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IMPACT OF GENDER AND SELF-EFFICACY ON SCIENCE LEARNING OUTCOMES OF SECONDARY SCHOOL STUDENTS

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ABSTRACT

Science is often viewed as a challenging subject requiring logical reasoning and problem-solving. Many students develop anxiety and low confidence toward science learning, leading to poor achievement. Exploring the connection between self-efficacy and science learning outcomes helps identify how confidence and motivation affect students' scientific understanding and skill acquisition. The present study provide insights in to understanding how gender and self-efficacy impact science learning outcomes and identify the gaps in students performance and address the potential biases and promote equal opportunities for all students in science education. Further, study also provides insight into how to design interventions that make science learning more engaging and less intimidating. In this context, the present paper an attempt has been made to investigate the Impact of gender and self-efficacy on science learning outcomes of secondary school students. To achieve the objective of present study a sample of 360 secondary school students of class 9^{th} selected randomly by using simple random technique (odd-even method) from different government schools situated in five districts of Himachal Pradesh. The requisite data is collected from the selected subjects by using the achievement test constructed and standardized by the researcher herself and Social support scale by Mathur and Bhatnagr (2012). For analysis of the data, the statistical technique Analysis of Variance (ANOVA) was applied. The findings of the study revealed that gender and self-efficacy significantly affects the science learning outcomes of secondary school students. The present study further contributes to promoting equity in science education and highlights the suggestions for promoting self-efficacy well as interventions that enhance science learning outcomes in secondary school students

Keywords: *Gender, Science Learning Outcomes, self-efficacy, Secondary School Students.*

1.1THEARETICAL FRAMEWORK

Education plays a pivotal role in shaping an individual's intellectual and social development. Among various disciplines, science occupies a central position due to its emphasis on inquiry, reasoning, and the development of logical and analytical thinking. Science education aims not only to impart knowledge but also to nurture curiosity, creativity, and a spirit of exploration among learners. In the secondary stage, science learning becomes increasingly complex as students are introduced to abstract concepts and scientific methods that demand both cognitive understanding and practical application. However, students' performance in science is influenced not only by their intellectual capacity but also by psychological variables, such as motivation, attitude, and self-efficacy. In recent years, self-efficacy has emerged as one of the most important predictors of students' academic achievement and learning behaviour. It represents a student's belief in their ability to successfully complete a specific task or achieve a desired goal. Learning outcomes in science can be viewed as measurable results of the learning process, encompassing cognitive (knowledge and comprehension), affective (attitude and interest), and psychomotor (skills and practical abilities) domains. The integration of

these outcomes ensures a holistic development of the learner's scientific understanding and practical competence. When students possess strong self-efficacy, they are more likely to attain better results across all these domains. By identifying how self-belief influences achievement, educators can adopt effective pedagogical strategies to enhance students' confidence, engagement, and ultimately, their science learning outcomes.

1.1 Concept of Self-Efficacy

The concept of self-efficacy was introduced by Albert Bandura in 1997 as part of his social cognitive theory. He defined self-efficacy as individuals' beliefs in their capabilities to organize and execute the actions required to manage prospective situations. In the context of education, self-efficacy reflects how strongly students believe they can master academic challenges, complete assignments, and performs well in examinations.

Self-efficacy refers to an individual's belief in their ability to perform specific tasks or achieve goals (Bandura, 1997). For secondary school students, self-efficacy reflects how confident they feel about their capability to succeed in academic subjects, complete assignments, or solve problems. Education today faces the critical challenge of not only delivering knowledge but also empowering students with the confidence to apply what they learn. Among the many psychological constructs influencing academic performance, self-efficacy-a student's belief in their ability to succeed at specific tasks-has emerged as a key determinant of learning outcomes.

Definitions of Self-Efficacy

Self-efficacy refers to an individual's belief in their own ability to plan, organize, and execute actions required to achieve specific goals or perform particular tasks successfully. It reflects a person's confidence in their capacity to deal effectively with different situations and challenges. In the educational context, self-efficacy represents students' confidence in their ability to learn, understand, and perform academic tasks, which strongly influences their motivation, learning behaviour, and achievement.

In the view of Bandura (1997) "Self-efficacy refers to beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments."

Zimmerman (2000)"Self-efficacy beliefs are students' judgments about their capability to successfully perform a given academic task at a designated level."

Definitions of Science Learning Outcomes

Science learning outcomes refer to the observable, measurable, and assessable results of students' engagement with science education. They indicate the extent to which learners have acquired knowledge, developed scientific skills, and internalized scientific attitudes as a result of instruction and learning experiences in science.

B.S. Bloom (1956) defined as the "Learning outcomes are the statements that describe the intended goals of education in terms of knowledge (cognitive), skills (psychomotor), and attitudes (affective) acquired by learners."

In simple terms, science learning outcomes describe what students know, understand, and are able to do after studying science.

According to UNESCO (2013) "Learning outcomes in science represent the knowledge, skills, values, and attitudes that learners are expected to demonstrate at the end of a learning process."

National Council of Educational Research and Training (NCERT, 2019) "Science learning outcomes refer to the specific competencies and understanding developed through scientific inquiry, experimentation, and reasoning, enabling students to apply scientific knowledge to daily life situations."

1.3 Rationale of the Study

Learning outcomes represent *what* students achieve, while self-efficacy reflects *why and how* they achieve it. Students who believe in their capacity to succeed are more likely to set higher goals, use effective learning strategies, and persevere through difficulties. Thus, studying both together enables researchers to understand the relationship between belief and performance, which is crucial for improving academic practices. Secondary school is a crucial period in students' lives, characterized by increased academic demands, complex social interactions, and significant developmental changes. During this stage, self-efficacy beliefs begin to solidify and can influence students' motivation, learning strategies, resilience, and overall academic performance. High self-efficacy often leads students to set challenging goals, persist in the face of difficulties, and employ effective learning strategies, resulting in better academic outcomes. Conversely, students with low self-efficacy may doubt their abilities, avoid challenging tasks, and give up easily, which can negatively affect their performance.

Despite the recognized importance of self-efficacy, many secondary school students struggle with self-doubt, which can limit their academic engagement and achievement. Exploring the relationship between self-efficacy and learning outcomes is essential for developing educational interventions that foster positive beliefs about one's academic abilities. This study aims to investigate the levels of self-efficacy among secondary school students and analyze how these beliefs relate to their learning outcomes. By understanding this relationship, educators, parents, and policymakers can better support students in realizing their academic potential.

1.4 Self-Efficacy and Science Learning Outcomes

Education today is not merely concerned with the transmission of knowledge but also with the development of attitudes, confidence, and self-belief that enable students to apply learning effectively in real-life situations. In this context, self-efficacy and learning outcomes are two interrelated and complementary constructs that together determine the quality and depth of students' academic success. Studying these variables together is essential for several reasons. Academic achievement does not depend solely on intellectual ability or content mastery; it is significantly influenced by students' psychological beliefs about their capabilities. Self-efficacy acts as a motivational force that determines how students approach learning tasks, how much effort they put in, and how they respond to challenges. Therefore, examining self-efficacy alongside learning outcomes helps in understanding the psychological foundation of academic success. Further, high self-efficacy increases motivation, which encourages students to engage more actively in learning tasks. This engagement leads to improved understanding and performance. Students with strong self-efficacy are more likely to set challenging goals and persist in achieving them, even when they face setbacks. High self-efficacy students often use effective learning strategies like time management, goal-setting, and self-monitoring, which enhance their academic outcomes. Students with high self-efficacy tend to experience lower levels of academic stress and anxiety, which helps them perform better in examinations and classroom activities. Teachers can significantly influence students' self-efficacy by providing constructive feedback, opportunities for mastery experiences, and supportive classroom environments. When

researchers study both self-efficacy and learning outcomes together, the findings guide teachers to adopt strategies that strengthen students' belief in their abilities, thereby improving both performance and interest in learning.

II. REVIEW OF RELATED LITERATURE

Ochieng (2015) Examined "The self-efficacy of secondary school students was examined in relation to their academic achievement". Result showed that there was a positive correlation between mathematics achievement and self-efficacy. Pavani & Agrawal (2015) examine the levels of self-efficacy among academic achievers. They found that high self-efficacy possessed high academic achievement. Ahuja (2016) studied the self-efficacy of secondary school students with reference to educational aspiration and academic achievement. Findings revealed that girls were found with significant higher self-efficacy than the boys. A significant positive correlation was foundbetween self-efficacy and educational aspiration, and between self-efficacy and academic achievement of students. Hwang et al. (2016) explore the relationship between self-efficacy and academic achievement. finding of study indicated that the academic performance of students from the first semester of the 8^{th} grade positively predicted self-efficacy beliefs for the second semester of the 8th grade and that self-efficacy beliefs from the second semester of the 8th grade positively predicted the academic achievement of students for the first semester of the 9^{th} grade. Meera & Jumana (2016) conducted a study Self-efficacy and academics performance in English. They found a significant difference in the academic performance in English and self-efficacy of rural and urban students. Soleymani & Rekabdar (2016) explore the relationship between mathematics self-efficacy and mathematics achievement of student. Results shows that self-efficacy as a strong predictor of mathematics achievement. Sawhney & Bansal (2019) studied Self-efficacy and Academic achievement among high school students. They found significant positive correlation between self-efficacy and academic achievement. Although no notable difference were observed between students with high and moderate academic performance in terms of self-efficacy across academic, social, and emotional dimension, a substantial difference was found between those with moderate and low academic levels. Furthermore, significant difference in self-efficacy across all domains- academic, social and emotional- were noted between students with high and low academic achievement. Wu,Q.(2024) explored the impact of self-efficacy on academic achievement among college students and reported that higher level of self-efficacy significantly contribute to improve academic outcomes, students confidence and adaptability in their education.

2.1 OBJECTIVES OF THE STUDY

i. To study science learning outcomes among secondary school students with respect to their gender.

ii. To study science learning outcomes among secondary school students in relation to their level of self-efficacy i.e. high, moderate and low.

iii. To study the interactional effect of gender and self-efficacy on science learning outcomes of secondary school students.

2.2 HYPOTHESES OF THE STUDY

- Male and female secondary school students differ significantly in their science learning outcomes.
- Students having different levels of self-efficacy differ significantly from each other with respect to science learning outcomes.

- Gender and self-efficacy do not have significant interactional effects on science learning outcomes of secondary school students.

III. METHODOLOGY

This section presents the research methodology that was adopted in present study. It includes the research design, research respondents, sampling technique and procedure, research instruments, validity and reliability of the research instruments, data gathering procedure, and the statistical treatment.

3.1 RESEARCH DESIGN

In present study quantitative research design was used. Quantitative approach seeks correlation, relationships, and causality and focuses on gathering numerical data and generalizing it across groups of people or explaining a particular phenomenon. Descriptive survey method was adopted. In descriptive research, the researcher has been studying the phenomenon of interest as it exists naturally, no chance to manipulate the individuals, conditions, or events.

3.2 **RESEARCH RESPONDENTS**

The population for the current research included total number of Government secondary school students studying in 9th grade in the state of Himachal Pradesh. The sample comprises of 360 students of both genders (180 male and 180 female) was taken from different Govt. Secondary schools from four districts namely; Hamirpur, Mandi, Kullu and Bilaspur of Himachal Pradesh, India. The respondent's age group ranged from 12 to 14 years.

3.3 **SAMPLING TECHNIQUES**

In the present study, multi-stage Random sampling technique was used. In first stage four districts has been selected randomly by making use of lottery method. Further in second stage Government secondary school has been taken from the sampled districts. In final stage, secondary school students were selected from each sampled schools by making use of random numbers table.

3.4 **RESEARCH INSTRUMENTS**

For the collection of requisite data in the present study, there researcher used two standardized tools namely; Self-efficacy Scale by Mathur and Bhatnagar (2012) and Science Achievement Test developed and standardized by investigator herself are used. Self-efficacy scale comprises 22 items out of which 15 are positive and 07 are negative items. Each item was rated on a Five-point Likert scale ranging from 'Strongly agree' , 'Agree', 'Undecided, 'Disagree,' to Strongly disagree'. The reliability of the tool was 0.81, The possible minimum and maximum score on the scale is 22 and 110 respectively. The Science Achievement test consisted of 48 items. Test is consisted of multiple choice items. Each correct answer carry 1 marks. The scores range from minimum 0 to maximum 48 marks.

3.5 DATA GATHERING PROCEDURE

The data for this study was collected from the month of October to November 2024. After taking the necessary permission from the principals of each sampled Government schools, the investigator interacted with the subjects of the study. The purpose of the study was made clear to them and they were ensured that the information provided by them would be used for research purpose only. After this, the booklets of the Science achievement test and self-efficacy scale were distributed to students one by one and instructions were read out to them. Then students were asked to start responding to the items of the tools. Enough time was given

to students to respond to all the items. The filled up booklets were collected and the students were thanked for the cooperation extended in the collection of the data.

3.6 STATISTICAL TREATMENT

The data were analyzed by using the Statistical Package for the Social Sciences (SPSS). The mean and standard deviation were computed to determine the level of Science learning outcomes the respondents and self-efficacy. In order to study the independent and interactional effect of gender and level of self-efficacy on science learning outcomes of secondary school students, 2X3 analysis of variance (Two-way ANOVA) involving two types of gender i.e. male and female and three level of self-efficacy i.e. high, moderate and low) was applied.

IV RESULTS AND DISCUSSION

This section comprises the analysis, interpretation of the data and discussion of the findings of the study. In order to study the main effects of gender and self-efficacy on science learning outcomes of secondary school students along with their interactional effects, analysis of variance (2X3 factorial design involving two types of gender and three levels of self-efficacy i.e. high, moderate and low) was applied on mean scores of science learning outcomes. The mean science learning outcomes scores at different levels of gender and self-efficacy are given in table-1 and figure-1 as under:

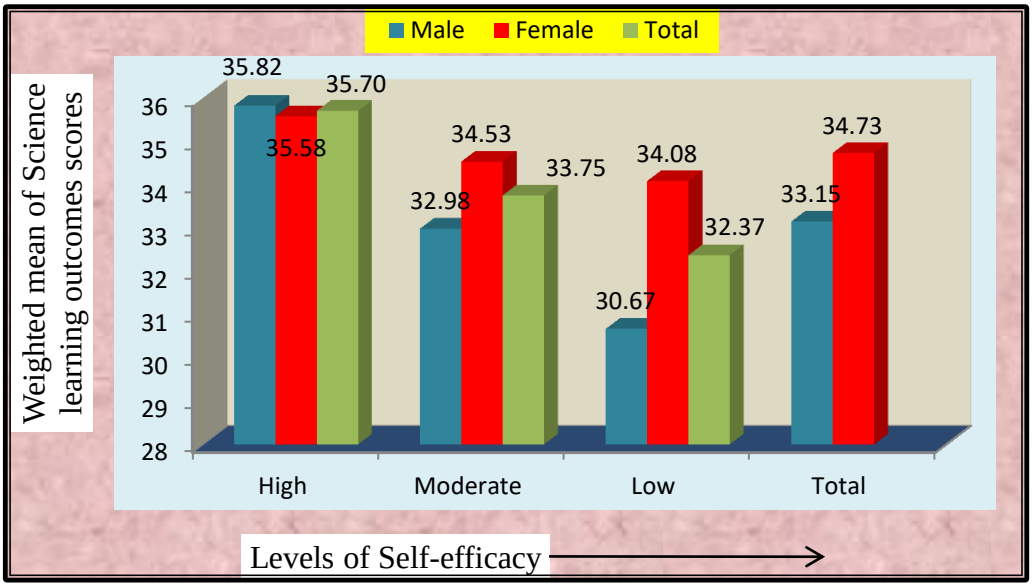
Table 1. Mean Scores of Science Learning Outcomes of Secondary School Students at different Levels of Self-efficacy

Sr. No.	Gender		Levels of Self-efficacy			
			High	**Moderate**	**Low**	**Total**
1	Male	Mean	35.82	32.98	30.67	33.15
		SD	6.45	6.83	6.56	6.91
		N	60	60	60	180
2	Female	Mean	35.58	34.53	34.08	34.73
		SD	7.00	7.20	6.21	6.81
		N	60	60	60	180
3	Total	Mean	35.70	33.75	32.37	33.94
		SD	6.71	7.04	6.59	6.89
		N	120	120	120	360

Table-1 indicates the mean scores of male (33.15) and female (34.73) secondary school students on science learning outcomes. Further table depicts the mean scores of high self-efficacy (35.70), Moderate (33.75) and low self-efficacy (32.37) secondary school students with respect to their science learning outcomes.

The pictorial representation of mean science learning outcomes scores of male and female secondary students at different levels of self-efficacy is given below in Figure-1. as under:

Figure-1. Bar Diagram Showing the Mean Scores of Male and Female secondary school Students at different Levels of self-efficacy with regard to Science Leaning outcomes



The complete summary of the 2X3 analysis of variance is given in Table-2 as following:

Table- 2.The Complete Summary of the 2X3 Analysis of Variance for Science Learning Outcomes Scores of Secondary School Students with respect to Gender and Self-efficacy

Sr. No.	Source of Variation	Sum of Squares	df	Mean Square (Variance)	F-Ratios
1.	Gender(A)	880.097	1	880.097	4.958*
2.	Self-Efficacy (B)	271.626	2	135.813	7.408 **
3.	Gender× Self-Efficacy (A×B)	23.802	2	11.901	2.211NS
4.	Error Variance	199.872	354	45.190	
5.	Total Sum of Squares	17090.889	359		

NS –not significant

*-Significant at 0.05 level of significance.

**-Significant at 0.01 level of significance.

Table value for *df* 1/354=3.86 and for df 2/354 =3.02 at 0.05 level of significance.

Table value for *df* 1/354=6.76 and for df 2/354=4.66 at 0.01 level of significance.

4.1 SCIENCE LEARNING OUTCOMES OF SECONDARY SCHOOL STUDENTS IN RELATION TO THEIR GENDER

From the Table-2 it was observed that 'F' Ratio for main effect of gender on science learning outcomes of secondary school students irrespective of self-efficacy for *df* 1/354 came out to be 4.958 which is much higher than the table value (3.86) at 0.05 level of significance. Hence, the Hypothesis-1 that, "Male and female secondary school students differ significantly with regard to their science learning outcomes." was accepted. It may be inferred that there is a significant differences in mathematics learning outcomes of male and female secondary school students. Further Table-1 indicates that Mean scores of female secondary school students (34.73) is significantly higher than the male students (33.15) on

science learning outcomes. Thus, from the analysis it may be concluded that female secondary school students outperformed in science learning outcomes than male counterparts.

4.2 SCIENCE LEARNING OUTCOMES OF SECONDARY SCHOOL STUDENTS IN RELATION TO THEIR LEVEL OF SELF-EFFICACY

Table-2 indicates that the 'F' value for main effect of self-efficacy on science learning outcomes of secondary school students irrespective of gender for *df* 2/354 came out to be 7.408 which is significantly higher than the table value (4.66) at 0.01 level of significance. Hence, the Hypothesis-2 that, "Students having different levels of self-efficacy differ significantly from each other on science learning outcomes" was accepted. Therefore, it may be inferred that self-efficacy has significant effect on science learning outcomes of secondary school students. Further, from the mean scores it can be interpreted that the students with high self-efficacy has exhibited significantly higher level of science learning outcomes (mean =35.70) followed by moderate (mean =33.75) and low level of self-efficacy (mean=32.37). The findings of the present study supported by Talluri (2019), Suryaratri Dyah Ratna etal. (2022) , WU,Q. (2024) Pilla & Chaktaborty (2025) who also reported that students possessed higher level of self–efficacy significantly contributed to improve science learning outcomes.

4.3 INTERACTIONAL EFFECT OF GENDER AND SELF-EFFICACY ON SCIENCE LEARNING OUTCOMES OF SECONDARY SCHOOL STUDENTS

It is evident from the Table-2 that calculated 'f' value for interactional effect of gender and self–efficacy on science learning outcomes of secondary school students for *df* 2/354 came out to be 2.221 which is less than table value (3.02) even at 0.05 level of significance. Hence, hypothesis no.3 that, "Gender and self-efficacy do not have significant interactional effects on science learning outcomes of secondary school students " was accepted. So, it may be inferred that gender and self-efficacy (in combination with each other) did not influence science learning outcomes of secondary school students in significant manner. It is evident from the figure-2 as given below that there are approximately the same differences in the mean science learning outcomes scores of male and female secondary school students regardless of their level of self-efficacy i.e. high, moderate and low. The non-significant interactional effect of gender and self-efficacy on science learning outcomes is given in Figure -2

Figure-2: Interactional Effect of Gender and Self-efficacy on Science Learning Outcomes of Secondary School Students.

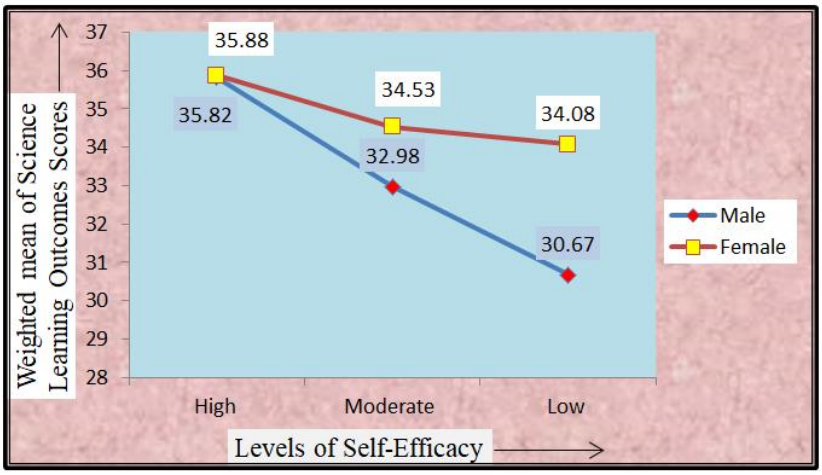


Figure-2 shows that the mean scores of female and male secondary school students with high self-efficacy i.e. 35.88 and 35.82, followed by moderate 34.53 and 32.98 and low self-efficacy 34.08 and 30.67 respectively. These differences are slightly varies from each other. From the above analysis it may be said that gender and self-efficacy (in combination with each other) did not influence science learning outcomes of secondary school students in significant manner.

V. RECOMMENDATIONS

The current study explores the independents and interactional effects of gender and self-efficacy on science learning outcomes of secondary school students. Finding of the present study revealed that Self-efficacy plays a central role in shaping students' academic behaviours, attitudes, and achievement. The belief students hold about their capabilities directly influences how they approach learning tasks, handle challenges, and maintain motivation. Understanding these effects has several important implications for educational practice, curriculum design, teacher training, and student support systems. On the basis of the findings following recommendations has been made for all the stakeholders parents, teachers, Teacher educators, community members as well administrations to promote the self-efficacy among students. It was found that students with high self-efficacy are more likely to be motivated, actively participate in all academic activities, and take initiative in their own learning. For this, Schools should be cultivate such motivation by designing tasks that promote a sense of mastery and gradual challenge. Teachers play a vital role in shaping students' beliefs about their abilities through verbal persuasion, modelling, and supportive feedback, educators can help students recognize their potential and believe in their capability to succeed. Classroom environments that emphasize effort, persistence, and progress over mere performance help strengthen students' self-belief. Teachers should be encouraging a growth mindset by recognizing improvement, giving constructive feedback, and avoiding comparisons among students during teaching learning process. They should be Adopted student-centred teaching approaches that allows students to make choices, reflect on their learning, and work at their own pace can enhance self-efficacy. Differentiated instruction tailored to students' needs and learning levels builds both confidence and competence. Besides the curriculum the students, Teacher should be fostered the different skills among students viz; Resilience and academic perseverance, stress management, and goal-setting skills that can help students remain persistent in challenging academic situations. Educational policies should prioritize student well-being and psychological development alongside academic content. Training programs for teachers and counsellors should include components on fostering academic self-efficacy.

VI. CONCLUSION

Science learning outcomes and self-efficacy are pivotal factors that influencing students academic achievement future career trajectories in science as well as for the student's academic success. The findings underscore the self-efficacy play a significant role in improving science learning among secondary school students. Teacher should be creating motivational and stress free supportive classroom environment where mistakes are seen as learning opportunities. teacher should encourage By understanding the influence of gender and self-efficacy , educators and policymakers may be implement more personalized and effective interventions that contribute to students science learning outcomes.

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