

Students' Perceptions of the Image of a Scientist in Enhancement of Learning Attitude in Biology

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Abstract

This study, students' perceptions of the image of a scientist in enhancement of learning attitude in Biology, employed survey research design. Four research questions and three null hypotheses guided the study. The population of the study was 12,315 Senior School 3 Biology students. A purposive sampling technique was used to select a sample size of 2,400 for the study. Two validated and reliable instruments, Perception of the Image of a Scientist Task, and Students' School Promotion Examination Results Sheet, were used to collect data for this study. Mean, standard deviation, frequency and z-test were used for data analysis. Findings revealed that academic achievement of the Senior School Biology Students whose perception is that a scientist is a white skin coloured is higher than the mean academic achievement of the Senior School Biology Students who perceived that a scientist is dark skin coloured. The researchers recommended, among others, that more female scientists should be referenced in the science textbooks in order to bridge the dichotomy that has been created over the years. Students should be exposed to the historical concept of science and the brain behind it so as to understand the nature of science and enhance academic achievement.

Keyword: Learning Attitude, Image, Perception, Scientist.

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INTRODUCTION

Science, refers to a systematic and organized body of knowledge that is gained through observation, experimentation, and analysis of natural phenomena. It is a discipline characterized by rigorous methods and processes aimed at understanding the underlying principles governing the universe and the living world [1]. Scientists employ empirical evidence, logical reasoning, and critical thinking to formulate hypotheses, test them through experiments, and draw conclusions based on the data collected [1]. According to [2], science is a continuing effort to discover and increase knowledge through research. Scientists make observations, record measurable data related to their observations, and analyze the information at hand to construct theoretical explanations of the phenomenon involved.

The study on the scientists has spanned through decades and is still on going as learners are yet to have complete or real images of science and the scientist [3;4]. There is no straight jacketed definition of science as many scholars have defined science from diverse perspective. This is also applicable to definition of a scientist among learners till date. Different learners have

different definition of scientist based on background or prior knowledge, culture, exposure, family dynamics, socialization, grade level, environment, education, gender, socio-economic status, among others [5]. The work of [5] also revealed image of the scientist as regards field of study, appearance, titles and workplace. Kuhn in [5] rightly argue that individual's understanding of science is pivotal to his or her attitude to science and conception of who a scientist truly is. [4] also affirmed that student's comprehension of science and scientist shape their perception and acceptance of science.

[5] reviewed relevant and historic literature which includes Draw a Scientist Test [DAST] designed by Chambers, "4-11-year olds' perception of the scientist using the DAST and qualities of a scientist which includes unkempt hair, glasses, scruffy beard, white laboratory coat, symbols of knowledge, symbols of research, technology tools and titles such as, I have found it, in the work of Newton and Newton. The reviews opined that conception of science start developing at preschool years [5], Draw A Scientist Checklist [DAST-C] by [5]. The historical and stereotyped image of science and the scientist has huge implication on Nigeria

education, in the space of scientific advancement and sustainable development [6]. [6] reported that learners have myopic knowledge about the scientist which is long aged and this stereotypical view of the scientist has negatively shaped STEM.

Perception involves opinion, emotion and feeling from experiences based on what and how we feel, see, hear to interpret and take a stand. Perception is the process by which individuals interpret and make sense of sensory information from their surroundings. It involves receiving sensory input from the environment, such as through sight, hearing, touch, taste, and smell. The brain selectively focuses on relevant stimuli while filtering out others through attention. According to [8] Perception refers to our sensory experience of the world. It is the process of using our senses to become aware of objects, relationships [8]. [5] reported that students' perception of a scientist was a male figure, having qualities such as diligent, wearing a lab coat and bald. Reviews in [5] also shows that over the years, perception of students of science and scientist is male dominated. Perhaps, this is the why they feature in male role play in cartoons and other television programmes and even prefer to watch male dominated cartoons. [5] reports that male students have male figure as the image of scientist while female students have female figure as the image of scientist. According to [5], individuals conceive their figure of image of the scientist based on their gender difference. Also, most of the programmes on the media and pictures in the science textbooks showcases the male as scientists carrying out experiment in the laboratory. The image of scientists is often influenced by historical stereotypes and representations in popular culture. Traditional portrayals often depict scientists as predominantly male, eccentric and socially isolated individuals engrossed in their works [5]. The science textbooks also referenced the male scientists without the females revealing a sharp dichotomy in science. Currently, we are experiencing inequality in gender in terms of female in science, representation, role model, female figure, among others [6]. Such perceptions create an unrealistic view of what it means to be a scientist, leading to negative attitudes and achievements of senior secondary students. It also showcased a gender biased picture that is unhealthy in teaching and learning. This is the why more male students see the scientists as male figures than female figures. According to [9], the scientists were Charles Darwin [1809 - 1882], Gregor Mendel [1822-1844], Carl Linnaeus [1707 - 1778], Joseph Priestly [1733 - 1804], William Harvey [1578 - 1657], Antonio Van Leeuwenhoek [1632 - 1723], Edward Jenner [1749 - 1823], Alexander Flemming [1881 - 1955], Lious Pasteur [1822 - 1895], Sir Frederick Gowland Hopkins [1861 - 1941], Sir Ronald Ross [1857 - 1922], etc. These stereotypes, perhaps, contributed to misconceptions about science, perception and disparity in academic achievement of students in science, biology in particular. [3] provides a historical view and platform on how

science and the image of the scientists is taught and can be reexamined and taught in schools. One of the solutions to the problem of STEM today is arresting the attitude and image of scientist of learners in the 21century.

Learning attitude in science refers to manners, disposition, beliefs and feelings that learners develop toward learning scientific concepts, participating in scientific activities and applying scientific knowledge in everyday activities. It is the pre-disposition to classify objects and events, and to react to them with evaluative consistency. It shows how students perceive biology as a subject and influences their active involvement in classroom and laboratory activities. A positive learning attitude encourages critical thinking, curiosity, creativity, collaboration and tenacity in solving scientific problems, while a negative attitude often results in lack of interest, indifference, poor motivation, low achievement, and avoidance of science activities.

Several factors influence students' learning attitudes in science. These include teaching methods, classroom environment, teacher factors, fear of science, availability of laboratory facilities, parental factors, anxiety, peer influence, students' factors, students' prior experiences, and students' image of the scientist, among others.

Students' perception of the image of a scientist plays a major role in shaping their learning attitude toward science and biology in particular [Kuhn in [5]]. The image of a scientist refers to the impression, belief and labels students hold about scientists, their appearance, work environment, personality and impacts on society. These perceptions influence students' interest in science, attitude to learning scientific concepts, academic achievement and readiness to pursue science-related careers in higher institutions [4].

Many students hold traditional belief of scientists as highly intelligent individuals who wear white coats and work alone in laboratories and carry out difficult experiments [5]. Such straight jacket images may paint science to be difficult and only suitable for exceptionally gifted and more intelligent individuals. Subsequently, some students may believe that they are not intelligent enough and therefore, incapable of learning and doing biology. This perception often cuts interest, motivation, curiosity, class involvement and reduce academic achievement.

In contrast, real exposure of image of the scientist helps students to make informed decision which foster positive attitudes toward science, active participation in the classroom / laboratory and improve academic achievement [3;4]. The role of teachers in guiding students towards forming a positive image of the scientist can not be overemphasized in the science

classroom. Teachers play a significant role in shaping students' perceptions of scientists in biology by helping them to understand that scientists are not superbeings but humans like them. These scientists are both male and female from different cultures, ethnic backgrounds and careers. Also, any students who is interested, focus, determined and ready to learn can become a scientist. Teachers should also help students know that scientists apply science to solve everyday problems and it is evident in medicine, engineering, agriculture, environment, technology, transportation, power, food, among others. This could be done effectively by the introduction of history and biographies of scientists before the lesson, their contributions to science and human existence. These, would arouse students' interest, curiosity, motivation, reasoning and inquiry skills to finding out more and more about science, hence, a positive attitude to science, improved academic achievement and better-informed students that would pursue science related courses in future. The integration of indigenous biology knowledge which involves local and indigenous scientific knowledge own by the communities enables students to recognize and appreciate that scientific thinking exists within their own communities and cultures. It is also significant to showcase the achievements of female scientists and scientists from different cultural heritage as it eliminates gender and cultural biases that may discourage some learners from engaging with science [5;6]. By nurturing an inquisitive attitude and appreciation for scientific inquiry, secondary school students are empowered to become scientifically literate citizens, capable of making informed decisions and contributing positively to society. Student's perception of the image of scientists can significantly influence the learning attitudes and achievements in Biology [10].

The study seeks to investigate students' perceptions of the image of a scientist in enhancement of achievement and attitude to science in Bayelsa State.

[11] examined a comparative content analysis of biology textbooks for upper-secondary school used in Finland and Nigeria to represent scientific-literacy [SL] themes and scientific inquiry [SL] levels. Data processing was done using modified framework of the Programme for International Student Assessment 2015 [PISA 2015] and a deductive content analysis were used for data processing. The findings showed significant differences in the representations of SI-levels and SL themes. In comparison, the books tilted towards scientific knowledge and competencies than on learning contexts and attitudes.

[7], carried out a study to investigate children's representations of scientists using the Draw-a-Scientist Test [DAST]. Participants [n = 210] were young school children from Romania. The study findings showed that most children represented stereotypical characteristics of

scientists in their drawings such as white male wearing lab coats using instruments that reflected a chemistry lab. Results, also, indicated significant differences in the score of stereotyping indicators with respect to student grade level. Additionally, students who visited science museums scored significantly higher in stereotyping indicators than students who indicated on their survey answers that they have not visited science museums.

[12] investigated secondary school students' perceptions and attitudes towards scientists. The study group consists of 53 fifth and sixth grade students receiving education in a state secondary school in Turkey. Convergent parallel design among mixed research methods was used during the research. Findings showed that female students and sixth grade students exhibited higher attitude levels towards scientists as compared to male and fifth grade students, respectively. This difference between the attitude of male and female was not significant. Results also showed that students have stereotyped opinions about scientists and they generally confuse the working fields of scientists with those of engineers.

[13] investigated analysis of the Image of scientists portrayed in the Lebanese National Science Textbooks. The study took the form of an analytical framework. An extensive review of the relevant literature, served as a tool for analyzing the textbooks. The framework focused on the individual and work-related attributes of scientists based on evidence based stereotypes. Quantitative and qualitative measures were used to analyze 15 of the science textbooks. Findings showed the presence of some stereotypical figures such as white males of foreign descent, no African scientist. Also, Lebanese and the Arabian were not featured in the textbooks. The scientists are shown as rational individuals who work alone without collaboration, conduct experiments in their labs using scientific method. Scientists are not influenced by external factors as they are actively engaged in a business which is objective, focusing on discovering the truth and involves dealing with direct evidence.

[14] carried out a study to examine STEM careers and opportunities. The study was carried out in Meatu district from March to April, 2017, involving four schools. 110 respondents including students, parents and science teachers were involved in the study. Data were gathered through questionnaires and structured interviews. A descriptive statistics for data analysis was employed in the study. Findings show that parents and science teachers have the potential to increase students to pursue science subjects. [4] reported historical representation of the image of science and scientist and how society presents the image of the scientist as a white and mystic picture and this effect individual's perception, conception, acceptance and application of science. This study was carried out in Bulgarian high school. The

scientist is a diligent and honest person with a wealth of knowledge and experiences. Idealized element was one of the students' representations. Also, knowledge of the image of the scientist was used as a criterion for recruitment. This showed how important it is in science.

Based on the reviews of relevant literature, there still exist a scarce literature of the image of the scientist and more especially, in relation to learning attitude in biology. Literature available were conducted outside Ogbia and Yenagoa Local Government Areas, hence, literature gap of the study. The study sought to investigate the students' perceptions of the image of a scientist in the enhancement of learning attitude in biology the topic.

Research Purposes

The general purpose of this study is to determine biology students' perceptions of the image of a scientist in relation to their learning attitudes enhancement in biology. Specifically, the study:

1. Determine mean learning attitude enhancements of Senior Secondary Biology Students who perceived that a scientist is a male and those who perceived that a scientist is a female;
2. Determine mean learning attitude enhancements of Senior Secondary Biology Students who perceived that a scientist is white skinned coloured and Senior Secondary Biology Students who perceived that a scientist is dark skinned coloured;
3. Determine mean learning attitude enhancements of Senior Secondary Biology Students who perceived that a scientist is an empiricist and the mean learning attitude of Senior School Biology Students whose perception is that a scientist is superstitious;

Research Questions

1. What are the mean learning attitudes enhancement of Senior School Biology

Students who perceived that a scientist is a male when compared to their counterparts who perceived that a scientist is a female?

2. What are the mean learning attitudes enhancement of Senior School Biology Students who perceived that a scientist is white skin coloured and the Senior School Biology Students who perceived that a scientist is dark skin coloured.
3. What are the mean learning attitude enhancement of Senior School Biology Students who perceived that a scientist is an empiricist and the mean learning attitude enhancement of Senior School Biology Students whose perception is that a scientist is superstitious?

Research Hypotheses

1. There is no significant difference in mean learning attitudes enhancement of Senior School Biology Students who perceived that a scientist is male vis-à-vis whoperceived that a scientist is a female.
2. There is no significant difference in the mean learning attitudes enhancement between the Senior School Biology Students whose perception is that a scientist is white skin coloured and Senior School Biology Students who perceived that scientist is dark skin coloured.
3. There is no significant difference in the mean learning attitude enhancement between Senior Secondary Biology Students who perceived that a scientist is an Empiricist and Senior Secondary Biology Students whose perception is that a scientist is Superstitious.

Research Question 1: What are the mean learning attitudes enhancement of Senior School Biology Students who perceived that a scientist is a male when compared to their counterparts who perceived that a scientist is a female?

Table 1: Mean learning attitude of students according to their perceptions

S/N	Perception	N	$\bar{X}$	SD
1	A Scientist is a male	2,000	3.00	3.3
2	A Scientist is a female	400	3.09	3.09

Source: Researcher field work.

Table 1, showed that Senior School Biology Students who perceived that a scientist is a male and their counterparts who perceived that a scientist is a female have 3.00 and 3.09 mean learning attitudes, respectively. The implication is that the mean learning attitude of Senior School Biology Students who perceived that a

scientist is a male is less enhanced than the students who perceived that a scientist is a female.

Research Question 2: What are the mean learning attitudes enhancement of Senior School Biology Students who perceived that a scientist is white skin coloured and the Senior School Biology Students who perceived that a scientist is dark skin coloured.

Table 2: Mean learning attitude enhancement SSBS according to skin coloured.

S/N	Perception	N	$\bar{X}$	SD
1	Scientist is white skin	1,537	3.05	3.1
2	Scientist is dark skin	863	3.01	3.4

Source: Researcher field work.

From table 2, the MLAE is almost for both the SSBS who perceived that a scientist white skin coloured and the SSBS who perceived that a scientist is a dark skin coloured. However, SSBS MLAE who perceived that a scientist is white skin is higher than that of SSBS who perception is that a scientist dark skin coloured by 0.04.

Research Question 3: What are the mean learning attitude enhancement of Senior School Biology Students who perceived that a scientist is an empiricist and the mean learning attitude enhancement of Senior School Biology Students whose perception is that a scientist is superstitious?

Table 3: Mean learning attitude enhancement of Senior School Biology Students who perceived that a scientist is an empiricist and superstitious.

S/N	Perception	N	$\bar{X}$	SD
1	Scientist is an empiricist	1,350	3.04	2.6
2	Scientist is superstitious	1,050	2.90	3.3

Source: Researcher field work.

From table 3, the MLAE of SSBS who perceived that scientist is an empiricist is higher than MLAE of SSBS who perceived that a scientist is superstitious. Consequently, mean learning attitude of male Senior School Biology Students who perceived that a scientist is a female is higher than that of their female

counterpart who, also, perceived that a scientist is a female.

Testing of Hypotheses

H0~1~: There is no significant difference in mean learning attitudes enhancement of Senior School Biology Students who perceived that a scientist is male vis-à-vis those who perceived that a scientist is a female.

Table 4: Z-test of mean learning attitudes of Senior School Biology Students by perception

S/N	Perception	N	X	SD	Df	Z-cal	Zcrit
1	A Scientist is a male	2,000	3.00	3.3			
					2,398	1.17	1.96
2	A Scientist is a female	400	3.09	3.9			

Source: Researcher field work.

From table 4, it can be seen that mean learning attitudes of Senior School Biology Students who perceived that a scientist is a male and female are 3.00 and 3.09, respectively. $Z_{cal} < 1.17 > Z_{crit} = 1.96$. so, H0~1~ is retained. This implies that there is not substantial variance in the enhancement of learning attitudes in biology in favour of the students who perceived that a scientist is a female.

H0~2~: There is no significant difference in the mean learning attitudes enhancement between the Senior School Biology Students whose perception is that a scientist is white skin coloured and Senior School Biology Students who perceived that scientist is dark skin coloured.

Table 5: Z-test analysis of different in mean learning attitudes enhancements of senior school biology students' perceptions by skin coloured

S/N	Perception	N	X	SD	df	Z-cal	Zcrit
1	Scientist is white skin coloured	1,537	24.5	3.05			
					2,398	0.93	1.96
2	Scientist is dark skin coloured	863	24.3	3.4			

Source: Researcher field work.

From table 5, it is observed that $Z_{cal} < 0.93 < Z_{crit} = 1.96$. Therefore, H0~2~ is retained. Consequently, there is no significant difference in mean learning attitude enhancement of Senior School Biology Students who perceived that a scientist is a white or black person.

H0~3~: There is no significant difference in the MLAE between SSBS who perceived that a scientist is an empiricist and SSBS whose perception is that a scientist is superstitious.

Table 6: Z-test analysis of mean learning attitude enhancements of Senior School Biology Students perceptions according to believe

N/S	Perception	N	X	SD	Df	Z-cal	Zcrit
1	Scientist is an empiricist	1,350	3.04	2.6			
					2,393	1.98	1.96
2	Scientist is superstitious	1,050	2.90	3.3			

Source: Researcher field work.

Table 6, shows that $Z_{cal} = 1.98 > Z_{crit} = 1.96$. The implication is that H_0 is rejected and the alternative that there is a significant difference in mean learning attitude enhancement of Senior School Biology Students in favour of the Senior School Biology Students who perceived that a scientist is an empiricist, is accepted.

DISCUSSION

The finding revealed that no significant difference in mean learning attitudes enhancement exist between senior school male Biology students and senior school female Biology students whose perception is that a scientist is a male. This might be probable because the experiences of both males and female were used as examples in science classes. This is in contrast with the study of [15;9].

The finding that the mean learning attitude enhancement of Senior School Male Biology Students is higher than the mean learning attitude enhancement of senior school female Biology students agrees with the findings of Harding, Hartstock and Smith in [15]. The reason might be that all examples given in science classrooms might be masculine in nature. It could also be due to exposure to male figure, stereotypical setting, prior experience and traditional belief over the years. These statements are in agreement with the study of Harding in [15], that noted that science is gender biased and has relegated the place of women for years. Ocal in [5] supported the assertion that male characteristics have been used to showcase science over the years.

This study revealed that the Senior School Biology Students who perceived that a scientist is white skin coloured had slightly higher mean learning attitude enhancement than the Senior School Biology Students whose perception is that a scientist is dark skinned. This study, also, found that the difference in mean learning attitude enhancement was not significant. This might be that the researchers used trusted instrument and quality students in their studies. It could also be that traditional belief that scientists are white skinned is losing hold on students, making them to make informed decision, hence, shaping their learning attitude in biology.

The finding also revealed that Senior School Biology Students who perceived that a scientist is an empiricist scored, significantly, higher in mean learning attitude enhancement than the Senior School Biology Students whose perception is that a scientist is

superstitious. The probable reasons could be that everything about science is logical and experimental. Teachers are making effort to use modern, innovative and blended teaching methods in teaching and learning which arouse and sustain students' interest, engage them, leading to improved learning attitude and academic achievement in biology [16].

CONCLUSION

The findings of the study revealed a higher percentage of students perceived that a scientist is white coloured, male students perceived that a scientist is white coloured and female students perceived that a scientist is black coloured. Also, students who perceived that a scientist is white coloured had better Learning attitude than those who perceived that a scientist is black coloured. This implied that perception of the image of the scientist is gender based. It also revealed the level of students' understanding of the nature of science and who the scientist is. The relevance of the study is crucial because students' perception of the image of the scientist greatly shape attitude in science and on the long run, STEM choices in career. By implication, enhancement of gender and diversity inclusion by providing equal opportunity of all students to actively participate in science classroom would enhance self-identity, break stereotypical belief and improve Learning attitude in biology. The limitations of the study include focus on limited sample size reducing generalization scope and short time frame for conducting of the study as perception changes over time which requires a longitudinal approach. And information given by the students were assumed to be accurate.

Recommendation

Based on the findings, the study recommended the following

1. Students should be exposed to the historical concept of science and the brain behind it so as to understand the nature of science and enhance Learning attitude.
2. Special attention should be paid to the female folk in order to bridge the gap created over the years, by giving the female priority in the textbooks, media and science related courses.
3. Role play using the female gender, science activities and visit to scientist so that students can connect theory to practical for better comprehension.

4. There is need for a review of science textbooks in order to ensure proper inclusion and representation of gender in its diversity.

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