

Gender Differences in Attitude towards Science Teaching and Learning Styles among Adolescents

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Abstract: *The present study is based on finding out the impact of gender on different learning style and attitude towards Science of students from the sample. Totally 300 students were taken for the study from three different schools. To verify the hypotheses, learning style inventory by Barbara A. Solomon, Richard M. Felde Scale and Modified Fennema-Sherman's Questionnaire for Attitude towards Science were used. Critical Ratio and correlation coefficient have been used to analyze the data and it has been concluded that gender has a significant impact on different learning styles and attitude towards science teaching.*

Keywords: Learning style, Attitude towards Science, Critical Ratio.

1. Introduction

Man has been learning from nature, by watching the world outside and inside him, from what others say and do. It is essentially about what we human beings are, why we behave the way we do, and the complexity of thought.

We learn, acquire knowledge and act from it. We also learn through doing. This is also accumulated as knowledge. Every subject has internal discipline. So learning of each subject demands application and order. Learning is also about order in life, order in school life that is learning why one should be punctual to classes, meals, the proper time for rest, why one should follow certain rules in school, and how they smoothen their learning.

In today's society, our younger generation has more access to a wide variety of information through various media. This situation is further augmented due to the advancement of information and communication technologies, in particular smart phones, laptops, and the Internet. While the media provides timely information and entertainment to us, its potential detriments cannot be underestimated. The term digital divide has been used to describe the phenomenon in which the poorer, less educated, and those from rural areas cannot participate equally in this information era (4). Yet a gender digital divide has been permeating in our society that deserves our attention. Low participation of Girls in computer science field has been a long standing problem. According to a study by (11), Girls are under-represented in all fields of computer science in academia and industry.

Maths and Science are two subject areas that are proven to be imperative for our society in terms of progress and success. These two subjects are important in order to continue to be a leader in this continually changing technological world. It is important for students to have a deep understanding of the concepts of both of these subjects from the beginning of their education. As society continues to become more reliant on technology, jobs are going to require a higher level of understanding of these concepts. It

is important that everyone receives an equal educational experience in these subjects because of all of these realities. Gender remains a dividing status between members of society today. In institutions such as education, this is especially evident. The research supports that there are gender differences in attitudes to and performances in math and science. This paper will investigate how these gender differences contribute to attitude towards science teaching and learning styles of students. From the moment a child is born, they are given a name that carries with it a gender role which the child is expected to fulfill. The child's nursery, clothes, book, toys, television shows, etc. all transmit ideas about what role the child must fill. Schools as a whole also contribute to gender role socialization and discrimination. Textbooks and children's literature are places that exhibit gender roles that students pick up on. In the 1991 study discussed by [20], women and girls were underrepresented in basal readers that were in widespread use in the 1970's [20]. They also found that the books contained sex stereotypes as well as derogatory comments about Girls, [20]. Researchers state that it is proven that teachers interact with Boys students much more frequently. In science classrooms, this interaction level is even higher. It has also been proven that praise from a teacher is crucial to a students' success in school. So, if teachers are favoring boys, it is obvious that they have a much better opportunity to perform above others. Girls are expected to be more docile in the classroom, almost to the point they are invisible. "They receive fewer academic contacts, less praise, fewer complex and abstract questions, and less instruction on how to do things for themselves". One way to improve student motivation and performance is to adapt teaching approaches to meet the different learning style preferences of our students [5]. Although it is known that students have a variety of learning style preferences [5], it is unknown if gender differences in learning style preferences exists among undergraduate physiology students. Knowing the students' learning style preferences will aide in the development of the most effective teaching approaches [6]. There are many methods available for assessing learning styles, with each method offering a distinctly different view of learning style

preferences. The method used in this study defines the preference in learning style based on the sensory modality in which a student prefers to take in new information. The three major sensory modalities are defined by the neural system that is preferred when receiving information: visual (V), aural (A), and kinesthetic (K), collectively known as VAK. In other words, VAK categorizes student learning based on the sensory preference of the individual. This classification system was recently expanded by [10] to VARK to include another category: read-write (R, a mixed sensory modality that is not assessed under VAK). Students with a V preference learn best by seeing or observing (drawings, pictures, diagrams, demonstrations, etc). Learner's preferences are best suited to learn by listening to or recording lectures, discussing material, and talking through material with themselves or others. R-type learners learn through interactions with textual materials. K-style learners perform best by using physical experiences: touching, performing an activity, moving, lessons that emphasize doing, and manipulation of objects. Student learners are capable of using all of these sensory modes of learning; however, each individual has a unique preference, or set of preferences, in which one mode is often dominant learners with a single learning style preference are referred to as uni-modal, whereas others preferring a variety of styles are known as multimodal. Of the multimodal learners, there are sub classifications for bi-, tri-, and quad-modal learners, who prefer to use two, three, or four styles, respectively.

2. Definitions of Learning Styles and Attitude Towards Science Teaching

The Attitude towards science teaching is a very significant outcome of the process of science education. Attitude towards science teaching of mind is essential to enable them to adjust themselves and live as efficient citizen in a scientific society. , the learners should be in the "process of developing a personal philosophy based on truth, understanding and logic rather than one based on superstition institution or wishful thinking". [37] have incorporated a range of components in their measures of attitudes to science including: the perception of the science teacher; anxiety toward science; the value of science; self-esteem at science; motivation towards science; enjoyment of science; attitudes of peers and friends towards science; attitudes of parents towards science; the nature of the classroom environment; achievement in science; and fear of failure on course.

Attitudes toward science are shaped by different factors such as ability, motivation, quality of instruction, the content of courses, teachers' personalities, home and school environments, the place students live, race and gender. Gender seems to be one of the important predictors of students' achievement in science learning and attitude toward science [28], [36]. Gender-related research indicates that boys favor science courses as well as science related jobs such as engineering more than girls [1], [8]. An international study conducted by the International Assessment of Educational Progress including 20 countries and students from nine to thirteen-year old students found that there was a considerable gap between Boys and Girls students for their attitudes toward science and science teaching in the participating countries except for Taiwan and

Jordan. In those countries, boys preferred mostly mathematics and physics courses while girls tended to take biology courses [29]. The same findings have also been in other studies where Boys had more positive attitudes toward science than girls. According to the report of [35] and [31], boys had significantly more positive attitudes than girls among 4000 students studying at grade 6 through 10. Besides, [14] presented similar results, to indicate that 6th grade Girls students felt science courses were more difficult to understand than Boys students did. This tendency affected choosing future careers by students which had resulted in 15% of the work force in science related areas being women [2].

Active and Reflective Learners

- Active learners tend to retain and understand information best by doing something active with it--discussing or applying it or explaining it to others. Reflective learners prefer to think about it quietly first."
- "Let's try it out and see how it works' is an active learner's phrase; 'Let's think it through first' is the reflective learner's response."
- "Active learners tend to like group work more than reflective learners, who prefer working alone."
- "Sitting through lectures without getting to do anything physical but take notes is hard for both learning types, but particularly hard for active learners."
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Sensing Learners and Intuitive Learners

- Sensing learners tend to like learning facts; intuitive learners often prefer discovering possibilities and relationships."
- "Sensors often like solving problems by well-established methods and dislike complications and surprises; intuitions like innovation and dislike repetition. Sensors are more likely than intuitors to resent being tested on material that has not been explicitly covered in class."
- "Sensors tend to be patient with details and good at memorizing facts and doing hands-on (laboratory) work; intuitors may be better at grasping new concepts and are often more comfortable than sensors with abstractions and mathematical formulations."
- "Sensors tend to be more practical and careful than intuitors; intuitors tend to work faster and to be more innovative than sensors."

- "Sensors don't like courses that have no apparent connection to the real world; intuitors don't like 'plug-and-chug' courses that involve a lot of memorization and routine calculations."

Visual Learners and Verbal Learners:

Visual learners remember best what they see--pictures, diagrams, flow charts, time lines, films, and demonstrations. Verbal learners get more out of words--written and spoken explanations."

- "Everyone learns more when information is presented both visually and verbally." Sequential learners and Global learners Sequential learners tend to gain understanding in linear steps, with each step following logically from the previous one. Global learners tend to learn in large jumps, absorbing material almost randomly without seeing connections, and then suddenly 'getting it.'"
- "Sequential learners tend to follow logical stepwise paths in finding solutions; global learners may be able to solve complex problems quickly or put things together in novel ways once they have grasped the big picture, but they may have difficulty explaining how they did it."

Sample

Total 300 students were taken for the study of which 100 from Government Schools, 100 students from Government Aided Schools and 100 students from Private schools. In each category it contains 50 boys and 50 girls. All the students were studying in XII standard. Schools were chosen from Thiruvallur District. All the students were selected randomly from the Thiruvallur District

3. Objectives of the Study

To find out the impact of gender on different learning style and attitude towards Science of students of the sample.

4. Hypotheses

1. Gender plays a very important role on the Attitude towards Science of students
2. There were no significant difference in Active learning style between Boys and Girls of the total sample
3. There were no significant difference in reflective learning style between Boys and Girls of the total sample

4. There were no significant difference in sensing learning style between Boys and Girls of the total sample
5. There were no significant difference in intuitive learning style between Boys and Girls of the total sample
6. There were no significant difference in visual learning style between Boys and Girls of the total sample
7. There were no significant difference in verbal learning style between Boys and Girls of the total sample
8. There were no significant difference sequential learning style between Boys and Girls of the total sample
9. There were no significant difference in global learning style between Boys and Girls of the total sample

5. Design of the Study

To verify the hypotheses, suitable tools have been selected for the present study. Survey method was used for the study. A brief resume has been given below.

- Learning style inventory by Barbara A. Solomon, Richard M. Felde Scale.
- Modified Fennema-Sherman's Questionnaire for Attitude towards Science

Establishing Reliability and validity of Questionnaires used in the Study

In order to establish the reliability for the questionnaire of attitude towards science was used. The reliability of this questionnaire was found out by test-retest method and was equal to 0.8956. Hence this questionnaire has been taken as highly reliable.

Table 1: To differentiate Attitude towards science teaching of Boys and Girls from the total sample

Variables	School Type	Gender	No.	Mean	S.D.	C.R.	L.S.
Attitude towards science teaching	Government	Boys	50	195	14.7	3.5	0.01
		Girls	50	185	13.3		
	Government Aided	Boys	50	202	16.4	6.15	0.01`
		Girls	50	181	17.7		
	Private	Boys	50	204	18.50	5.23	0.01
		Girls	50	184	19.7		

From the table 1, and also from Figure –A, it is clear the calculated 'C.R' values are more than that of table'. R values. Hence the Hypothesis has been accepted and proved that the gender played a very important role on the attitude towards science of students of Government, Government aided and unaided schools of the total sample

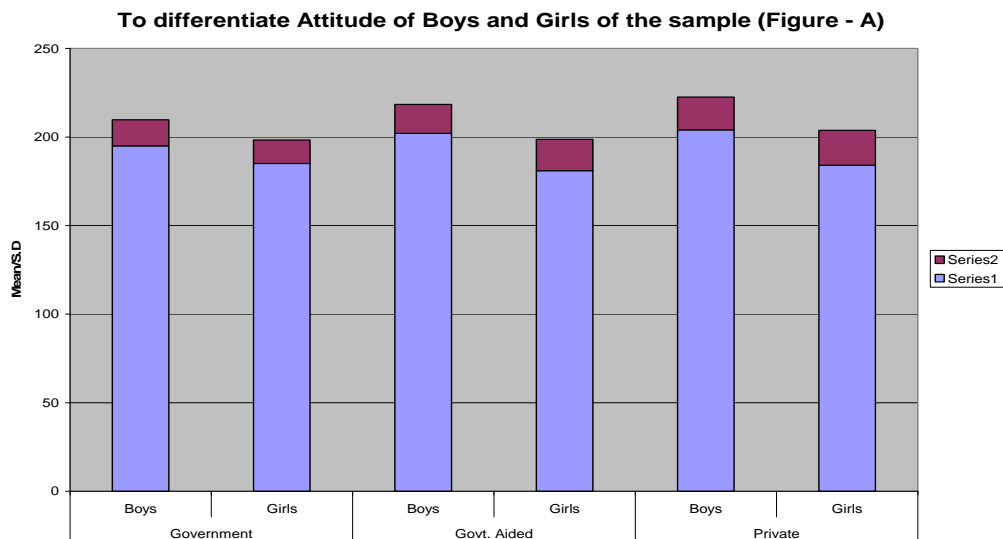


Table 2: To Differentiate between Active learning style of Boys and Girls students

Variables	School Type	Gender	No.	Mean	S.D.	C.R.	L.S.
Active Learning Style	Government	Boys	50	6.3	0.81	4.34	0.01
		Girls	50	5.6	0.8		
	Government Aided	Boys	50	8.07	0.4	6.5	0.01
		Girls	50	7.5	0.47		
	Private	Boys	50	7.08	0.45	6.09	0.01
		Girls	50	6.5	0.45		

From Table 2 also from Figure - B, it is clear that the calculated 'C.R' values of Government, Government Aided and Private School are more than that of the table 'C.R' values. Hence, the hypothesis was rejected and proved that there were significant difference in active learning style between Boys and Girls of Government, Government Aided and Private School.

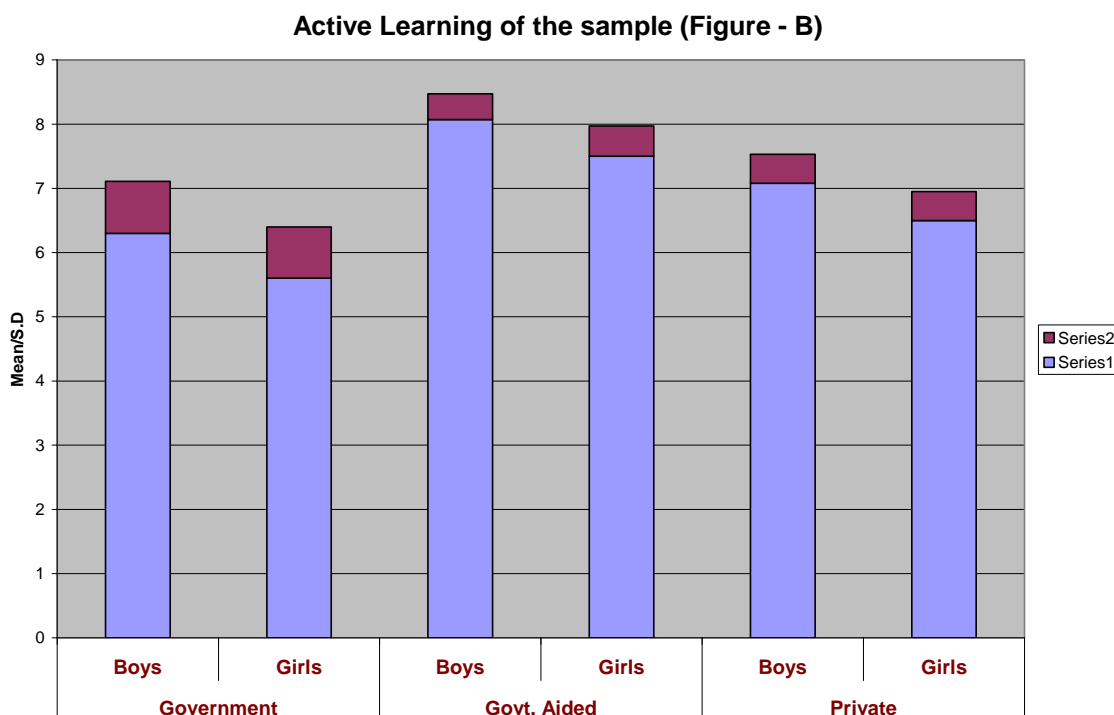


Table 3: To Differentiate between Reflective learning style of Boys and Girls students

Variables	School Type	Gender	No.	Mean	S.D.	C.R.	L.S.
Reflective learning	Government	Boys	50	6.58	1.28	3.8	0.01
		Girls	50	6.23	1.87		
	Government Aided	Boys	50	6.92	1.35	6.11	0.01
		Girls	50	6.373	1.95		
	Private	Boys	50	6.82	1.52	5.01	0.01
		Girls	50	6.37	1.86		

From Table 3 and also from Figure- C, it is clear that the calculated 'C.R' values of Government, Government Aided and Private School is more than that of the table 'C.R' values. Hence, the hypothesis was rejected and proved that there were significant difference in reflective learning style between Boys and Girls of Government, Government Aided and Private School.

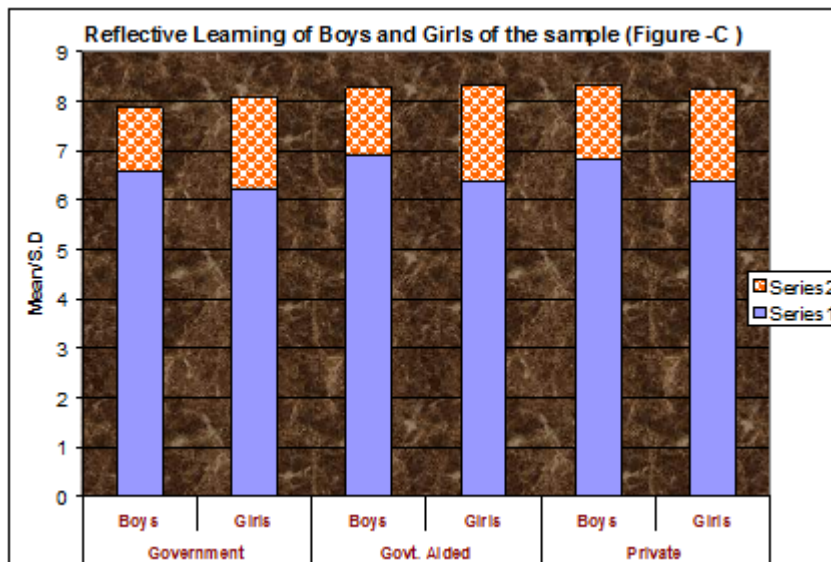


Table 4: To Differentiate between Sensing learning style of Boys and Girls students

Variables	School Type	Gender	No.	Mean	S.D.	C.R.	L.S.
Sensing learning style	Government	Boys	50	7.51	0.98	5.6	0.01
		Girls	50	7.6	0.56		
	Government Aided	Boys	50	8.44	0.78	7.006	0.01
		Girls	50	7.46	0.54		
	Private	Boys	50	9.91	0.52	25.29	0.01
		Girls	50	7.07	0.6		

From Table 4 and also from Figure - D, the above table it is clear that the calculated 'C.R' values of Government, Government Aided and Private School is more than that of the table 'C.R' values. Hence, the hypothesis was rejected and proved that there were significant difference in sensing learning style between Boys and Girls of Government, Government Aided and Private School.

Sensing Learning of Boys and Girls of the sample (Figure - D)

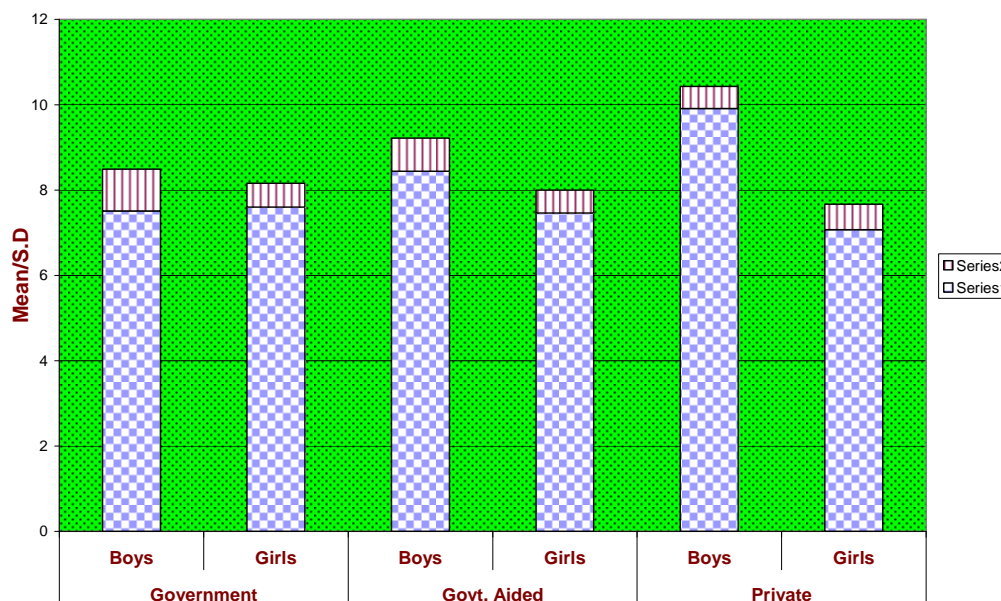


Table 5: To Differentiate between Intuitive learning style of Boys and Girls students

Variables	School Type	Gender	No.	Mean	S.D.	C.R.	L.S.
Intuitive Learning style	Government	Boys	50	6.56	0.39	3.9	0.01
		Girls	50	6.03	0.36		
	Government Aided	Boys	50	5.48	0.22	3.6	0.01
		Girls	50	5.19	0.41		
	Private	Boys	50	5.17	0.38	3.06	0.01
		Girls	50	4.96	0.30		

From table 5 and also from Figure-E, it is clear that the calculated 'C.R' values of Government, Government Aided and Private School is more than that of the table 'C.R' values. Hence, the hypothesis was rejected and proved that there were significant difference in intuitive learning style between Boys and Girls of Government, Government Aided and Private School.

Intuitive learning of Boys and Girls of the sample (Figure - E)

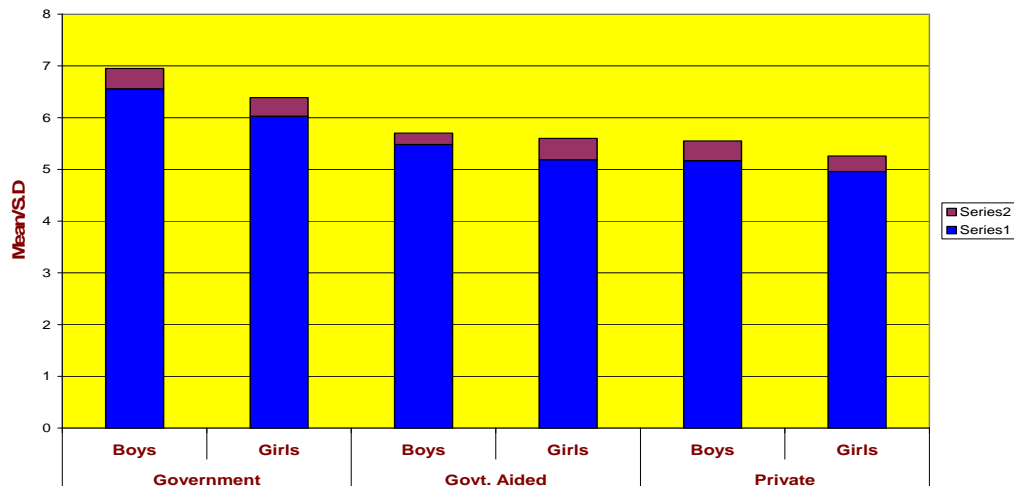


Table 6: To Differentiate between Visual learning style of Boys and Girls students

Variables	School Type	Gender	No.	Mean	S.D.	C.R.	L.S.
Visual Learning Style	Government	Boys	50	7.8	0.37	11.36	0.01
		Girls	50	6.57	0.67		
	Government Aided	Boys	50	7.64	0.53	6.89	0.01
		Girls	50	6.76	0.73		
	Private	Boys	50	7.44	0.67	5.67	0.01
		Girls	50	6.46	0.96		

From table 6 and also from Figure - F, it is clear that the calculated 'C.R' values of Government, Government Aided and Private School is more than that of the table 'C.R' values. Hence, the hypothesis was rejected and proved that there were significant difference in visual learning style between Boys and Girls of Government, Government Aided and Private School.

Visual Learning of Boys and Girls of the sample (Figure - F)

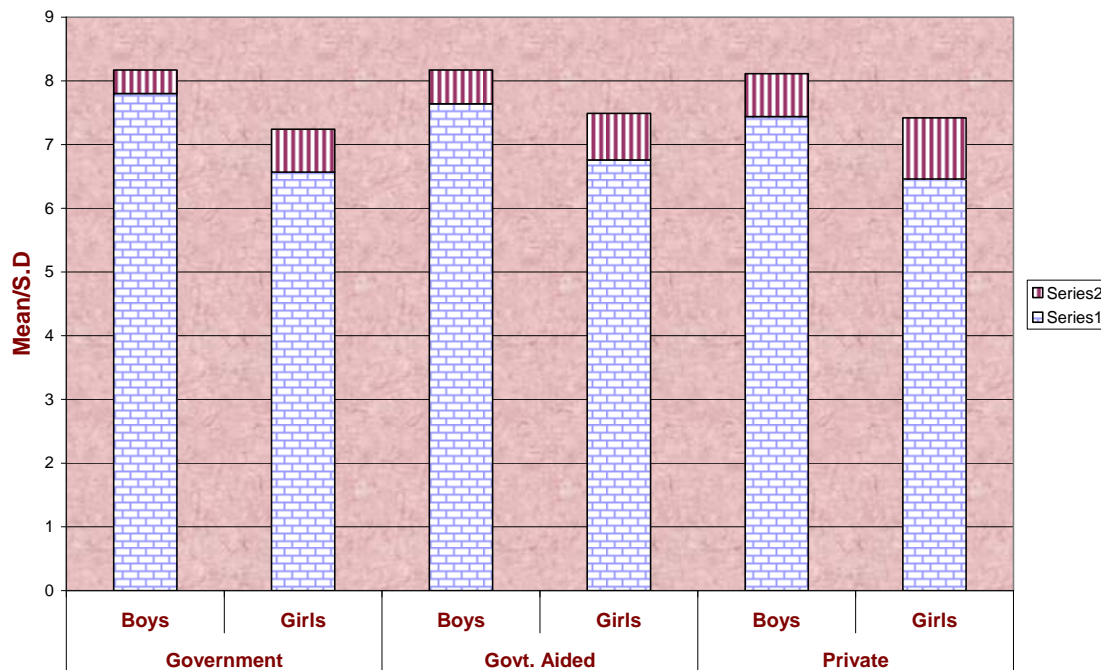


Table 7: To Differentiate between Verbal learning style of Boys and Girls students

Variables	School Type	Gender	No.	Mean	S.D.	C.R.	L.S.
Verbal Learning Style	Government	Boys	50	8.2	0.4	1.99	0.05
		Girls	50	8.42	0.675		
	Government Aided	Boys	50	8.36	0.35	2.093	0.05
		Girls	50	8.05	0.26		
	Private	Boys	50	9.73	0.06	2.24	0.05
		Girls	50	9.57	0.5		

From table 7 and also from Figure - G, it is clear that the calculated 'C.R' values of Government, Government Aided and Private School is more than that of the table 'C.R' values. Hence, the hypothesis was rejected and proved that there were significant difference in verbal learning style between Boys and Girls of Government, Government Aided and Private School.

Verbal learning of Boys and Girls of the sample (Figure - G)

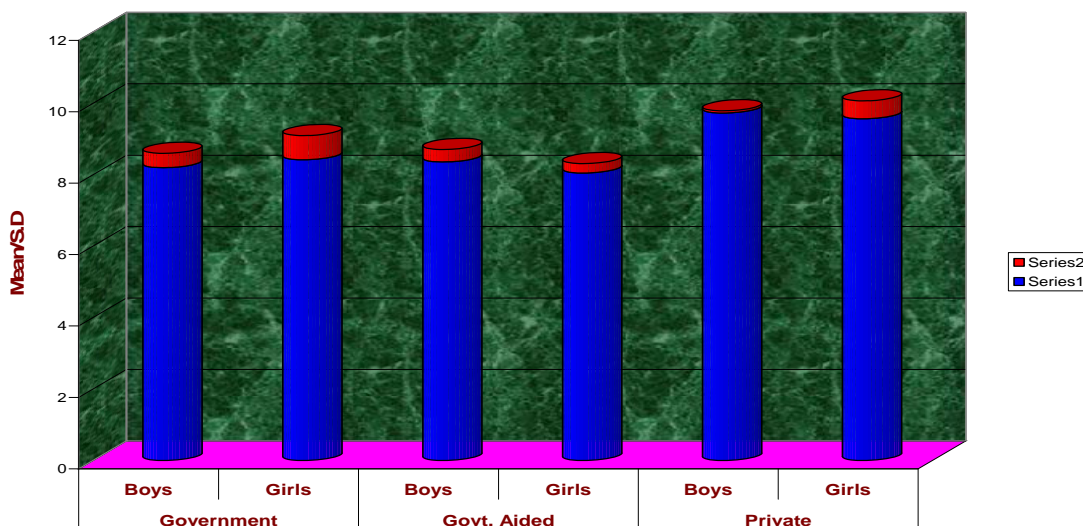


Table 8: There is a significant difference between Sequential Learning style of Boys and Girls students

Variables	School Type	Gender	No.	Mean	S.D.	C.R.	L.S.
Sequential Learning Style	Government	Boys	50	6.45	0.43	36.5	0.01
		Girls	50	7.18	0.56		
	Government Aided	Boys	50	6.16	0.48	5.0	0.01
		Girls	50	6.26	0.7		
	Private	Boys	50	6.17	0.64	10.1	0.01
		Girls	50	6.37	0.63		

From table 8 and also from Figure - H, it is clear that the calculated 'C.R' values of Government, Government Aided and Private School is more than that of the table 'C.R' values. Hence, the hypothesis was rejected and proved that there were significant difference in sequential learning style between Boys and Girls of Government, Government Aided and Private School.

Sequential Learning of Boys and Girls of the sample (Figure - H)

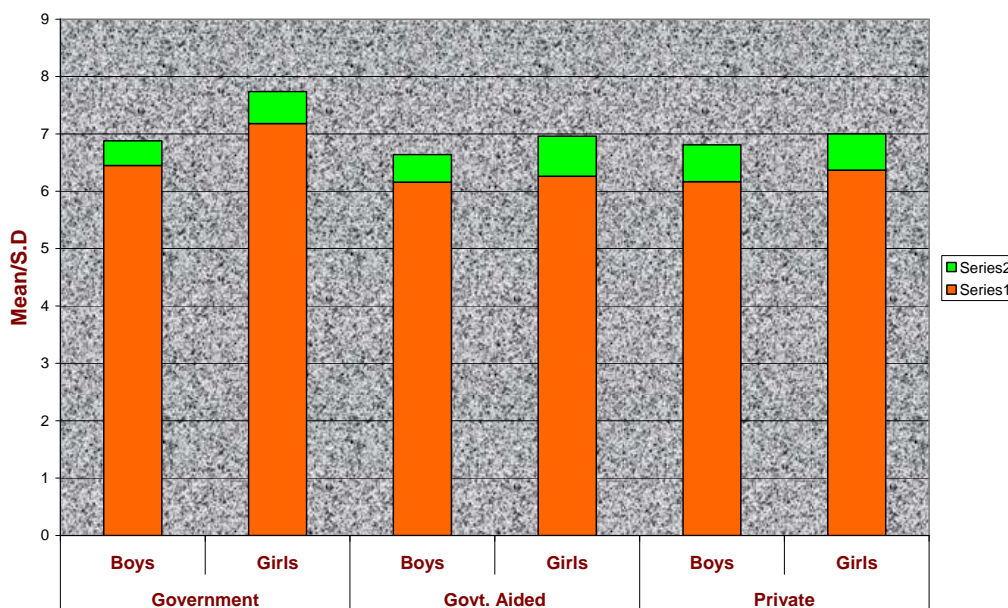
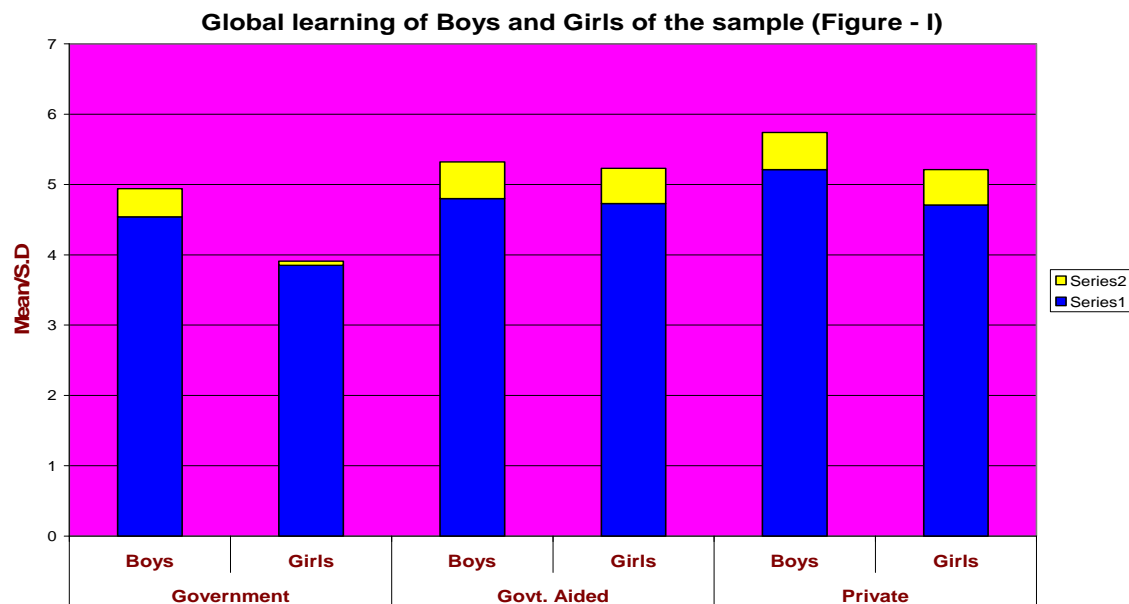


Table 9: To Differentiate between Global learning style of Boys and Girls students

Variables	School Type	Gender	No.	Mean	S.D.	C.R.	L.S.
Global Learning Style	Government	Boys	50	4.54	0.4	38.33	0.01
		Girls	50	3.85	0.06		
	Government Aided	Boys	50	4.8	0.52	3.5	0.01
		Girls	50	4.73	0.5		
	Private	Boys	50	5.21	0.53	14.4	0.01
		Girls	50	4.71	0.5		

From table 9 and also from Figure - I, it is clear that the calculated 'C.R' values of Government, Government Aided and Private School is more than that of the table 'C.R' values. Hence, the hypothesis was rejected and proved that there were significant difference in global learning style between Boys and Girls of Government, Government Aided and Private School.



This study contributes to the field of research because it gives a fresh look at the thoughts of students. It shows that maybe us as a society is making some advances in this area of gender equality in schools. However, it also shows that there are many gender stereotypes that still must be broken down. Teachers and parents must be the ones to do this through modeling appropriate behavior and communication, talking openly about gender issues, and most of all, being acutely aware how their actions might affect the self-esteem of a child, and in turn, that child's future.

6. Results

Results indicated that pedagogical implications of gender differences in learning styles are significant. As science is still a young and emerging discipline, it is anticipated that workforce in the field is always in high demand. Low participation of Girls and high attrition of students are currently serious threats to the development of related industries. As [4] contended, "Everyday, we risk losing the talents of women as contributors to science, technology, and the arts because the advantages that given technology are being conveyed disproportionately to men in modern society" This research advances our understanding of the issue and suggests some partial remedies to alleviate the problem. Although further studies are required to validate our proposal, it serves as a research manifesto for science educators who are seriously thinking of implementing innovative pedagogical practices to narrow the gender gap. Through various remedial interventions, we anticipate more Girls participation in science field and hence the gender issue is addressed. However, the students who said that the class was hard may not be getting the support from the teacher that they need to succeed. This could be due to the fact that it is common in our society to think that girls do not have the ability to understand science's complexities. It is vital that students are treated equally in the classroom. They should be equally called on, praised, supported, motivated, and punished. These are important so that every student may have a deeper understanding of all disciplines, especially

math and science. In our changing world, an understanding of technology has become crucial to remain competitive, and along with that comes an advanced knowledge of math and science. It is somewhat surprising that so little work has been done in the context of science classrooms to identify what are the nature and style of teaching and activities that engage students. , attitudes are enduring while knowledge often has an ephemeral quality. The price of ignoring this simple fact and its implications is the potential alienation of our youth and/or a flight from science – a phenomenon that many countries are now experiencing. There can, therefore, hardly be a more urgent agenda for research.

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