Exploring The Interest of Female Students Towards Physics

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Abstract

This research study aims to identify effective strategies for promoting greater interest and engagement in physics among female students at the secondary level. Despite the pivotal role of physics in understanding the natural world, there exists a persistent gender gap in the field, with women being underrepresented in physics-related careers and academic programs. The study focuses on understanding the perceptions and attitudes of female students towards physics, as these factors significantly influence their academic choices and career aspirations. By addressing the gender gap in STEM fields, the research seeks to foster inclusivity and encourage greater female participation in the scientific community. Using a qualitative approach, the study explores school-level factors that impact girls' involvement and achievements in physics, including pedagogy, school organization, and environment. Through focus group discussions and in-depth interviews, insights are gathered from female students in secondary schools in Tanahun district, Nepal.The research aims to provide a comprehensive understanding of the challenges faced by female students in physics education and to identify strategies that can effectively address these challenges. By bridging gaps in existing knowledge, the study contributes to enhancing gender equality in physics education and lays the groundwork for targeted interventions and initiatives to promote greater interest and engagement among female students in the subject.

Keywords: Physics, Interest, Career Aspiration, Gender stereotype, School facility, teaching method

Introduction

Physics, often regarded as the fundamental science, serves as the cornerstone for understanding the natural world. One of the largest and longest-standing issues in the field of physics is the underrepresentation of women

(Skibba, 2019). However, despite its pivotal role, there exists a persistent gender disparity in the field, with female representation notably lower compared to males. This phenomenon has sparked considerable interest and concern among educators, policymakers, and researchers alike. Numerous studies have shown that females remain significantly less in physics-related careers and academic programs, starting from secondary education levels. This underrepresentation can be attributed to various factors, including societal stereotypes, lack of role models, and biases in educational systems (Makarova et al. 2019).

According to the 2078 census, women constitute more than half of Nepal's population, with a total male population of 1,42,91,311 (48.96%) and a total female population of 1,49,01,169 (51.04%). Women fulfill various roles including mothers, spouses/partners, and breadwinners. Shrestha et al. (2015) report that they contribute approximately 65% of the labor force in the agricultural sector, playing a crucial role in food production, particularly in subsistence farming. Nevertheless, women's participation in leadership and decision-making roles remains low (FAO, 2023). In secondary level education, among Class 11-12 students, the perception towards physics holds significant importance. This critical stage not only shapes academic choices but also influences career aspirations and societal contributions. Understanding the perceptions of female students towards physics is paramount in addressing the gender gap and fostering inclusivity within the scientific community. Understanding the perceptions of female students towards physics in secondary education is essential for developing effective interventions to address the gender gap in STEM fields. By exploring the factors influencing female students' attitudes, educators and policymakers can implement strategies to

create more inclusive learning environments and encourage greater participation of women in physics and related disciplines (Abraham et al, 2023).

Schools play a crucial role in shaping students' interest and engagement in subjects as they serve as the conduits through which knowledge is passed on. By identifying the factors that influence their attitudes and experiences, this research aims to inform targeted interventions and initiatives aimed at promoting gender equity in physics education. The emphasis is placed on gaining a more profound insight into the school-level factors that impact girls' involvement and achievements in physics.

Statement of the Problem

According to the national education system plan 2028 BS, it had identified various problems in the education system and one of them was of the backward communities deprived of educational opportunities. But there was nowhere any mention of girls' and women's backwardness in education. The interest and attitude in the field of science and technology is different for male and females. Moreover, in the field of physics there is a more significant difference in the male and female. So, this study has raised the issue of interest, attitude as well as perception of girls towards studying physics. This study delves into the school-level factors impacting girls' involvement in physical science. It primarily explores how pedagogy, school organization, and environment influence girls' interest and attitudes towards physical science programs in senior high schools. It investigates characteristics such as teaching styles, teacher-student relationships, among others, and their effects on girls' interest and attitudes towards studying physical science.

Objectives of the study

The objective of this research is to identify effective strategies for promoting greater interest and engagement in the subject among female students at the secondary level.

Review of the literature

We can find some articles and theses written related to gender and participation and perception in different disciplines like physical science. A journal institute of physics (2005) reports reveals some of the important issues that underlie the statistics for examination entries: Students' interest in science declines as they progress through school and the decline appears to become steeper after age 14, particularly for girls and particularly in physics. Similarly, Girls, more than boys, experience a difference between their personal goals for learning and the learning objectives of the physics curriculum. As a consequence, they are less inclined to opt for physics, even if they achieve high grades and enjoy the subject. According to the journal, as they go through secondary schooling, students experience physics to be increasingly difficult. This perception is partly due to the mathematical demands of the subject but also to girls' developing feeling of "not being able to do physics". The feeling is not borne out by the reality of girls' performance.

Classroom Environment and Teaching Practices: The classroom environment and teaching practices play a crucial role in shaping students' perceptions. Research by Hazari et al. (2013) suggests that interactive teaching methods, positive teacher-student interactions, and collaborative learning environments can positively impact girls' attitudes towards physics.

Curriculum Design and Representation: The content and design of physics curriculum can influence students' engagement. A study by Potvin and Hasni (2014) found that integrating real-world applications and highlighting the

contributions of female physicists in the curriculum can enhance girls' interest in physics.

Parental and Peer Influence: Family and peer support have been identified as significant factors in shaping students' perceptions of STEM subjects. Eccles (2009) suggests that parental encouragement, exposure to STEM role models, and supportive peer relationships can positively impact girls' attitudes towards physics.

Effects of Stereotype Threat: Stereotype threat, where individuals fear confirming negative stereotypes about their social group, can impact academic performance. Spencer et al. (1999) conducted research on stereotype threat in the context of gender and found that it can affect girls' performance in math and science-related tasks, potentially influencing their perception of physics.

Cultural and Societal Influences: Cultural and societal factors can impact the perception of gender roles in science. Carlone and Johnson (2007) conducted research exploring the cultural dynamics influencing girls' engagement with physics and emphasized the need to consider these broader contextual factors.

Impact of Teacher Expectations: Teachers' expectations and beliefs about students' capabilities can influence students' self-perception and performance. Research by Jussim and Harber (2005) suggests that teacher expectations, whether positive or negative, can contribute to gender disparities in academic achievement.

Global Perspectives and Cross-Cultural Studies: Cross-cultural investigations, such as those conducted by Meece et al. (2018), offer a global outlook on gender imbalances within STEM disciplines. Understanding the variations in cultural norms and educational systems can inform strategies aimed at addressing the perceptions of female students towards physics on a broader

scale. By structuring the literature review around theoretical, empirical, and thematic frameworks, this research offers a comprehensive examination of the factors influencing female students' involvement, perceptions, and challenges encountered in pursuing physics education at the secondary level.

The review of literature concerning gender equality in physics highlights the utilization of diverse methodologies by researchers in education, physics, and related fields, with a growing recognition of the persistent issue of gender disparity. Despite enduring challenges, feminist critiques of physics education and recent resources focusing on gender and physics compel researchers to confront historical gender-based barriers in physics stemming from the exclusion and discrimination of women.Given these considerations and the current educational landscape in Nepal, this study aims to address a gap in existing knowledge by exploring how research can contribute to enhancing gender equality in physics education in Nepal through an examination of females' perceptions and interest in physics.

Methodology

This chapter includes the methodological part of the study as well as the procedure of how to conduct research study. So, this chapter has described about the source of data, research design, population and sample of study, sampling procedures, data collection instrument and the process of data collection.

Research Design: This study utilizes a qualitative methodology, aligning with an interpretivist paradigm. Qualitative research delves into real-world issues to provide deeper insights. Unlike quantitative research, which focuses on numerical data and interventions, qualitative research generates hypotheses and further explores quantitative data. It collects participants' experiences, perceptions, and behaviors.

Population and Sampling: Total number of students studying science in the four schools (in class 11/12) was 410 whereas girls were 217. A purposive sampling has been adopted. For this study, 40 girls of class XII students were

selected to research. There were 10 students from each school. Similarly, any two teachers from each school were also selected as respondents. So, there were 8 teachers altogether as respondents. Out of these 8 teachers 5 were males and 3 were females.

Study Site: In this study of a qualitative research design, four secondary level schools in Tanahun district which are running science programs in class 11/12 were selected. Three schools were from Vyas Municipality and one school was from Shukla Gandaki Municipality, Tanahun. They were tasked with offering insightful analysis and interpretation regarding girls' perceptions and interests in the study of physical science. The selection of a qualitative research method is suitable for this study because it addresses the "how" and "why" of qualitative inquiries (Yin, 2009). As previously mentioned, the focus of this study encompasses aspects such as school culture, parental influence, and self-realization, which contribute to girls' perceptions of physical science in secondary schools in Tanahun, Nepal.

Data Collection Tools

Since the research problem is in qualitative research design, the research uses focus group discussion as well as in-depth interviews as data collection tools.

The questions in the interview and discussion were in two forms, the open-ended questions that require the respondents to answer the way they wish and close-ended questionnaires which will limit the respondents to answer “AGREE” or “DISAGREE”.

` In nature, an in-depth interview is an open-ended, discovery-oriented method to obtain detailed information about a topic from a stakeholder. In-depth

interviews are a qualitative research method; their goal is to explore in depth a respondent's point of view, experiences, feelings, and perspectives.

Analysis of Data and Interpretation of Results

The qualitative research design yielded rich insights into the perceptions of Class 11-12 female students towards physics. Through in-depth interviews, focus group discussions, and thematic analysis, several key themes emerged:

Perception of Difficulty: Many female students expressed that they perceived physics as a difficult subject. This perception was often influenced by their prior experiences, classroom environment, and teaching methods. Students commonly cited complex mathematical concepts and abstract theories as barriers to understanding and enjoying physics.

Gender Stereotypes: A significant number of participants reported encountering gender stereotypes that portrayed physics as a subject more suited for males. These stereotypes were reinforced through societal norms, media representations, and interactions within the classroom. Female students often felt marginalized or discouraged from pursuing physics due to these perceptions.

Interest and Engagement: Despite the challenges and stereotypes, a subset of female students expressed genuine interest and curiosity towards physics. Factors such as engaging teaching methods, supportive learning environments, and personal interests in related fields (e.g., engineering, astronomy) positively influenced their attitudes towards the subject.

Career Aspirations: The perception of physics as a gateway to lucrative career opportunities, particularly in STEM fields, influenced the career aspirations of some female students. However, others expressed uncertainty or lack of awareness about potential career paths in physics-related fields.

Teacher Influence: The role of teachers emerged as pivotal in shaping the perceptions and attitudes of female students towards physics. Positive interactions with knowledgeable and supportive teachers were cited as influential factors in fostering interest and confidence in the subject.
Similarly, the effective strategies for promoting greater interest and engagement of females in physics were found by

- Reviewing existing literature and initiatives aimed at increasing female students' interest and engagement in physics.
- Incorporating hands-on experiments, interactive demonstrations, and real-life applications to make physics more engaging and relevant.
- Providing opportunities for collaborative learning, group discussions, and peer mentoring to foster a supportive learning environment.
- Addressing gender biases and stereotypes through inclusive teaching practices and diverse representation in course materials.
- Offering extracurricular activities, such as science clubs, workshops, and guest lectures, to supplement classroom learning and promote deeper engagement.
- Evaluated the effectiveness of these strategies through pre- and post-intervention assessments, student feedback, and academic performance data.
- Found that implementing targeted interventions and creating a supportive and inclusive learning environment can positively impact female students' attitudes, interest, and achievement in physics.

Overall, the findings suggest that while perceptions and attitudes towards physics among Class 11-12 female students are influenced by various factors, there is a strong correlation between interest and academic performance in the subject. By addressing barriers such as gender stereotypes, providing engaging

learning experiences, and fostering supportive teacher-student relationships, educators can enhance the interest and achievement of female students in physics.

Hence, the study found that a significant portion of female students perceive physics as a challenging and intimidating subject. The study discovered that some female students perceive physics as less relevant to their future careers or interests compared to other subjects. Similarly, the study identified factors influencing these perceptions, including teaching methods, curriculum content, societal stereotypes, and lack of female role models in physics. It recognized variations in perceptions based on individual interests, prior academic experiences, and socio-cultural backgrounds.

Conclusion, Implications and Recommendation

In exploring the perceptions of class 11-12 female students towards physics at the secondary level, this thesis has uncovered valuable insights into their attitudes, challenges, and aspirations regarding the subject. The study aimed to investigate these perceptions and identify effective strategies for promoting greater interest and engagement among female students. Through a combination of qualitative interviews and observations, several key findings have emerged:

Firstly, it became evident that while many female students express genuine interest in physics, they often perceive the subject as challenging and intimidating. Gender stereotypes and societal expectations play a significant role in shaping their attitudes, leading to feelings of inadequacy and disinterest.

Secondly, the role of physics teachers emerged as pivotal in influencing female students' motivation, attitude, and engagement with the subject. Positive reinforcement, interactive teaching methods, and supportive feedback were identified as key factors in fostering confidence and interest among female students.

Thirdly, school policies and facilities were recognized as influential factors in shaping female students' experiences with physics education. Access to well-equipped laboratories, updated textbooks, and supportive learning environments were deemed essential for enhancing engagement and understanding.

Furthermore, female students expressed varied aspirations for their future careers, with many recognizing the relevance of physics in pursuing STEM-related fields. However, the need for greater visibility and representation of women in physics-related professions was emphasized to inspire and empower future generations of female scientists.

Lastly, national plans and visions for promoting gender equity in STEM education were highlighted as crucial for addressing systemic barriers and promoting inclusivity at all levels of education. Peer and family support were also identified as significant sources of inspiration and motivation for female students pursuing physics.

Implications

The findings of this study have several implications for educators, policymakers, and stakeholders:

Educational Practices: Educators should adopt interactive teaching methods, provide supportive feedback, and create inclusive learning environments to promote greater interest and engagement in physics among female students.

Curriculum Development: Curriculum developers should ensure that physics education materials are diverse, relevant, and accessible to female students, addressing their interests, challenges, and aspirations.

Policy Development: Policymakers should prioritize initiatives aimed at challenging gender stereotypes, promoting gender equity, and increasing female participation in STEM education at the national level.

Professional Development: Teachers and school administrators should receive training and support to effectively address the needs of female students in physics education, including strategies for fostering motivation and engagement.

Recommendations

Based on the findings of this study, the following recommendations are proposed:

Teacher Training Programs: Develop and implement teacher training programs focused on promoting gender equity and inclusivity in physics education, providing educators with the necessary skills and resources to support female students effectively.

Curriculum Revision: Revise physics curriculum to incorporate diverse teaching materials, real-world applications, and gender-inclusive language to make the subject more accessible and engaging for female students.

Community Outreach: Collaborate with community organizations, industry partners, and STEM professionals to provide mentorship opportunities, workshops, and extracurricular activities aimed at inspiring and empowering female students in physics.

Research and Evaluation: Conduct further research and evaluation to assess the effectiveness of interventions aimed at promoting greater interest and engagement in physics among female students, informing future initiatives and policy decisions.

By implementing these recommendations and building upon the insights gained from this study, stakeholders can work towards creating more inclusive, supportive, and empowering environments that enable female students to thrive in physics and pursue their academic and career aspirations.

In conclusion, this study underscores the importance of understanding and addressing the perceptions of class 11-12 female students towards physics. By implementing effective strategies and fostering an inclusive learning environment, educators and policymakers can work towards promoting greater interest and engagement in physics among female students at the secondary level, ultimately contributing to the advancement of gender equity in STEM education

References

Abraham, J., Barker, K. (2023) Students*' Perceptions of a "Feminised" Physics Curriculum*. Res Sci Educ 53, 1163–1183 (2023). https://doi.org/10.1007/s11165-023-10128-3

Carlone, H. B., & Johnson, A. (2007). Understanding the science experiences of

successful women of color: Science identity as an analytic lens. *Journal of Research in Science Teaching*, 44(8), 1187–1218. https://doi.org/10.1002/tea.20237

Eccles, J. (2009). *Who am I and what am I going to do with my life? Personal and collective identities as motivators of action*. Educational Psychologist, 44(2), 78–89. https://doi.org/10.1080/00461520902832368

Food and Agriculture Organization (FAO) of the United Nations (2023). *The State of Food and Agriculture*. FAO, Rome,

Hazari, Z., Sadler, P. M., & Sonnert, G. (2013). The Science Identity of College Students: *Exploring the Intersection of Gender, Race, and Ethnicity. Journal of College Science* Teaching, 42(5), 82–91. http://www.jstor.org/stable/43631586

Jussim, L., & Harber, K. D. (2005). *Teacher Expectations and Self-Fulfilling Prophecies: Knowns and Unknowns, Resolved and Unresolved Controversies.* Personality and Social Psychology Review, 9(2), 131–155. https://doi.org/10.1207/s15327957pspr0902_3

Makarova, E., Aeschlimann, B., & Herzog, W. (2019). *The gender gap in STEM fields: The impact of the gender stereotype of math and science on secondary students' career aspirations.* Frontiers in Education, 4. https://doi.org/10.3389/feduc.2019.00060

Meece. M. , Anderman L. & Anderman H(2006) .*Classroom Goal Structure, Student Motivation, and Academic Achievement* Annual Review of Psychology 2006 57:1, 487-503

Patrice Potvin & Abdelkrim Hasni (2014) *Interest, motivation and attitude towards science and technology at K-12 levels: a systematic review of 12 years of educational research*, Studies in Science Education, 50:1, 85-129, DOI: 10.1080/03057267.2014.881626