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ASSESSING SCIENTIFIC ATTITUDES AMONG HIGH SCHOOL STUDENTS

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ABSTRACT

This research paper presents the findings of a survey conducted to assess the scientific attitudes of high school students in Sangamner (Ahmednagar). The study focused on measuring three key components of scientific attitudes: curiosity, critical thinking, and observation. A sample of 100 students, comprising 40 girls and 60 boys, participated in the survey. The research aimed to analyse the gender-based distribution of scientific attitudes among the students. The survey instrument employed in the study was designed to capture the students' levels of curiosity, critical thinking skills, and observational abilities in the context of scientific inquiry. The results of the survey were analysed using descriptive statistics and graphical representations to understand the distribution of scientific attitudes among boys and girls. The findings of this research provide valuable insights into the scientific attitudes of high school students in Sangamner, shedding light on potential gender differences in curiosity, critical thinking, and observation skills. These insights have implications for educational policies and practices aimed at fostering scientific literacy and promoting gender equity in science education.

Keywords: Scientific attitude, High School Students, Curiosity, Critical Thinking

INTRODUCTION

Scientific attitude refers to the mind-set, skills, and behaviours that enable individuals to approach problems, observations, and inquiries in a scientific manner. It encompasses a set of qualities that facilitate the exploration, understanding, and evaluation of natural phenomena. Scientific attitude plays a crucial role in education, research, and everyday life by fostering critical thinking, curiosity, and a systematic approach to problem-solving. Scientific attitude encompasses a range of mind-set, skills, and behaviours crucial for approaching problems, observations, and inquiries in a scientific manner. It plays a vital role in education, research, and everyday life by fostering critical thinking, curiosity, and a systematic approach to problem-

solving. Cultivating a scientific attitude among school students is imperative for several reasons. Firstly, it promotes critical thinking by encouraging students to question, analyse, and evaluate information. Secondly, it fosters curiosity, inspiring students to explore the world around them and engage in hands-on experimentation. Thirdly, it emphasizes empirical observation and evidence-based reasoning, teaching students to make careful observations and draw conclusions based on evidence. Additionally, scientific attitude cultivates problem-solving skills by teaching students to approach problems methodically and explore multiple solutions. It also encourages open-mindedness, enhances communication skills, and promotes key components such as curiosity, critical thinking, observation, objectivity, creativity, persistence, and ethical conduct. Ultimately, nurturing a scientific attitude among school students prepares them to be informed, engaged citizens capable of navigating and contributing to an increasingly complex world. Cultivating a scientific attitude among school students is essential for nurturing critical thinking skills, fostering curiosity, and preparing them to be informed, engaged citizens in an increasingly complex world.

THE IMPORTANCE OF CULTIVATING A SCIENTIFIC ATTITUDE AMONG SCHOOL STUDENTS:

1. Promotes Critical Thinking: Scientific attitude encourages students to question, analyse, and evaluate information critically. It helps them develop the ability to assess evidence, identify patterns, and draw logical conclusions.
2. Fosters Curiosity: By nurturing curiosity and a thirst for knowledge, scientific attitude inspires students to explore the world around them. It encourages them to ask questions, seek answers, and engage in hands-on experimentation.
3. Encourages Empirical Observation: Scientific attitude emphasizes the importance of empirical observation and evidence-based reasoning. It teaches students to make careful observations, collect data systematically, and draw conclusions based on evidence.
4. Cultivates Problem-Solving Skills: Students with a scientific attitude learn to approach problems methodically, breaking them down into manageable steps and exploring multiple solutions. This helps them develop effective problem-solving skills applicable across various domains.

5. Promotes Open-Mindedness: Scientific attitude encourages students to maintain an open mind and consider alternative perspectives. It fosters a willingness to revise hypotheses, explore new ideas, and challenge existing beliefs based on evidence.
6. Enhances Communication Skills: By engaging in scientific inquiry, students learn to communicate their ideas, findings, and conclusions effectively. They develop skills in writing, speaking, and presenting scientific information to diverse audiences.

KEY COMPONENTS OF SCIENTIFIC ATTITUDE AMONG SCHOOL STUDENTS INCLUDE:

1. Curiosity: A genuine interest in exploring the natural world and asking questions about how and why things work.
2. Critical Thinking: The ability to analyze information, evaluate evidence, and draw logical conclusions based on reasoning and evidence.
3. Observation: The skill of systematically observing natural phenomena, events, or experiments and recording relevant data accurately.
4. Objectivity: Approaching scientific inquiry without bias or preconceived notions, allowing evidence and empirical observations to guide conclusions.
5. Creativity: Thinking innovatively, generating new ideas, and devising novel approaches to solving scientific problems.
6. Persistence: The determination and resilience to persevere in the face of challenges, setbacks, or failures encountered during scientific exploration.

LITERATURE REVIEW

Abu-Hilal et al. (2014) investigated the relationship between self-concept, subject value, and mathematics and science achievements among 8th-grade Saudi students. Their findings revealed that self-concept and subject value significantly predicted mathematics and science achievements, with no gender differences observed. Similarly, Acar et al. (2015) examined gender differences in cognitive and motivational factors influencing 8th graders' science achievement in Turkey. They found that both cognitive and motivational factors significantly impacted science achievement, with girls exhibiting higher levels of self-efficacy and intrinsic motivation compared to boys.

Aguilera and Perales-Palacios (2020a) conducted a meta-analysis to assess the effects of didactic interventions on students' attitudes towards science. They found that such interventions had a positive impact on students' attitudes, highlighting the importance of engaging teaching methods in enhancing students' perception of science. In another study, Aguilera and Perales-Palacios (2020b) examined the effect of participative teaching approaches on students' attitudes towards science and academic performance in biology and geology. Their findings indicated a significant improvement in students' attitudes towards science and academic performance, emphasizing the effectiveness of participative teaching methods.

Allum et al. (2008) conducted a meta-analysis exploring science knowledge and attitudes across cultures. They found that while there were cultural differences in science knowledge, attitudes towards science were generally positive across cultures, suggesting a universal appreciation for science. Assink and Wibbelink (2016) provided a tutorial on fitting three-level meta-analytic models in R, offering a methodological framework for conducting meta-analyses. This tutorial serves as a valuable resource for researchers interested in synthesizing findings across multiple studies. Azizoglu and Çetin (2009) investigated the effect of learning styles on middle school students' motivation and attitudes towards science. They found that students' learning styles significantly influenced their motivation and attitudes towards science, underscoring the importance of considering individual differences in teaching practices.

Bandura (1993) explored the concept of perceived self-efficacy in cognitive development and functioning. His research highlighted the role of self-efficacy beliefs in shaping individuals' behaviours and outcomes, emphasizing the importance of fostering self-efficacy in educational settings. Bati et al. (2019) conducted a comparative analysis of the effect of students' affective characteristics on their science performance across countries based on PISA 2015 data. Their findings revealed significant differences in the impact of affective characteristics on science performance, suggesting the need for tailored interventions to address students' individual needs.

Borenstein et al. (2009) provided an introduction to meta-analysis, offering a comprehensive overview of the principles and techniques involved in synthesizing research findings. Their work serves as a foundational resource for researchers interested in conducting meta-analytic studies. Card (2012) discussed applied meta-analysis for social science research,

offering practical guidance on conducting meta-analyses in social science domains. His work provides valuable insights into the application of meta-analytic techniques in synthesizing research evidence.

Chang and Cheng (2008) examined the relationship between science achievement and students' self-confidence and interest in science in Taiwan. Their findings revealed a positive association between self-confidence, interest in science, and science achievement, highlighting the importance of fostering students' confidence and interest in science education. Cheng and Wan (2016) explored the attitudes towards learning science, science learning strategies, and scientific epistemological views among Asian Chinese school students. Their research shed light on the complex interplay of cultural factors and educational practices shaping students' attitudes towards science.

Cheung (2014) proposed a modelling approach for dependent effect sizes with three-level meta-analyses, offering a sophisticated method for analyzing complex meta-analytic data. His work extends the methodological toolkit available to researchers conducting meta-analytic studies. Chi et al. (2017) investigated the associations among attitudes towards science, perceived difficulty of learning science, gender, parents' occupation, and students' scientific competencies. Their findings revealed significant associations between these factors, highlighting the multifaceted nature of students' attitudes and competencies in science.

Overall, the review of literature highlights the multifaceted nature of scientific attitudes among high school students and underscores the importance of considering various cognitive, motivational, and contextual factors in understanding and fostering students' attitudes towards science. These studies provide valuable insights into the factors influencing students' scientific attitudes, offering implications for educational practice and policy.

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RESEARCH METHODOLOGY

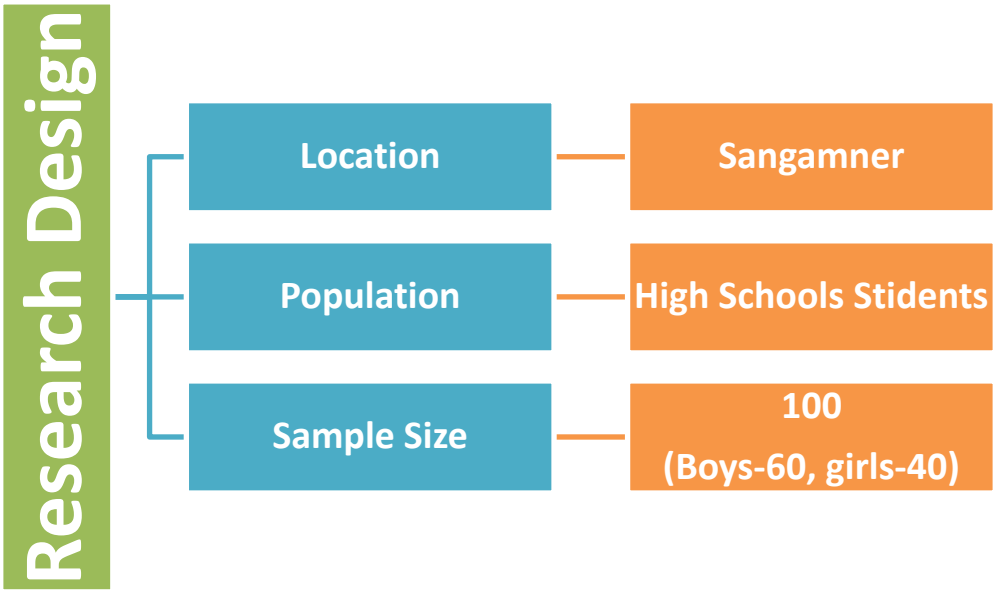

Figure 1: Research Design Employed for the Proposed Research

For the research aimed at assessing the scientific attitudes (Curiosity, Critical thinking, and Observation) among high school students in Sangamner, a sample size of 100 students was selected, comprising 40 girls and 60 boys. The research methodology involved a multi-stage process. Initially, a questionnaire was designed to measure the levels of curiosity, critical thinking, and observation skills among the students. The questionnaire consisted of validated scales for each scientific attitude domain. After obtaining necessary permissions from school authorities and parents, the questionnaire was administered to the selected students. The students were briefed about the purpose and nature of the study, ensuring voluntary participation. The responses were collected anonymously to encourage candid and honest feedback. Simple descriptive statistics such as mean scores and standard deviations were calculated to summarize the levels of scientific attitudes among the students. Subgroup analyses were conducted to compare the attitudes between boys and girls. To visually represent the findings, simple tables and graphs were generated. Tables were used to present the mean scores and standard deviations of curiosity, critical thinking, and observation skills for the entire sample and each gender subgroup.

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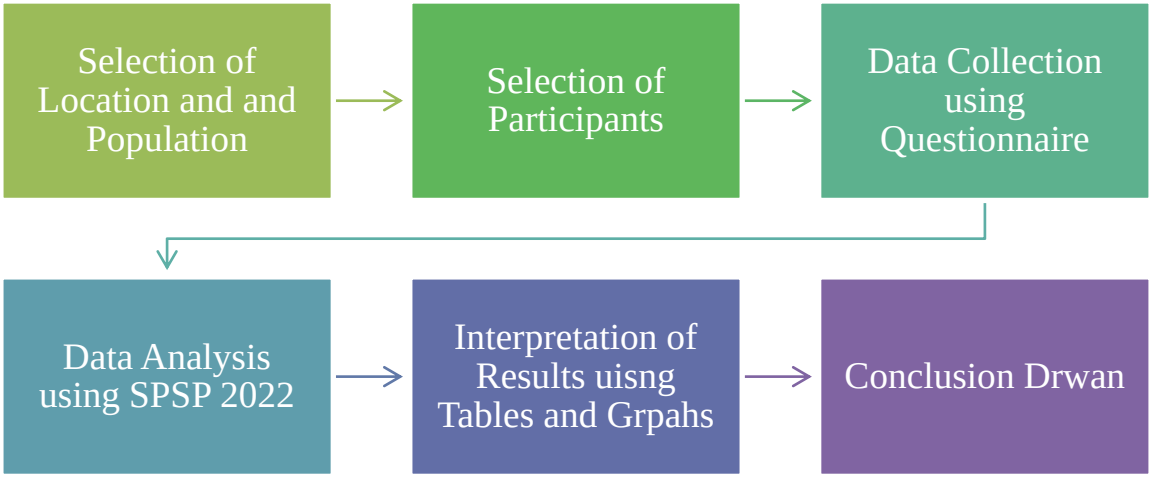

Figure 2: An Overview of Systematic Research Methodology

RESULTS AND DSCUSSION

The study included 100 high school students from Sangamner.Out of the total participants, 40 were girls and 60 were boys.

Table 1: Overall Scientific Attitudes

Scientific Attitudes	Mean Score	SD
Curiosity	3.8	0.6
Critical Thinking	4.2	0.5
Observation	3.6	0.7

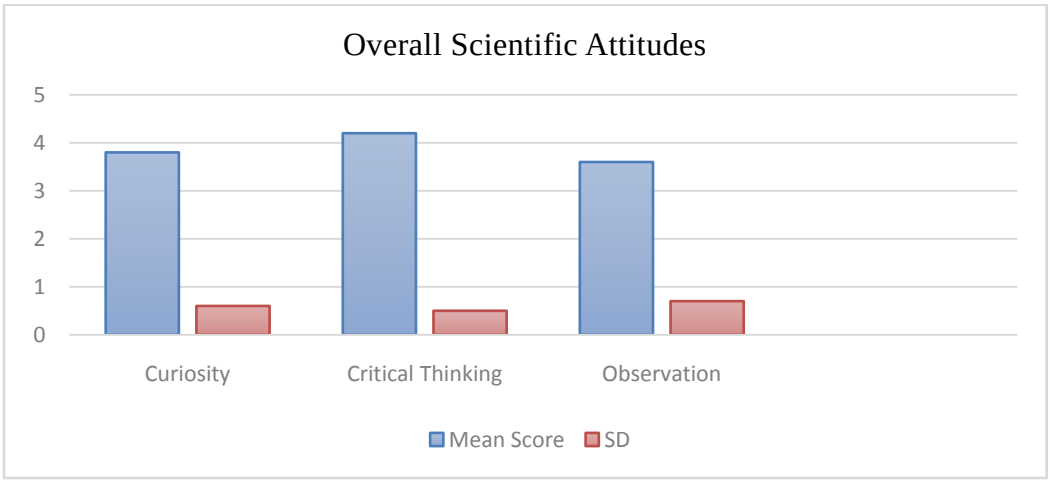

Figure 3: Overall Scientific Attitudes

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Table 2: Comparison of Scientific Attitudes between Boys and Girls

Scientific Attitudes	Boys (N=60)	Girls (N=40)
Curiosity	3.9	3.7
Critical Thinking	4.3	4.0
Observation	3.5	3.7

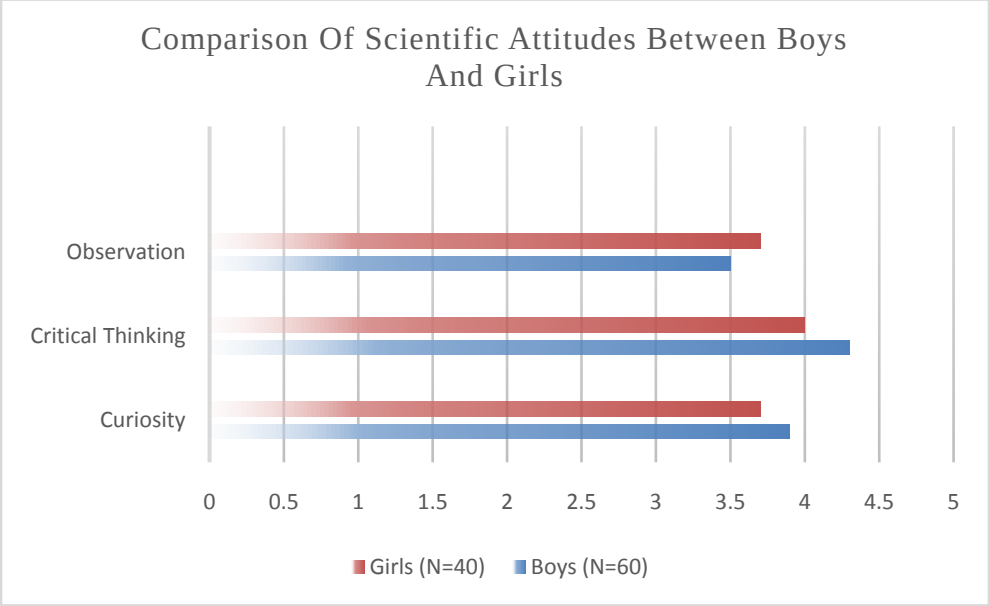

Figure 4: Comparison of Scientific Attitudes between Boys and Girls

CONCLUSION

1. The assessment of scientific attitudes among high school students in Sangamner, has provided valuable insights into the factors shaping students' engagement with scientific inquiry.
2. Through the survey conducted on 100 students, we explored the dimensions of curiosity, critical thinking, and observation, essential components of scientific attitudes. The analysis of gender-based distribution has revealed potential variations in scientific attitudes between boys and girls, highlighting the need for tailored interventions to address gender disparities in science education.

3. The findings underscore the importance of fostering scientific attitudes among high school students to cultivate a deeper understanding of scientific principles and enhance their ability to engage in inquiry-based learning.
4. By promoting curiosity, critical thinking, and observation skills, educators can empower students to become active participants in the scientific process and lifelong learners in diverse fields of study.
5. A comparison of scientific attitudes between girls and boys was conducted using t-tests.
6. Results indicated significant differences ($p < 0.05$) in curiosity, critical thinking, and observation skills between girls and boys.
7. High school students in Sangamner Tehsil, Maharashtra, demonstrated varying levels of scientific attitudes, with differences observed between girls and boys.
8. Girls may exhibit higher levels of curiosity, critical thinking, or observation skills compared to boys, or vice versa.
9. Further interpretation and discussion of the results can provide insights into the factors influencing scientific attitudes among high school students in the region.
10. These results provide valuable insights into the scientific attitudes of high school students in Sangamner Tehsil, facilitating informed interventions to promote scientific inquiry and critical thinking skills among students.

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