Himachal Pradesh that can be categorised as government (i.e., public) or private (Himachal Pradesh Department of Education, 2023). These levels include the primary level (grades I-V), upper primary level

(grades VI-VIII), secondary level (grades IX-X), and the senior secondary level (grades XI-XII). Himachal Pradesh state government oversees Directorate of Elementary Education, Directorate of Higher Education and Himachal Pradesh Board of School Education (HPBOSE) for its government schools.

The importance of quality education in the educational policies of Himachal Pradesh Hence, it has implemented some steps to enhance the teaching quality in the state. The examination system is replaced by Continuous and Comprehensive Evaluation (CCE). CCE stands for Continuous and Comprehensive Evaluation, which is a method of assessment that is based more on the all-round growth of learners instead of his or her performance in some subjects or exams. Besides, the implementation of the National Education Policy (NEP 2020) and student-centred education are also the interest areas of the state to bring about the transformation of the education system to a global standard. NEP 2020, the ongoing efforts towards its implementation, focus on strengthening the teaching and learning process, and the use of technology goes a long way in improving the education system and ensuring equitable access to quality education for every child in Himachal Pradesh.

After introducing the context, a brief overview of the study area of Himachal Pradesh, and its background, it is important to discuss further the framework on which these constructs are based in this study.

1.2 Theoretical Foundation

According to previous studies, personality characteristics and abilities are some important predictors for academic performance (Maqsud, 1997; Hakimi et al., 2011; Bhat, 2016; McCoach et al., 2017; Herrera et al., 2020). Similar claims can also be made regarding other contextual aspects such as the family and educational context, which have been shown to be closely associated with students' academic success (Daulta, 2008; Gietz & McIntosh, 2014; Ciping et al., 2015). There are various well-established psychological, pedagogical and sociological models which try to describe interactions between psychosocial factors in student-centered paradigms, where a school environment is a complex concept. To illustrate the argument, researchers use the Stage-Environment Fit Theory by Eccles and Roeser (1999), which claims that the alignment of the school environment with their developmental needs can help to

explain adolescents' motivation, sense of autonomy, competence, and relatedness towards others—important variables for success in academic performance.

Scientific reasoning, a foundational component of problem-solving and evidence-based decision-making, is grounded in Piaget's Cognitive Development Theory (1970), which marks the formal operational stage as the critical time in development when abstract and logical thought processes reach their full potential. This correlates with Vygotsky's Sociocultural Theory (1978), which emphasises the necessity of scaffolding and social interactions in reasoning development. The Miller's Information Processing Theory also explains the informational channels related to cognitive processing, such as working memory and attention, which enables scientific reasoning.

Procrastination is defined as the tendency to continuously postpone and delay task performance, with Steel and König (2006) adding Temporal Motivation Theory for elucidation, stating that procrastination is the underlying preference for instant gratification over delayed gratification. Drawing on Baumeister and Heatherton's Self-Regulation Theory (1996), procrastination is seen as a failure of self-control, while Weiner's Attribution Theory (1985) argues that attributions to uncontrollable factors drive procrastination. Lastly, necessary for independence and volitional functioning is parent autonomous support rooted in Deci & Ryan's always-shifted emphasis of their Self-Determination Theory (1985), Bowlby's Attachment Theory (1969), and the work of Eccles et al.'s Expectancy-Value Theory (1983). Such ideas raise the importance of a supportive parenting style in developing a child's intrinsic motivation and learning outcomes. Collectively, these theoretical approaches present a holistic understanding of how these constructs interconnect and shape student behaviour, thereby promoting both academic and personal development.

Theoretical foundations for the present research can be drawn from Bronfenbrenner's Ecological Systems Theory (1979). Bronfenbrenner's Ecological Systems Theory would be a suitable theoretical model for the present research topic because it pays attention to the interdependency of individual traits and contextual factors that may have an impact on academic achievement. There are multiple environmental systems identified, but they all interact in various ways and feed into student development. At the microsystem level, school climate, teacher-student relationships, and peer

interactions affect a student's learning experience, while parents' autonomy support plays a role in motivation and engagement with learning. The mesosystem explores the ways in which connections between environments (e.g., how the school's policies align with this, which most likely would be between schools for children and their equivalent ages, as well as the role of home (parental support). The exosystem comprises external factors such as educational policies and societal norms that indirectly shape procrastination as well as scientific reasoning. The macrosystem includes cultural attitudes regarding education and STEM fields, which impact a student's interest and attitude toward physics and other subjects. Finally, the chronosystem encompasses long-term changes in academic behaviours and cognitive development, including changes in scientific reasoning ability and procrastination. By integrating multiple dimensions, this model enables a holistic investigation of factors related to school climate, scientific reasoning, parent autonomy support, procrastination, and physics academic performance. It highlights the dynamic interplay between individual, family, school, and societal influences, providing a solid framework for examining the relationships between these variables. Therefore, utilising Bronfenbrenner's Ecological Systems Theory will allow you to recognise levels of environmental systems and their respective interactions that lead to senior secondary students academic achievement in physics while providing rules for how a change in scientific reasoning, procrastination, and a supportive educational environment leads to both change in students who are high achievers and those who struggle academically, ultimately enabling a strong rationale for this research. The variables of the study are selected keeping in mind the contribution of both nature and nurture to the development of an individual.

1.3 Conceptual Framework

School climate is the general learning environment in a school, within which is the safety it maintains and the relationships with one another and teachers, the infrastructure and resources, etc. A healthy school climate can stimulate motivation and school engagement, which can in turn have a direct effect on students' academic performance and how they feel about learning. Evidence indicates students in supportive school climates may perform better academically (Cohen et al., 2009). Such is the case of physics, where the level and manner of teaching can influence students to correctly understand many complex scientific concepts.

Scientific reasoning skills reflect cognitive skills used by students to dissect, combine, and assess scientific information, which are critical in a course like physics. The institution of a well-developed scientific reasoning ability enhances students' ability to solve physics problems and increases their ability to grasp abstract physics concepts (Kuhn, D., Amsel, E., & O'Loughlin, M., 1988). Therefore, scientific reasoning is one of the predictors of students' academic achievement in physics because physics requires logical thinking and theoretical knowledge. Studies of the correlation between scientific reasoning skills and general higher-order thinking achievement show that students with the former tend to do better in the latter (Schoenfeld, 1987).

As a behavioural factor, procrastination directly affects the management of time for students which can result in last-minute rushes to meet deadline or in turning in incomplete assignments. Procrastination on the other hand, according to the literature on physics education is harmful because it generally does not promote a proper deep approach to understand the physics concepts (Steel, 2007). Academic and non-academic outcomes are also negatively impacted; For example, students with poor time management skills often perform poorly on academic tasks (Tuckman, 1991). However, dealing with procrastination can improve the academic performance because it fosters execution and self-regulatory skills among students.

Parental Autonomy Support fostering of students' independence and choice. Parents who offer autonomy support also facilitate self-motivation and resilience, enabling their children to take charge of their learning. This kind of parenting has been associated with academic success and is particularly relevant in fields like physics, where the ability to think critically and solve problems is crucial. According to Grolnick and Ryan's (1989) research, students are more likely to develop intrinsic motivation and perform well in school when parents provide support without psychological control.

These four elements—school climate, scientific reasoning, procrastination tendency, and parental autonomy support—demonstrate a collective impact on academic achievement. A positive school climate increases students' engagement and motivation, resulting in improved learning environments. Strong reasoning skills for scientific reasoning allow students to understand complex concepts and apply critical thinking in solving problems. Conversely, procrastination tendencies interfere with

these processes, causing a lack of time management and slip-ups in learning. Lastly, parental provision of autonomy-support promotes the independence and motivation necessary for academic achievement. So together they interact in complex ways to influence academic achievement.

Conceptual Framework: Predictors of Academic Achievement in Physics
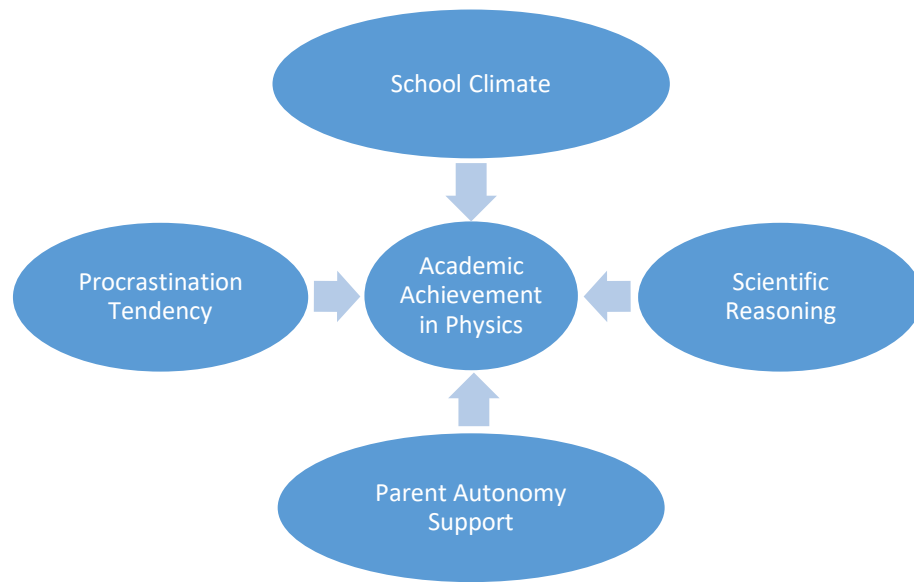

Figure 1.1 Conceptual Framework: Predictors of academic achievement in Physics

In the figure 1.1 the conceptual framework diagram that captures the relationships between the predictor variables (school climate, scientific reasoning, procrastination tendency and parent autonomy support) and the outcome variable (academic achievement in physics). The arrows represent the direction of influence.

1.4 School Climate

School climate is a social determinant of institutional efficacy, along with the individual members involved there, including teachers, students, administrators and other stakeholders. One of the most notable inanimate agents existing in schools. Utilizing data-driven conceptions of not only life in the classroom but to also the life outside of it, expectations, values, and relationship/educator models (NSCC, 2007). According to Hoy and Miskel (1996), "School climate is the distinctive quality of the school environment and the way these characteristics influence the behaviour and attitudes of people." The conduct of an individual person is different from that of others because faculty possess unique characteristics in interpersonal interactions. School climate is one of the most important predictors of many outcomes in the school setting — academic achievement, student development, teacher and school

performance (Cohen et al., 2009). Perkins (2006): School climate describes the educational environment that is created by social relationships, physical environment, and emotional atmosphere. Health-Related Quality of Life (HRQoL) is a multidimensional construct that includes physical, social, and academic perspectives (Loukas, 2007).

Inanimate features of educational institutions such as school building, classroom size, teaching-learning resources, methods used in the teaching-learning process and safety and security measures. The social dimension relates to the social characteristics of relationships among members of the school, peer competition and comparisons among students as well as the participation of students, teachers, and staff in making decisions. The academic element is related to the instruction quality, the educators' expectations of students' achievements, and the level of supervision and support students receive (Loukas, 2007).

Each school has its own climate because of the structured difference. School climate types rely on the specific approach of a person to the school. According to Halpin (1966), there are seven types of school climate, which include open climate, controlled climate, autonomous climate, paternal climate, family climate, and closed climate.

We begin to form and grow our first habits, attitudes, relationships, and knowledge within a familiar climate of care where all members of the school—head of the school, teachers, students, and parents—collaborate in a friendly manner as part of a big family. When there are the teachers and students who do not have free space to enjoy that they can perform, the principal doesn't make an effort; also, she is not careful about the activity of teachers. Principals that failed as a maestro, or an orchestra conductor of the school drama (Hoy & Sabo, 1998).

It senses a set of teachers and students against enthusiasm, involvement, sense of duty, vision, and mind-set towards themselves and others. It engages far more profoundly with the engagement of teachers in deciding on the school vision and representing the identity qualities, integrity of purpose, integrity, justice, and safety (Singh, 2020). "Behavioural adjustment is more likely to happen in a school environment where the students feel comfortable, feel they are treated fairly by the teachers, and feel that they belong to the school environment" (Brooks, 999). Factors

affecting schools include interactional quality, environmental factors, academic performance, school safety and size, belief, and reverence (Singh, 2020).

A school has to be a safe, healthy, and positive environment where the teacher is not just an instructor but a facilitator of the learning process, a promoter of positive relationships, and someone who mentors them to prepare better to return back and overcome all the obstacles. School climate should positively influence the students to remove the various impediments in the path of their effective learning and to explore academic talents in students (Gregory et al., 2010). A pleasant atmosphere encourages the meeting that fuels a cordial and familiar environment. A conducive learning space is one of the seven starting points to quality education (Lee et al., 2011).

The school climate can reduce children's exposure to risk factors and foster healthy youth development. In addition, having a positive school climate is associated with increased students' academic motivation and engagement and greater psychological well-being. Hence, it is clear why schools encouraging interesting learning contexts will see decreased absenteeism in students and enhanced academic outcomes for students at all grade levels (Shochet et al., 2006; Ruus et al., 2007).

A positive school climate can also benefit teachers and other school support staff. Fifth grade teachers who felt supported by their administration were more dedicated to their work and more collegial towards each other (Singh & Billingsley, 1998). By the same token, schools in which teachers collaborate freely with one another, where colleagues and administration support them, and where time is taken to forge strong relationships with learners have shown positive results academically and behaviourally for students (Brown & Medway, 2007).

1.4.1 Understanding School Climate

School climate refers to the social, emotional, and physical environment in which students learn, including norms, attitudes, and expectations that promote a positive and safe environment overall. It stems from the interactions between children, parents and families, teachers, support personnel, and administrators (ICRI, 2007). A positive school environment is created through mutual respect and engagement, a shared goal, a sense of safety and care in physical surroundings (Gruenert, 2008). When we think about school culture, it usually brings to mind the informal rules and norms among school personnel. Safety (regulations, standards, physical and emotional safety);

pedagogy (support for academic and civic learning); interpersonal dynamics (celebration of differences/social support); institutional climate (concerning school involvement/a physical environment); and faculty relations (leadership/professional relationships). According to the National School Climate Centre. The U.S. Department of Education monitors three interconnected domains—student engagement, safety, and the school environment—to emphasize the comprehensive nature of a supportive school climate.

1.4.2 Importance of School Climate

Thapa et al. (2009) and Cohen et al. (2009) recommend a positive school climate as a key component of effective school transformation efforts linked to positive behavioural, academic, and mental health student outcomes, an idea that received supporting empirical evidence in 2012 (Cohen, McCabe, Michelli, & Pickeral). Research shows that schools with a positive school climate have fewer student discipline problems, less acts of aggression and violence (Gregory et al., 2010), and fewer high school suspensions (Lee et al., 2011).

More specifically, a positive school environment is associated with lower risk behaviours such as (substance) abuse, bullying and harassment, particularly in children (La Russo et al; 2008; Meyer-Adams & Conner, 2008; Bradshaw et al; 2009; Attar-Schwartz, 2009). It helps children to develop positively (Eccles et al., 1993) — greater motivation and engagement in education, and better psychological health (Ruus et al., 2007; Shochet et al., 2006). Gottfredson et al. (2005) found that students in schools where widespread involvement was routine tended to miss class less often, while Brand et al. (2003) and Stewart (2008) described increased performance in these environments. The staff is not the only entity that benefits from a positive school climate; students show similar trends. A supportive administration will give teachers greater loyalty and collegiality (Singh & Billingsley, 1998). The evidence indicates that schools (a) have open lines of communication between the staff, (b) provide support for teacher-student relationships and peer social skills, and (c) produce better student academic achievement and behavioural outcomes overall [48]. Additionally, a positive climate promotes job satisfaction and retention of teachers, which can reduce high rates of turnover in the education system (Boe et al., 2008; Kaiser, 2011).

1.4.3 Adopting Strategies to Improve School Climate

Greenberg et al. (2001) and O'Connell et al. (2009) always states that once a school has taken time to critically evaluate its climate and found room for improvement (e.g., more supervision in hallways or staff development in cultural diversity), it is not enough for educators to simply think of and implement ways to change the beliefs and behaviours of its people. Integrated and multi-tiered approaches are often the most effective; however, no single program will fit all populations and settings. Key features of practices reported on in the research are modified for specific contexts. While some programs are directed to specific problems (e.g., bullying), increasing interests are apparent in multicomponent programs. The following models reflect a spectrum and continuum of programming and supports that are focused on addressing behavioural needs yet consider the social ecology of schools. Punishing cliques is harmful to their makers and to outsiders, too, and it's far more useful when the entire school community—students, faculty, and heads—collaborates on prevention programs (Greenberg et al., 2001; Rigby, 2007).

The added cost of assessing the school climate on its own: parents, students, and staff often view the climate in different ways (Bradshaw et al., 2009; Waasdorp et al., 2011). Such appreciation of diverse perspectives aids in spotting the converging vs. expanding opportunities while giving a panoramic view of school climate. Furthermore, an HPISD–international schools consensus emerged that cross-data sources needed to be used in order to create sound decisions such as surveys conducted (students, parents, and staff); discipline data; observational data; and demographics of schools, including enrolment and mobility. This evidence shapes universal, selective, and indicated prevention programs.

An instance of this type of three-tiered prevention paradigm that centres around prevention of behavioural issues as well as the promotion of a pleasant school environment is Positive Behavioural Interventions and Supports (PBIS; Sugai & Horner, 2006). They use a collaborative approach, state the behaviour standard, celebrate success, and use data to inform them. Source straight out to be integrated. To address SDR from a population standpoint, school-wide PBIS treatments cause significant reductions in disciplinary issues (eg, bullying, violence) and improvements

in positive educational and prosocial outcomes (Bradshaw et al., 2010,2012; Hornet al., 2009).

The goal is to use research to address the problem and formulate strategies that can bring about social change. The Olweus Bullying Prevention Program (OBPP), for instance, is an evidence-based, schoolwide initiative designed to combat bullying and improve the school climate (Olweus et al., 2007). This program is used in all the school contexts, and it consists of school-wide components, classroom rules, and meetings but also specific interventions for bullies or victims. It also promotes involvement by the community, emphasising roles for parents and mental health practitioners (Limber et al., 2004; Olweus, 2005). Studies show it is effective in reducing bullying and delinquent behaviours like vandalism and truancy as well as improving school social climate.

1.5 Scientific Reasoning

Scientific reasoning, in the broadest/most general sense, is a way of thinking in which students generate and test hypotheses (especially about how stuff works). In the reasoning process, people usually make connections between the observed phenomenon and known knowledge while investigating new knowledge that emerges when it is corrected and assimilated into existing beliefs. It is helpful to understand scientific reasoning. A problem-solving process in which a person critically thinks about content, procedural, and epistemic knowledge together has been described as scientific reasoning (Kind, P.M., 2013). Piaget's theory of formal operations (sensitivity, experimentation) to make quality of scientific reasoning as if processing skills. Essentially, this means linking what you see happening to science and making predictions about what might happen. All of these elements demonstrate that scientific reasoning is required to design the experiment, test the hypothesis, and draw data. This scientific reasoning involves not only referring to the conceptual understanding used in that research but also inquiry skills (Zimmerman, 2007), which are matched to the theoretical combination of those experimental data to formulate the maximum possible conclusion. Morris et al. (2012) stress that two core skills are deductive and inductive skills, which are necessary if such scientific reasoning is to be effective. One of those is that people should critically assess what is known or believed, formulate potential questions for exploration, empirically test hypotheses,

and come to reasonable conclusions from empirical data and theory. A similar type of reasoning also needs noticing data in a systematic way and drawing logical conclusions based on patterns we observe. It also involves the ability to think back on one's reasoning at each step of the process.

Students' ability to think scientifically has been linked to their academic performance across a wide range of courses. This is an essential part of all the professional fields and academic streams. You care about learning, so it matters in academics. Data analysis is one of the most basic higher-order thinking skills required to meet the science and technology needs of today's society and was recently defined as an important goal of science education.

Create an environment that encourages robust development of students' minds. But it's also not close to its goal. The school curriculum is mostly knowledge-based, and you are trained up to a certain level, and after that, your past knowledge plays on. Therefore, as per the school curriculum, a principal determination of the informative system must be to advance students' logical thinking capacity. It is unclear what the implications of this domain-specific reasoning are for academic achievement in general, and we do not know whether training in this form of reasoning has long-term effects for students. It would then also be interesting to study whether students' scientific reasoning ability affects their academic performance.

Schunn and Anderson (1999) suggest that scientific reasoning is the use of two different reasoning processes, drawing on two kinds of declarative knowledge. The first type of declarative knowledge concerns information about the scientific problem being studied i.e., details about the scientific topic of interest and results from relevant experiments. The second is specialised information known to authorities in a particular field. Procedures for reasoning may be domain-general or domain-specific in their own right. Scientific reasoning involves a lot of different things: defining the problem, interpreting a result, deduction and induction, building a conclusion… A third challenge for studying scientific reasoning is that it is actually a composite construct made up of multiple cognitive processes rather than a single cognitive activity.

Scientific reasoning is a convergence of conceptual understanding and inquiry skills (Kuhn & Franklin 2006). Feist (2006) built on this, saying it encompassed the

abilities to reason and solve problems needed to produce, confirm, and modify hypotheses or theories. For someone who has grown more in that skill, it also implies metacognitively reflecting on how knowledge is gained and changed through inquiry activities.

Morris et al. (2012) argued that reasoning about science well requires skills in both deduction and induction. People must be able to assess existing ideas or beliefs, formulate testable queries, evaluate hypotheses, and reach evidence-informed conclusions by combining empirical findings with theoretical contexts. Such reasoning requires systematic examination of the evidence, the drawing of valid conclusions from patterns in the data, and a critical evaluation of one's reasoning at each step along the path of inquiry.

The ability to reason scientifically is a core dimension of scientific literacy and provides students with the capacity to comprehend and engage in systematic ways with science phenomena. Scientific reasoning (Lawson, 2004) draws on the use of logical principles during inquiry, such as using explanations, forming hypotheses, predicting outcomes, devising tests to validate predictions, identifying controls within variables being tested, analysing data, and constructing empirical laws. This happens in four main steps: abduction, retroduction, deduction, and induction.

In the abductive phase, a learner sees phenomena and proposes a hypothesis based on declarative knowledge that includes new observations (Lawson, 2005). The next stage is retroduction, where the student tests the hypothesis by reflecting on it and changing it if something novel has not conformed to earlier predictions (Lawson, 2005). Deduction, consequently, reconstructs the hypothesis that was developed during the abductive phase into applicable predictions and gathers relevant information (Lawson, 2005). The last part is an inductive phase, where the students base their conclusions on all previous phases information (Lawson, 2005), topping up reasoning.

Lawson et al. emphasise the necessity of hypothetical-deductive reasoning, a form of induction used in all scientific disciplines (Elliott et al. This reasoning involves forming and testing hypotheses, selecting a hypothesis to test, making predictions, running experiments, and confirming or disconfirming hypotheses by results This reasoning continues to be a trait of inquiry-based learning environments in which students formulate and evaluate hypotheses, employ modal supported proportionality

reasoning, manipulate variables, engage in correlational reasoning, and execute probability reasoning (Lawson, 1978, 1988, 1995; Lawson & Abraham, 2005; Lawson et al., 2010). In contrast, inquiry instruction facilitates the development of these reasoning strategies as students are cognitively engaged in underlying science concepts (Johnson & Lawson, 1998).

Compared with typical reasoning, scientific reasoning involves higher standards of proof and more stringent defensive mechanisms (Rehorek, 2004). It includes cognitive skills such as critical thinking, creativity, and problem-solving. And analysis is critical to the processes of inquiry, experimental design, evidence evaluation and argumentation that undergird the development of scientific knowledge. These skills enable the building and adjustment of mental models that explain natural and everyday phenomena.

Reasoning, in and of itself, means taking what we know from previous experience and applying it to solve a new problem step by step in a logical way. It starts with a goal or aim, mentally considering available solutions based on past experiences and current perceptions, choosing the one that seems the best option, and then rigorously testing whether or not this conclusion makes sense. This is an example of higher-order thinking and indicates the person's ability to think analytically. Reasoning is especially important when someone is presented with a new problem with no prior solution and needs to consider the cause-and-effect relationship to make a deliberative decision.

Nonetheless, scientific reasoning ultimately is indicative of extensive diversity of skills and cognitive processes, which are therefore relevant to solving complex problems in the scientific and real-world dimensions. The skills allow for the exploration of science and form a foundation for learning, creativity, and adaptability across disciplines.

1.6 Procrastination Tendency

Procrastination is a pathology that students experience. Procrastination has traditionally been defined as a personality type or behavioural tendency of delaying or postponing a task or decision. The word procrastination comes from the Latin "procrastinatus," which has two parts. "Pro" is ahead, "crastinus" means present-day (Klein, 1971). It is presented as a behaviour pattern and malformation that acts

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delaying from a task or decision. The practice of procrastination is self-handicapping actions once people delay the completion of a task that they intend to do in the future; this will lead to wastage of productivity, poor performance, and stress as stated (Milgram et al., 1998).

Procrastination is to postpone even an activity that falls in a domain of one's control till the eleventh hour or not doing it at all. It's procrastination; it is the delay; it could be actions or tasks. Deferred today for a tomorrow that may never come. Procrastination is quite prevalent and occurs in daily habits. Procrastination has been linked with a wide variety of individual differences, such as the lack of motivation, an inability to self-regulate, an external locus of control, perfectionism (Harris & Lemoine, 2019), disorganisation, and poor time management skills (Ackerman & Gross, 2005).

According to Chu and Choi (2005), there are two constructs of procrastination tendencies known as active procrastination and passive procrastination. Active procrastination can be defined as a person's conscious decision to push an activity off while using their high motivation under pressure to finish all events of one type before the time limit, creating a positive outcome. Active procrastination relates to individuals' self-efficacy, stress management, and performance (Choi & Moran, 2009) People on a higher end of the active procrastination scale plot their work, schedule their stuff, but they take their own sweet time to carry out a plan. Active procrastinators need to evaluate the least possible time needed for a project, and keep motivating themselves until they approach deadlines. She says that in times of stress, we resort more to task-oriented coping strategies. But this procrastinator is only putting off tasks because they are very good at self-motivation and will just get it done by the deadline. Usually they produce adequate results, but they take time (Chu & Choi, 2005). According to Choi and Moran (2009), active procrastination can be defined by specific behavioural features that can be summarised as follows: (a) having a preference for time pressure, (b) making a cognitive decision to procrastinate, (c) having a behavioural ability to accomplish tasks before the deadline, and (d) producing satisfactory academic results.

Passive procrastination is the procrastination we just traditionally think of. According to Chu & Choi (2005) Traditional or passive procrastinators get frozen by people's

inability to take action and not getting the work done on time. They often bestow more fun or satisfying tasks to others without planning or structuring their time. They often do not get things done on time because they tend to miscalculate the amount of time it takes to get them done. They often have difficulty focusing on the task at hand and prefer to do something more fun than finish the assignment. This type of procrastinator finds immediate gratification for their desires, which could bring some stress temporarily but results in self-defeating consequences over the long haul.

Thus, it is fair to say that procrastination tendency will only lead students to such undue stress and tension when they reach their last submission deadline where they want to submit on time. Procrastination is the irrational but willful delaying of academic tasks to within a given time frame despite expecting negative consequences from the delay (Steel 2007). It is going to will hinder their chances academically instead of help them. Belonging has a positive impact on achievement. The procrastinator, according to Ferrari & Emmons (1995), suffers from a low sense of self-efficacy resulting in an eternal postponement of tasks from a belief that he/she is incapable of executing tasks successfully. Their self-efficacy and self-esteem are low; they suffer from public self-consciousness and high irrational self-judgement. According to the researcher, procrastinators are also perfectionists/overconscientious as they have high hopes (Effert & Ferrari, 1989). They exhibit neurotic avoidance due to their irrational fear of success and fear of failure. They might even be emotional, stressed, and anxious, less demanding of cognitive complexity, and hence more prone to external and temporality attributions of success (Solomon & Rothblum, 1984). In general terms, procrastination is seen as a self-rated problem, which disturbs the overall personal, social, and academic life of the doers.

1.6.1 Theoretical Approaches related to Procrastination Tendency

Arguably some of the earliest theories of procrastination to appear, psychoanalytic theories drew attention to behaviours more based in anxiety and defence mechanisms. Freud and counterparts touched upon procrastination within specific contexts of task completion, stating that anxiety is a quintessential human phenomenon and that individuals evolve defence mechanisms to minimise its effect (Ferrari et al., 1995). Freud proposed that such mechanisms spring up when the ego meets disturbing stimuli that reside beyond awareness. He announced especially that unfinished

business annoys the self so that procrastination is adopted as an effective and defensive reaction (Goroshit, 2018). Although this behaviour protects the individual from anxiety in the short term, it slows down long-term development. According to Freud, defence mechanisms relieve anxiety in the short term but are unable to address the core cause of anxiety, exposing individuals to future anxiety when confronted with the same issues (Ferrari et al., 1995). Procrastination entails avoiding the lunging out of beliefs and emotions, which protects the inner self against feelings of inadequacy in the moment but is counterproductive towards moving forward in life.

Also, psychodynamic theorists—though they diverged from Freud's stiff schemas—agreed upon the fluidity of human conduct and the enduring impact of childhood experiences on adult thought and character. Burka and Yuen (2008) defined a "procrastination syndrome"—a behavioural pattern associated with faulty parenting styles. And unrealistic parental expectations that hinge on child achievements form a breeding ground for anxiety and feelings of worthlessness. These feelings, she says, come out as procrastination. Research indicates that both excessively high and excessively low parental expectation levels tend to increase procrastination behaviours in children.

Behavioural theorists consider procrastination to be learnt behaviour that is reinforced by escaping punishment (avoiding an unwelcome consequence) or by getting an unintentional reward (doing better without effort). Under this perspective, which is driven by principles of reinforcement, previous successful avoidance of harmful consequences reinforces procrastinatory behaviours (Bijou et al., 1976). If an individual submits late homework with no punishment, the person is likely to repeat this behaviour. Ainslie (1975), among others, noted that, when punishment does not exist or reward does, procrastinatory tendencies are strengthened. The next concept is from Bandura's self-efficacy, a key component of the social learning theory, which presents individuals choosing the activities based on their belief on achieving success (Bandura, 1986).

According to cognitive theories, which attribute procrastination to illogical beliefs, low self-esteem, and indecisiveness (Ferrari, Johnson, & McCown, 1995). Ellis and Knaus (1977) defined procrastination as an emotional disease rooted in unreasonable beliefs, like the widespread belief that a task needs to be done perfectly in order to be

highly rewarded. This kind of perfectionist thinking usually results in task procrastination—avoiding responsibility out of fear of failing or being criticized. Low self-esteem is also an important trigger of procrastination because delaying performance will protect one from having to expose perceived shortcomings. Procrastination as a means of protecting fragile self-worth through delaying evaluation (Burka and Yuen, 2008) Janis and Mann (1977) examined procrastination as a conflict-driven reaction, specifically regarding decision-making, wherein fear of an unsatisfactory outcome can promote procrastination. In Beswick et al. (1988), procrastination was further clarified in terms of conflict, e.g., choosing which academic course to take or research topic to study, whereas indecisiveness contributes to the procrastination.

1.6.2 Types of Procrastination

Procrastination has many faces, and it affects life in many spheres. Milgram (1987) pointed out that the typology of procrastination is subjective and functionally mostly overlapping. These classifications, designed for the sake of observation, imply that all types of procrastination could potentially be within each individual to greater and lesser degrees. Forms include academic procrastination, decisional procrastination, neurotic procrastination, obsessive procrastination and regular procrastination. Academic procrastination is the postponement of work until last minute. Decisional procrastination is characterized by a lack of timely decision-making, while neurotic procrastination denotes avoidance of important life decisions. Compulsive procrastination combines decisional and behavioural procrastination, while life routine procrastination describes a general inability to plan and execute daily tasks.

Ferrari (1994) also presented the notion that procrastination could either be functional or dysfunctional. The first one is a negative situation, and the second one was a deliberate strategy. Functional procrastination occurs when delaying a task result in increased data to work with (Ferrari, 1994). In 2005, however, Chu & Choi distinguished between active and inactive procrastination and defined the former as "active procrastination." Active procrastinators sap themselves of potential energy and motivation but work well under pressure, producing acceptable results. Inactive procrastinators, on the other hand, put off doing tasks by habit or anxiety and as a result, typically come with feelings of guilt and fail.

These types, situational and chronic procrastination, represent two broad categories that show habitual tendencies. Chronic procrastination happens in many areas of life, while situational procrastination is limited to certain domains. Situational procrastination can be divided into two situations: the first is called general procrastination, and the second is called academic procrastination (deferral of academic tasks such as delaying homework, test preparation, or project completion) (Dryden, 2000). Procrastinators who procrastinate situationally often struggle not just with starting, but with finishing a task once they have begun.

Of these different types, academic procrastination is particularly relevant to students. Considering that the research relates directly to the new population of secondary school students, the researcher intends to study academic procrastination, its consequences, and its extent as a problem among secondary school students. This study aims to find out how procrastination affects these students' academic obligations and overall academic productivity.

1.6.3 Academic Procrastination Tendency

Lay (1986) defined academic procrastination as avoidance of academic work until a later time. This is exactly what one group looks like in the classroom with students postponing examinations, assignments, or even joining a class at a later stage. Rothblum, Solomon, and Murakami (1986) found that procrastinating students tend to delay studying until the eve of an examination, and as a result, prepare hastily and poorly, which harms their performance. With the current system of holistic development being the rule of the land, students are subject to continuous testing in forms of internal tests, projects, assignments, etc. This constant pressure can cause students to feel overwhelmed, causing them to procrastinate on finishing work or studying for tests.

With the knowledge that students have to learn trending upwards, and distractions such as online games, social media, and gaming platforms becoming more prevalent, the issue becomes more compounded." Andreassen (2015) also identifies student addiction to social media as a contributing factor. There are other situations in which students postpone theirs so that they might go through them more seriously later, but those situations are often accompanied by psychological pain and suffering due to deadlines not being met. Schouwenburg (2004) reveals from empirical studies that

more than 70% of students procrastinate on a regular basis, demonstrating that academic procrastination is one of the most serious problems in education, as it prevents students from accomplishing their goals and succeeding in life.

As per Yong (2010), academic procrastination is the irrational behaviour of delaying starting or completing an academic task. They do not have the motivation to get started working on assignments, even with deadlines looming. Even back as early as Beswick, Rothblum, and Mann (1988) associated academic procrastination with the earlier mentioned behaviours of missing deadlines, delaying their studies, getting lower grades, and occasionally dropping courses. This was further elaborated upon by Binder (2000) as an irrational delay in the accomplishment of tasks that appears to be due to a disjunction of will and deed and which is damaging ultimately to the student. Deniz et al. (2009) show that procrastination usually refers to delaying the study responsible, such as submitting coursework or preparing for exams.

According to Ackerman and Gross (2005), procrastination can occur in various contexts—such as writing term papers, studying for exams, and doing weekly readings. Students know what needs to be done and how important it is, but they don't push themselves to get the stuff done in the time allotted. A significant association for procrastination with irrationals belief, social anxiety, perfectionism, depression, self-handicapping beliefs, and reduced self-efficacy/self-esteem was given (Solomon and Rothblum, 1984). They found that fear of failure, born of performance anxiety, perfectionism, or a lack of self-confidence, is a leading cause of procrastination. Students who procrastinate experience greater anxiety and unhappiness, and lower self-esteem than their peers.

Academically, procrastination is considered to be an intricate pattern of cognitive, affective and behavioural processes. Özer et al. (2010); Rothblum, Solomon, and Murakami (1986). The Behaviour Development Institute defined procrastination as failing to do everything you want to do or doing things later than you're supposed to (2014) This transition from having homework that one finds pleasurable to turning it into a chore accompanied by lateness both in academic and non-academic realms is due to psychological factors like irrational beliefs and perfectionism which cause a gap between goals, thoughts, and behaviour (Psychyl, T.A., Lee J. M., Thibodeau, R., & Blunt, A., 2000; Balkis 2013). Essentially, procrastination is a complex problem

occurring on multiple levels: cognitive (the nature of our thinking), emotional (our feelings), and behavioural (what we actually do or don't do). Procrastination is not merely an excuse for laziness and bad time management. It brought about serious issues, particularly in academic environments, affecting students' performance, mental well-being, and progress.

1.6.4 Impacts of the Academic Procrastination Behaviour

Academic procrastination is a pervasive and complex phenomenon that can have deeply negative consequences. Many will continue to put off necessary tasks, despite the consequences it has for their everyday lives, mental health, and performance in school. The dysfunctions of academic procrastination, especially as an antecedent of poor academic performance, are well documented in the literature. And in addition, studies have indicated a relation of procrastination with lower academic performance (Burka & Yuen, 1983; Ferrari et al., 1995; Knaus, 1998; Tice & Baumeister, 1997); higher rates of course dropout (Semb, Glick & Spencer, 1979; Rothblum et al., 1986); and low class attendance resulting at most in academic abandonment by students (Knaus, 1998).

Procrastination limits learning; therefore, it affects the quantity and quality of students work. According to the research, procrastination results in less commitment to the goal, not enough time to do the task, and lower achievement in class (Akinsola, Tella & Tella, 2007). Additionally, Steel, Brothen, and Wambach (2000) further note that those students that engage in academic procrastination will then receive lower grades in the specific course and on the final exam, respectively. This statement is verified by Popoola (2005), who states that high- or moderate-level procrastinators tend to perform poorly compared to low-level procrastinators by the evaluation of their academic performance. Michinov et al. (2011) highlight the high correlation of procrastination with negative academic performance in online discussion forums, whereas Steel and Ferrari (2013) link procrastination with low education levels, showing how important self-regulation is in the academic context.

The effects of procrastination go far beyond academics. It has been associated with higher rates of sadness (Solomon & Rothblum, 1984) anxiety (Rothblum et al., 1986), guilt (Pychyl, Lee, Thibodeau & Blunt, 2000), and lower self-esteem (Ferrari, 2000). Procrastinators internal struggles are comestibles; inadequacy, embarrassment, guilt,

tension, panic, and chronic anxiety can be all too often on the plate (Burka & Yuen 1996). Knaus (1998) gives us some of the details: anxiety and self-efficacy interact, where low confidence along with high anxiety already creates failure expectation; failure leads to crippling procrastination.

Health shock is another fearsome angle of academic procrastination. According to Tice and Baumeister (1997), although procrastinators initially report lower stress and fewer physical symptoms at the start of a semester, their stress and physical symptoms later increase dramatically by the end of the term. In this way, this pattern mirrors the self-sabotaging reality of procrastination, as it provides temporary relief at the cost of long-lasting health. This urgency is underscored by the health consequences and depressed academic achievement.

Approaches addressing academic procrastination have primarily centred on cognitive, affective, and behavioural dimensions of interventions. One such method that has shown promise is cognitive restructuring, as studies have highlighted the need to target dysfunctional ways of thinking that lead to procrastination (Solomon & Rothblum, 1984; Uzun Özer, 2010). Negative self-evaluation was determined to be a main component of procrastination (e.g., Chow, 2011), and Flett et al. (2012) associated it with automatic negative thoughts. These cognitive distortions then contribute to students abandoning tasks too early, entrenching patterns of procrastination.

Cognitive-based counselling and educational programs have been found effective in reducing procrastination. Collaborative cognitive-behavioural methods promoting goal setting and self-regulation strategies, have been implemented in student populations and have shown general effectiveness in reducing procrastination (Binder, 2000; Schubert et al., 2000; Ramsay, 2002; Horebeek et al., 2004). Overall, the evidence points toward an urgent call for targeted interventions to combat academic procrastination, delivering benefits for academic success as well as personal well-being.

1.7 Parent Autonomy Support

Autonomy consists of acting from values or interests that the individual has endorsed (or integrated into their value system). It is about the world experience of desire (wish)—feeling a degree of selection, as well as having the flexibility to act (take

initiative) or consult with (Reis et al., 2000). And some theorists have treated autonomy as a basic universal human need, such that without it, ill-being and cultural alienation follow (Deci et al., 1989). It is about the self-instrumentalisation or self-validation of one's behaviour. Autonomous behaviour, therefore, is action that one can relate to and is deemed self-initiated. Autonomy's antipode, heteronomy dependence, is when one's movement is being moved by outside forces. When autonomous competence assessment occurs under environmental control standards, in turn regaining autonomy over the development of self-motivation/welfare is negatively affected by lighting up fear and guilt (Ryan, 1993).

Autonomy-support is an interaction style in which a teacher or parent attempts to view the situation from their student or child's perspective and gives them the opportunity to make decisions and self-initiate (Deci & Ryan, 2000). Specifically, autonomy support refers to providing students with moderate structure and guidance as well as freedom, volition, and responsibility for themselves (Legault et al., 2006). This method encourages students to have respect for the suggested ideas and gives them an opportunity to lead or contribute to decision making.

Self-determination is commonly associated with positive outcomes among autonomous academic-oriented children (Deci & Ryan, 1985) if their autonomy is supported by teachers and parents (Lam et al., 2007). Autonomy-supportive teachers help students develop an internal relation between what they do in the class and their motivational resources. Teachers cannot directly give students experiential autonomy, but they can create and nourish that experience by being aware of students' inner motivational resources and facilitating opportunities within the classroom for students to align that resource with the workings of what is happening in a classroom. Another motivational framework that may help explain this finding is self-determination theory (Deci & Ryan, 1985) that guides the investigation that individuals have needs for competence, autonomy, and relatedness. When these needs are met in students these lead to increased intrinsic motivation and academic achievement (DeCharms, 1976). Students in autonomy-supportive environments outperform students in environments with controlling teachers on measures of classroom engagement, emotionality, creativity, intrinsic motivation, and academic achievement (e.g., Benware & Deci, 1984; Black & Deci, 2000).

On the other hand, self-determination theory suggests that socialisation agents, such as parents and teachers, can be more autonomy-supportive than controlling—thereby enhancing the motivation, competence and accomplishment of students. Parental autonomy support is positively associated with children's self-regulation, academic performance, and achievement (Grolnick & Ryan, 1989). Additionally, parental autonomy support has been associated with positive academic results as per several studies (Gottfried et al., 1994; Cooper et al., 2000; Grolnick et al., 2002; Deci & Ryan, 2008). Parental autonomy support will include a wider range of aspects, including empathising with children's thoughts, offering as many choices as possible, helping children explore and discover their own value, interest, etc. Perceived parenting practices, including parental autonomy support but certainly not limited to it, were positively associated with school achievement and psychological adjustment according to Gottfried et al. (2009). Autonomy support from parents predicted self-determination and academic accomplishment, in contrast to teachers and school administration (Vallerand, 1996). Guay et al. (2023a) study used a field experiment that interacted with party members as the experimental subjects. Compare the autonomy support from fathers, mothers, and French teachers in this study where teachers' provided autonomy support was more significantly correlated with students' academic performance (2013).

Self-Determination Theory posits that the satisfaction of three universals, or basic psychological needs—autonomy, competence and relatedness—accounts for human motivation and resultant success (Deci, 1980). Autonomy is nothing but the sense we have as children that we control our own behaviour. When children have the assurance, they have the skills to tackle what is placed in front of them, they can satisfy the competence need. Relatedness is when we feel cared for, accepted, and valued in a community, group or family. Psychosocial settings that satisfy these needs correlate with higher intrinsic motivation, well-being, and success (Beiswenger & Grolnick, 2010; Grolnick et al., 2002; Hui et al., 2011). When contexts are not amenable to these needs this undermines adaptive functioning (Bronstein et al., 2005; Jiang et al., 2011). Autonomy, in particular, i.e., "volitional, harmonious, and integrated functioning" (Joussemet et al., 2008, p. 194), indeed, is vital for motivation and psychological well-being as well. At the center of self-determination theory is a three-component model (Ryan & Deci, 2000), where autonomy is a necessary

addition to competence and relatedness for positive effects on motivation and well-being. The evidence supports that (particularly from parents) this type of support for children to become independent ultimately nurtures motivation, psychological well-being and educational results (Grolnick, 2009; Annear & Yates, 2010; Joussemet et al., 2008).

Examining the link between parental autonomy support and academic achievement has been an important topic of research since the concept was first introduced. Moreover, autonomy-supportive parenting is positively correlated with achievement indices such as grade point average (GPA; Cooper et al., 2000; Soenens & Vansteenkiste, 2005) and grades in individual courses (Bronstein et al., 2005; Halpern-Felsher, 1994). Pomerantz et al. (2007) further suggested that autonomy-supportive parenting enhances academic achievement as it provides access to motivational and cognitive resources that facilitate school engagement. But while many studies show a relationship between autonomy support and school related performance, some contributions present ambivalent results or low associations (Bronstein et al., 2005; Grolnick et al., 2002; Halpern-Felsher, 1994). For example, Grolnick et al. Except for a study by Wainwright et al. (1991), who only reported small and non-significant correlations between perceived maternal and paternal autonomy support and school grades. Meta-analytic approaches are useful to assess the magnitude of this association.

Parental encouragement of autonomy is a new concept that originated in a variety of psychological framework, including Self-Determination Theory (Deci & Ryan, 1985), Attachment Theory (Bowlby, 1969), Baumrind's Parenting Styles (Baumrind, 1971), Vygotsky's Sociocultural Theory of Cognition (Vygotsky, 1978), and Cognitive Evaluation Theory (Deci & Ryan, 1985). According to Self-Determination Theory, autonomy, competence, and relatedness are basic needs that will foster intrinsic motivation, well-being, and psychological growth if satisfied. Parents, who promote autonomy, provide tonnes of choices so that it creates space for them to feel competent and belonging; they validate how children feel and exercise less control. (Joussemet et al., 2008). Attachment theory underlines this by emphasising the importance of secure emotional attachment. Autonomy-supportive parents serve as a sort of safe haven; they offer support that is emotional while also encouraging kids to explore and be more independent.

The style of home parenting known as authoritative, as conceptualized by Baumrind, closely resembles an autonomy support method with an appropriate level of structure and independence. Authoritative parenting—high responsiveness and low to moderate demands—has been associated with favourable developmental outcomes, such as emotional regulation and academic success (Steinberg, 2001). On the other hand, authoritarian and permissive styles focus too much control or a lack of structure, which stalls the process of development.

A major 20th-century developmental theorist, a Russian by the name of Lev Vygotsky, posited that social interaction was critical to cognitive development and consequently human learning, emphasising culture's role in this process. Parents act as a "scaffold" that helps children learn by giving them support balanced with the fostering of greater independence through getting him or her to think critically while within the Zone of Proximal Development. Cognitive Evaluation Theory also stresses that it is environments with high support of autonomy that maintain intrinsic motivation, leading to more sustained engagement. Autonomy support involves acknowledging children's perspectives, explaining decisions, and avoiding pressure.

Negative parenting practices, as outlined by Barber's Psychological Control Theory, restrict autonomy through emotionally and cognitively manipulative strategies that correlate with a range of negative outcomes, including anxiety and low self-esteem (Barber, 1996). On the contrary, autonomously optimal strategies also promote self-efficacy and emotional well-being.

Autonomy support depends on culture to be properly expressed. Whereas Western cultures emphasise autonomy at the individual level, collectivist societies build autonomy as a role within the family and reap similar beneficial effects. For instance, a case in point made by Chao (1994) was that even directive Chinese parents foster autonomy with culturally sensitive ways that prove its universality benefits.

Developmental theories surrounding parent autonomy support emphasise the need for a parent to provide their child with independence, competence, and emotional security. Self-Determination Theory is the core framework on which the other concepts hang and includes Attachment Theory, Baumrind's Parenting Styles, Vygotsky's Sociocultural Theory, and Cognitive Evaluation Theory. In conclusion, an industry of in-depth review and research indicates that autonomy-supportive parental

practices help foster intrinsic motivation, psychological well-being, and adaptive social development. Yet, while cultural factors may influence the method used to promote autonomy, this way of increasing independence is generally seen as a positive thing.

1.8 Significance of the Present Study

Recently the study of these factors relating to academic achievement has emerged as a problem of continuing interest to psychologists convinced of the practical usefulness of predicting the future academic achievement of a student on the basis of information related to his abilities. However, the effect of these psychological factors on academic achievement in the physics subject at the higher secondary level specifically has been very little explored. Hence a need exists for more systematic exploration of these factors with specific reference to physics.

The investigator's interest in this study is chiefly rooted in the fact that a good education system is the backbone of most developing nations, like India, and it is very much of the essence to review the current education system in India and bring forth the sustainable changes in the system to measure it up against the changing global education scenario.

The major goal of any education system is students` academic achievements, but the issue is that only a few students achieve high achievement. Poor student achievement and school failures constitute a challenge for nearly all countries of the world in all subjects. Physics is a subject taught in schools that concerns matter and its interaction with energy. It encompasses the exhibition of the physical and natural phenomena surrounding our lives, so it is really interesting. It requires the precise study of theoretical and practical ideas associated with natural processes with illustrations, graphics, flowcharts, and experiments. This study wants to find out the variables that affect students of Physics at the senior secondary level in their academic achievement. The investigator, herself, is from the physics background. Why are students getting low grades or failing in physics? What causes the factors that are linked to low achievement or failures? Intelligence alone doesn't account for their accomplishments, right? How do other aspects impact the academic performance of students?

As the whole literacy major action is done with a view to enhance the academic performance level of the learners, the researcher desires to use some plausible factors

such as school climate, scientific reasoning, procrastination tendency, and parent autonomy support of senior secondary level students, specifically in relation to the Physics subject context, to correlate with academic performance for the benefit of the worst performance students. Improving education does not have to mean a total overhaul of the curriculum. Some small, simple changes to how content and activities are approached can make a difference.

1.9 Statement of the Problem

The review of literature undertaken for the study indicates that the performance outcome of students in both English language and other native languages is pertinent to each other. Mathematics and science, as well as physics, tend to be checked comparatively less specifically in mentoring success outcomes in the physics subject. But a sole study that is based on the combination of these four factors—school climate, scientific reasoning, procrastination tendency, and parent autonomy support of students as pertaining to the physics subject at the higher secondary level—has hardly been done. Understandably, it is very important that learning should happen in the most suitable and appropriate way right at this stage itself for the students so that they can comprehend it and apply it even better when they are going for higher studies, being that the higher secondary level is the bridge, you know, for further higher studies, so the meaningful research questions, which become the base for this study, are:

1. What type of school climate, scientific reasoning, procrastination tendency, and parent autonomy support do senior secondary school students possess?
2. Are school climate, scientific reasoning, procrastination tendency, and parent autonomy support of senior secondary school students related to gender, type of institution, and location of institution?
3. Are school climate, scientific reasoning, procrastination tendency, and parent autonomy support of senior secondary school students related to their academic achievement in Physics?

Putting these broad research questions in unified form, the problem of the study was stated as:

"School Climate, Scientific Reasoning, Procrastination Tendency and Parent Autonomy Support of Senior Secondary School Students in relation to their Academic Achievement in Physics."

1.10 Rationale of the Study

In any educational system, one of the key outputs is the level of academic achievement by its students; however, the challenge here is that only a subset of students achieves at a high level. Weak student performance and school failures are an issue for nearly every country in the world in all subject areas. Through this study, the investigator intends to investigate the factors affecting the academic achievement of the senior secondary students in Physics. Why are students scoring low or failing in physics? What factors correlate with low achievement or failures?

Their success may depend in part on factors such as the school they are studying in. The place where one lives, like its weather or climate, influences how one feels or if one is willing to get engaged in that place, and the same is true for school climate. So, when it's warm externally, we feel warm and comfortable, but when the temperature soars high or decreases, we seek extra comfort and try to acclimatise ourselves to the climate. And when cloudy, some people experience relief when the sun rises. Likewise, the feeling of the teachers and students, how much volunteers they are to get engaged, and their dedication toward whatever they are doing is dependent on the school climate (Rapti, 2013). The students will do better at school when they feel comfortable at school; teachers treat every student equally in the school and, students feel that they belong to the school (Brooks 1999). Are schools a safe and appropriate environment for student growth? Do teachers act as allies in the educational process, or not? Encouraging better relationships and giving the tools to better navigate the challenges they face? The investigator should address these questions and understand whether the school climate is either beneficial or detrimental to the students, as an unwelcome environment can affect the academic potential of every student and result in them underachieving, causing low academic success (Rapti, 2013).

The home is the other place, apart from school, that the child spends a lot of time in. Indeed, at birth, children are totally dependent on their family, especially their parents. They move slowly from dependence to independence and learn to make decisions for themselves. It is widely agreed upon that parenting is a robust and consistent predictor of autonomy development (Kouros & Garber, 2014). Parents who support autonomy help their children explore, put their choices into action, ratify their autonomous behaviour, and sustain their individual interests and views (Ryan et al.,

1995). The investigator will explore if this type of autonomy support might contribute in some way to academic performance in the school setting.

Academic achievement may also be affected by a student's procrastination tendency, not just by school and family. In the context of performance, procrastination is viewed as a failure to self-manage behaviour and tends to extend to the adjustability of an uninterrupted procrastinator towards work on assigned work. But there are many other researchers who talk about the positive side, saying procrastination is in delaying an activity purposely or taking time and avoiding rushing and making yourself spend more time on thinking through a task and completing it. It also implies doing something in a few days or doing nothing when that thing will, on its own, be done because of this wise action avoiding unnecessary work. Sometimes students deliberately decide to procrastinate on something if it is at the low end of their priority list or they wish to focus and ponder on it before the action is taken by them to do it. They procrastinate in order to reflect, brainstorm more ideas, and determine what is most important to them at the time. Hence, bearing all these points in mind, it has become highly essential for the researcher to know what constitutes the factor leading to procrastination behaviour in students and how this behaviour is affecting their academic performance (Hooda & Devi, 2017).

This research is centred only on science students, particularly on the physics students, which is one of the major highlights of this study. In an era of swift change in the world, education is characterised by a rapidly transforming paradigm, and it is the ability to develop scientific reasoning power that allows students to explore the domain of science and technology. Logic is needed to comprehend science in a systematic, logical, and scientific way. Scientific reasoning is defined as the ability to recognise and solve problems, to make logical inferences about any scientific process or event, to understand scientific situations, results, and tables, and to use deductive and inductive reasoning. These scientific reasoning processes may help them to catch a systematic understanding of the concepts, and the knowledge gained by students might be transformed into practical knowledge of the science. In fact, Jaleel and Premachandran (2017) state that every activity and all written work should be designed to stimulate interest and scientific reasoning. All lesson tasks and writing must engage students and support scientific reasoning. So, this will in turn lead to swift understanding of the science concepts and as a result improved performance.

Hence, scientific reasoning plays a significant role, and the moderator will be whether this ability has any impact on their academic performance. There is very limited research in both India and abroad with regard to these variables, and hardly any study has been conducted so far in the state of Himachal Pradesh taking physics students as the target sample. The investigator shall study these variables and find out how they all influence academic achievement in physics.

1.11 Objectives of the Study

1. To find out the school climate, scientific reasoning, procrastination tendency, parent autonomy support, and academic achievement levels in physics of senior secondary school students.

2. To study and compare school climate, scientific reasoning, procrastination tendency, and parent autonomy support of senior secondary school students in relation to their gender, locality, and type of institution.

3. To study the relationship between school climate and academic achievement, scientific reasoning and academic achievement, procrastination tendency and academic achievement, and parent autonomy support and academic achievement in physics of senior secondary school students.

4. To find out the joint contribution of School climate, scientific reasoning, procrastination tendency, parent autonomy support on academic achievement in Physics of senior secondary school students.

1.12 Hypotheses of the Study

	Hypotheses
Objective 2	**Gender:** $H_0 1$: There is no significant difference in the overall mean scores of school climate with respect to male and female. $H_0 2$: There is no significant difference in the mean scores of rules and norms dimension 1 of school climate with respect to male and female. $H_0 3$: There is no significant difference in the mean scores of sense of physical and socio emotional Security dimension 2 of school climate with respect to male and female.

H_04: There is no significant difference in the mean scores of support for learning dimension 3 of school climate with respect to male and female.

H_05: There is no significant difference in the mean scores of interpersonal relationship dimension 4 of school climate with respect to male and female.

H_06: There is no significant difference in the mean scores of School connectedness dimension 5 of school climate with respect to male and female.

H_07: There is no significant difference in the mean scores of scientific reasoning with respect to male and female.

H_08: There is no significant difference in the overall mean scores of procrastination tendency of with respect to male and female.

H_09: There is no significant difference in the mean scores of good planning dimension 1 of procrastination tendency with respect to male and female.

H_010: There is no significant difference in the mean scores of delaying dimension 2 of procrastination tendency with respect to male and female.

H_011: There is no significant difference in the mean scores of doing things in last minute dimension 3 of procrastination tendency with respect to male and female.

H_012: There is no significant difference in the mean scores of good time management dimension 4 of procrastination tendency with respect to male and female.

H_013: There is no significant difference in the mean scores of poor time management dimension 5 of procrastination tendency with respect to male and female.

H_014: There is no significant difference in the mean scores of autonomy support dimension 1 of parent autonomy support with respect to male and female.

H_015: There is no significant difference in the mean scores of psychological control dimension 2 of parent autonomy support with respect to male and female.

H_016: There is no significant difference in the mean scores of academic achievement with respect to male and female.

Locality:

H_017: There is no significant difference in the overall mean scores of school climate with respect to urban and rural.

	$H_0$18: There is no significant difference in the mean scores of rules and norms dimension 1 of school climate with respect to urban and rural.
	$H_0$19: There is no significant difference in the mean scores of sense of physical and socio emotional Security dimension 2 of school climate with respect to urban and rural.
	$H_0$20: There is no significant difference in the mean scores of support for learning dimension 3 of school climate with respect to urban and rural.
	$H_0$21: There is no significant difference in the mean scores of interpersonal relationship dimension 4 of school climate with respect to urban and rural.
	$H_0$22: There is no significant difference in the mean scores of School connectedness dimension 5 of school climate with respect to urban and rural.
	$H_0$23: There is no significant difference in the mean scores of scientific reasoning with respect to urban and rural.
	$H_0$24: There is no significant difference in the overall mean scores of procrastination tendency of with respect to urban and rural.
	$H_0$25: There is no significant difference in the mean scores of good planning dimension 1 of procrastination tendency with respect to urban and rural.
	$H_0$26: There is no significant difference in the mean scores of delaying dimension 2 of procrastination tendency with respect to urban and rural.
	$H_0$27: There is no significant difference in the mean scores of doing things in last minute dimension 3 of procrastination tendency with respect to urban and rural.
	$H_0$28: There is no significant difference in the mean scores of good time management dimension 4 of procrastination tendency with respect to urban and rural.
	$H_0$29: There is no significant difference in the mean scores of poor time management dimension 5 of procrastination tendency with respect to urban and rural.
	$H_0$30: There is no significant difference in the mean scores of autonomy support dimension 1 of parent autonomy support with respect to urban and rural.
	$H_0$31: There is no significant difference in the mean scores of psychological control dimension 2 of parent autonomy support with respect to urban and rural.
	$H_0$32: There is no significant difference in the mean scores of academic achievement with respect to urban and rural.

Type of Institution:

$H_0 33$: There is no significant difference in the overall mean scores of school climate with respect to government and private.

$H_0 34$: There is no significant difference in the mean scores of rules and norms dimension 1 of school climate with respect to government and private.

$H_0 35$: There is no significant difference in the mean scores of sense of physical and socio emotional Security dimension 2 of school climate with respect to government and private.

$H_0 36$: There is no significant difference in the mean scores of support for learning dimension 3 of school climate with respect to government and private.

$H_0 37$: There is no significant difference in the mean scores of interpersonal relationship dimension 4 of school climate with respect to government and private.

$H_0 38$: There is no significant difference in the mean scores of School connectedness dimension 5 of school climate with respect to government and private.

$H_0 39$: There is no significant difference in the mean scores of scientific reasoning with respect to government and private.

$H_0 40$: There is no significant difference in the overall mean scores of procrastination tendency of with respect to government and private.

$H_0 41$: There is no significant difference in the mean scores of good planning dimension 1 of procrastination tendency with respect to government and private.

$H_0 42$: There is no significant difference in the mean scores of delaying dimension 2 of procrastination tendency with respect to government and private.

$H_0 43$: There is no significant difference in the mean scores of doing things in last minute dimension 3 of procrastination tendency with respect to government and private.

$H_0 44$: There is no significant difference in the mean scores of good time management dimension 4 of procrastination tendency with respect to government and private.

$H_0 45$: There is no significant difference in the mean scores of poor time management dimension 5 of procrastination tendency with respect to

	government and private.
	$H_0 46$: There is no significant difference in the mean scores of autonomy support dimension 1 of parent autonomy support with respect to government and private.
	$H_0 47$: There is no significant difference in the mean scores of psychological control dimension 2 of parent autonomy support with respect to government and private.
	H048: There is no significant difference in the mean scores of academic achievement with respect to private and government.
Objective 3	$H_0 49$: There is no significant relationship between school climate and academic achievement of senior secondary schools.
	$H_0 50$: There is no significant relationship between scientific reasoning and academic achievement of senior secondary schools.
	$H_0 51$: There is no significant relationship between procrastination tendency and academic achievement of senior secondary schools.
	$H_0 52$: There is no significant relationship between autonomy support dimension 1 of parent autonomy support and academic achievement of senior secondary schools.
	$H_0 53$: There is no significant relationship between psychological control dimension 2 of parent autonomy support and academic achievement of senior secondary schools.
Objective 4	$H_0 54$: There is no joint contribution of school climate, scientific reasoning, procrastination tendency, parent autonomy support on academic achievement in physics of senior secondary school students.

1.13 Operational Definitions of the Terms Used

School climate: School climate encompasses the quality and character of school life. It's built on the people experiences of such as school staff, students, and parents and catapults standards and values, organisational structures, and interpersonal relationships (Cohen et. al., 2009). This study measures school climate by the combinations of rules and norms, physical and socio-emotional safety, learning support, interpersonal relationships, and school connectedness. In this study, school climate had been assessed through a self-developed questionnaire.

Scientific reasoning: Scientific reasoning refers to the cognitive abilities required to comprehend and assess scientific data, which frequently includes the comprehension and evaluation of theoretical, statistical, and causal concepts (Dunbar, Kevin N., and David Klahr, 2012). In this study, scientific reasoning has been measured with the help of the Lawson classroom test of scientific reasoning (LTCSR, 2000).

Procrastination Tendency: Academic procrastination tendency refers to an irrational tendency to delay the initiation and/or completion of an academic task (Day, V., Mensink, D., & O'Sullivan, M., 2000). In this study, academic procrastination tendency has been measured with the help of the Procrastination Scale adapted from Lay (1986).

Parent Autonomy Support: Parent Autonomy Support encompasses both the provision of behavioural Autonomy Support through choice and the facilitation of psychological Autonomy Support through the reduction of psychological control, variables traditionally seen as oppositional (Deci, E.L., Ryan, R.M., 2012). In this study, parental autonomy support has been measured with the help of the Perceived Parental Autonomy Support Scale (P-PASS) adapted from Mageau et al. (2015).

Academic achievement of students in Physics: It is the performance of the students in the achievement test in Physics developed by the investigator for the present study.

Senior secondary students: The students studying in Class XII in HPBSE (Himachal Pradesh Board of School Education) in the science stream.

Gender: Boys or girls studying in Class XII in Himachal Pradesh.

Locality of institution: This refers to the locality in which the school is constructed in Himachal Pradesh. It can be rural or urban.

Type of institution: Private or government senior secondary school in the state of Himachal Pradesh.

1.14 Delimitations of the Study

The study has been delimited to:

1. Senior secondary students of Himachal Pradesh studying in Class XII.
2. Students of the science stream studying physics as one of the major subjects in Kangra district of Himachal Pradesh.

3. Senior secondary schools in Himachal Pradesh are affiliated to Himachal Pradesh Board of School Education (HPBSE), Dharamshala.

1.15 Structure of the Thesis

The thesis is structured into six chapters:

Chapter 1: Introduction Purpose of the study and significance of study This chapter describes the conceptual and theoretical framework that grounds the investigation. Additionally, the relation among the research objectives to be addressed, the previous research gaps, hypotheses, and the operational definitions of the term apply.

Chapter 2: This chapter presents relevant literature reviews from 2010-2024 and identifies the research gap based on the reviews.

Chapter 3: This chapter describes all details of the research methods applied in order to help achieve the research objectives. Which includes the research design, population and sample, selection of research tools and their validity and reliability, procedures for data collection, and statistical techniques used in data analysis.

Chapter 4: This chapter states the findings of the research. These refer to what was found in relation to each objective and their analysis and interpretation.

Chapter 5: This chapter discusses the findings from the previous chapter. This chapter discusses and interprets findings in perspective with previous literature.

Chapter 6 shows the contribution aimed at knowledge on other patterns in other environments as well as educational implications to be drawn from how that knowledge can be used in, for example, educational settings. In addition, a brief summary of the thesis is given.