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Students' and Teachers' Perceptions on Effective Physics Teaching and Learning

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Abstract

This research investigates how secondary school learners as well as teachers perceived effective physics learning and instruction. Consequently, a quantitative survey methodology was adopted for the investigation. Fifty-five students enrolled in grade twelve of two institutional secondary schools in Kathmandu and Lalitpur districts formed the sample size of the study. Seven teachers were enrolled in the study to collect data from two schools. The study was directed by two research questions. Researchers created a questionnaire with a four-point Likert scale as a tool for data collection. Cronbach's alpha was used to determine the reliability coefficient, which was found to be 0.84 after the instrument had undergone validation. In order to guarantee a 100 percent return, the researcher circulated the surveys via a Google Form and collected them. After the data were analyzed using mean and frequency distribution analysis to answer the research questions, the percentage of students' and teachers' responses to each item was calculated and tabulated. Some of the conclusions that were reached include the fact that most students' comprehension of physics has a weak foundation.

Keywords: *Effective teaching, Effective learning, Institutional secondary school, Perception, physics*

Introduction

A significant portion of a nation's progress is determined by its capacity to effectively utilize science and technology. With the use of its principles in contemporary technologies, one of the sciences, physics, is essential to technological advancement (Chinyere, 2014). Adeyemo (2003) asserts that physics is among the most foundational among the various sciences and that has a significant impact on human growth in terms of science and technology.

Physics, as a science, is crucial in describing the occurrences in the universe. We may observe physical rules and principles in all of the events that take place around us. The 20th century's advances in physics have been exceptionally effective in that they have

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had a significant positive impact on both basic and applied sciences (Fishbein & Ajzen, 1977). Despite the fact that physics is present in many aspects of our lives and helps them, national and international research reveal that physics education is less successful than other fields (Dieck, 1997; Gök & Silay, 2008; Mattern & Schau, 2002; Rivard & Straw, 2000). Furthermore, physics is crucial to comprehending the globe, and physicists have a substantial impact on both the welfare and economic advancement of nations. Physics experts are required to possess the relevant knowledge and problem-solving abilities by numerous sectors and professions. Understanding physics and making progress in it are among the most crucial physics-related challenges in many countries all over the globe (Baran, 2016). However numerous research has shown that science performance is not promising (Jacob Kola Aina, 2013; Jacob Kola Aina & Philip, 2013). The issue is significant, particularly in physics. According to Bamidele (2001), students' lack of enthusiasm in physics is a result of their belief that the subject is challenging. Also, the students' unfavorable perceptions have affected how well they do in the physics class.

The problems that students have during learning science concepts vary depending on the learner. According to Bahar and Polat (2007), student perspectives of science are a factor in the perceived difficulties they have with particular science concepts and disciplines, particularly physics. Also, according to Nwona and Akogun (2015), a learner's learning environment, prior knowledge, and academic motivation may all be factors in the difficulty they have learning. They argued that the synergistic effect of the aforementioned factors, as opposed to teacher and school climate difficulties, could considerably contribute to students' poor achievement and insufficient enrollment in several physics-related courses. The aforementioned opinions support the claims made by Olatoye (2002), Ajayi (2007) and, Adedayo (2008) that the students' perceptions of the subject may be related to their underperformance in physics during external examinations as well as their poor enrollment in physics courses at tertiary institutions.

Students frequently find physics to be extremely difficult, which explains why they consistently perform poorly in the subject. Students score extremely low in physics across all educational levels, according to Jacob Kola Aina and Akintunde (2013). However, numerous experts concur with the view that student performance in physics was subpar (Aigbomian, 1994; Aiyelabegan, 2003; Akanbi, 2003). According to Adeyemo (2010), the abstract character of the course may be a significant contributing factor to this poor result. The abstract character of physics has made teaching it in classrooms difficult. To help students study physics, it is necessary to use instructional materials. Without the utilization of instructional materials, Oladejo, Olosunde, Ojebisi, and Isola (2011) emphasized, it is impossible to thoroughly understand physics concepts. The inability of secondary schools to graduate students who are prepared for a vocation or higher education is further evidenced by low student accomplishment and high rates of dropout (NIRT, 2016).

Researchers in Nepal noted numerous issues with physics instruction and student learning. Due to a practice-based and teacher-driven educational system in Nepal, teachers are seen as the center of the teaching-learning process (Koirala, Gurung, & Wagle, 2020). According to Semela (2010), researchers in the field of physics have discovered that the majority of school students lack enthusiasm for studying the subject, which has resulted in poor performance on final exams. The teaching-learning process has been demonstrated via experience to rely excessively on the use of words by teachers to describe concepts or convey information. This strategy is referred to as the "chalk-talk" strategy (Onasanya & Omosewo, 2011). The issue was evident in the classroom, where the investigator observed a discrepancy between the student learning strategies and the teacher's instructional approach. In this context, a variety of factors have been identified that influence students' poor performance in physics and all science subjects. As a result, the study aims to learn how physics concepts are perceived by secondary school students and teachers in Kathmandu and Lalitpur.

The primary objectives of this study were to determine the factors that contribute to the issue of effective physics teaching and learning at the secondary level, to examine how students and teachers perceived the problem, to identify the factors that contribute to the problem, and to suggest solutions. The research question that this study addressed was as follows:

What do students think about the problem of teaching and learning physics?
What do teachers think about the issue of teaching and learning physics?

Methods

Research design

An online survey was used in the study to learn more about students' and teachers' perspectives on the issue of effective secondary physics instruction. The design was appropriate because a questionnaire was used to collect the study's data.

Population of the study

Secondary schools in Kathmandu and Lalitpur, two metropolitan areas, were the target population of the study. The study samples were randomly selected from two institutional secondary schools in the metropolitan areas of Lalitpur and Kathmandu.

Sample and sampling techniques

The study used simple random sampling approaches to choose the sample, which included 55 students and 7 physics teachers from two secondary schools in Lalitpur and Kathmandu.

Research instrument

The data collection tool was a semi-structured questionnaire to find out how secondary school students viewed the issue of effective physics teaching and learning. Strongly agree (SA), agree (A), disagree (D), and strongly disagree (SD), with weights of 4, 3, 2, and 1, respectively, were used to denote responses to questions in a dignified manner. Five of the fifteen questionnaires inquired about students' perceptions of physics teaching and learning issues based on student-related factors, five more inquired about teacher-related factors, and the remaining five inquired about other factors.

Validity and reliability of the instruments

The questionnaires were reviewed by two professors from Tribhuvan University's department of science education, and they determined whether the study questions were appropriate by removing, adding, and reorganizing some of the questions. The Cronbach alpha reliability coefficient of the test was calculated and found to be 0.84 using SPSS version 20.0.0.

Method of data collection

The researcher made introductions to the principals, teachers, and students at the selected schools before explaining his visit to both the subjects and the school authorities. Then, using a Google Form with brief instructions on how to respond to each question, the researcher randomly selected the number of students and their e - mail addresses required for the study and distributed the questionnaire to them. The fifteen-item questionnaire was composed of guidelines for effective physics teaching and learning that can be utilized to assist students develop the scientific expertise and knowledge necessary for technological growth. To guarantee a 100 percent return, the researcher emailed the questionnaires via the internet and then collected them. In order for the responses to be gathered and examined, the participant was also encouraging.

Analysis and interpretation

The Statistical Package for the Social Science (SPSS) 20.0.0 version was used to analyze the student data collected. To provide answers to the following research question, frequency distribution analysis and percentages of students' responses to each item were computed and tallied.

Research question 1

What do students think about the problem of teaching and learning physics?

Table 1: *Student-related Factors*

Student-related Factors	SA	A	D	SD	Mean	Agreement (%)	Disagree (%)
Physics foundations among students are weak	10	37	8	0	3.04	85.5%	14.5%
A psychological dread of physics exists among students	15	32	7	1	3.11	85.5%	14.5%
Even when examples are provided, students struggle to solve physics problems	7	26	19	3	2.67	60%	40%
Students are no longer as motivated to work hard	7	18	19	11	2.38	45.5%	54.5%
The absence of a tutor prevents students from attempting to do their physics assignments at home	11	26	15	3	2.82	67.3%	32.7%

Table 1 above reveals the following factors that have an impact on effective physics teaching and learning: (1) students' weak physics background, which was agreed upon by 85.5% of the participants, as opposed to 14.5% of those who disagreed, (2) 85.5% of the participants believed that students have a psychological dread of physics, whereas just 14.5% did not, (3) While similar examples are given, only 60% of respondents agree with this assertion, indicating that pupils still have difficulty solving physics difficulties, (4) Students no longer are motivated by hard work, according to 45.5% of respondents, who disagreed with this statement by a margin of 54.5%, and (5) 67.3% of respondents agreed that the lack of a tutor discourages students from trying to do their physics homework at home, while 32.7% disagreed. The following image 1, which is a visual depiction of the data analysis acquired above, shows student opinions on the student-related problem of physics learning and instruction.

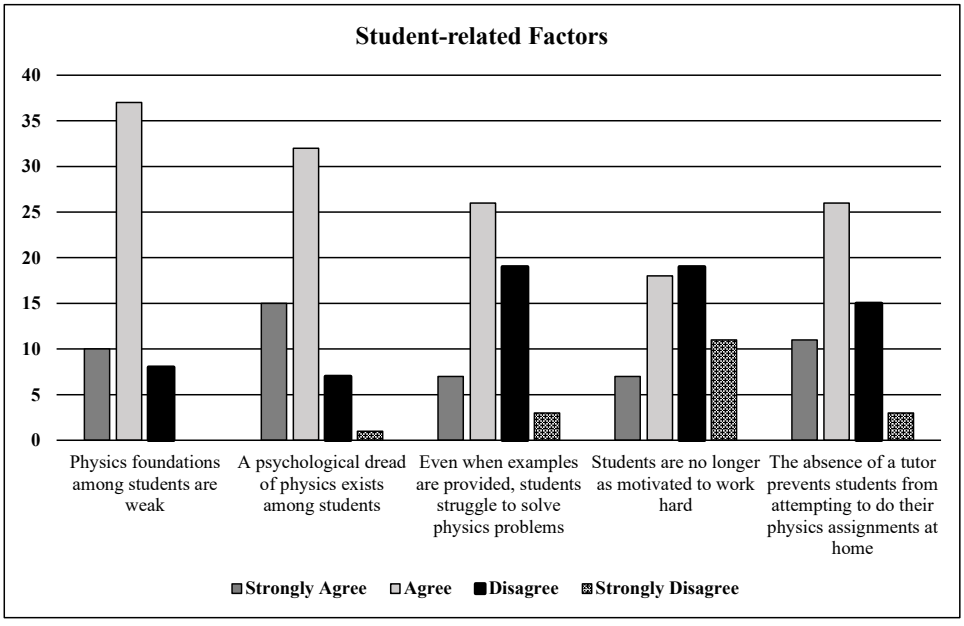

Figure 1: Analysis of the opinions of students about the student related issue of teaching and learning of Physics

The examination of the student replies to the question of physics teaching and learning as it relates to students is displayed in Figure 1. It was revealed that all of the problems listed are problems, with the exception of item 4, which claims that pupils are no longer interested in working hard as agreed, as perceived by students in class twelve.

Table 2: *Teacher- related factors*

Teacher- related factors	SA	A	D	SD	Mean	Agreement (%)	Disagree (%)
The application of physics concepts in the classroom is lacking	6	26	21	2	2.65	58.2%	41.8%
Questions from students are not addressed by teachers	3	20	28	4	2.40	41.8%	58.2%
As well as in number and quality, there aren't enough physics teachers in the schools	4	9	37	5	2.22	23.6%	76.4%
Physics teachers use poor teaching and conventional approaches	6	28	19	2	2.69	61.8%	38.2%
Due to their extensive workload, teachers do not prepare their Physics classes properly	6	25	22	2	2.64	56.4%	43.6%

Table 2 above demonstrates that the following teacher-perceived characteristics are problematic for physics teaching and learning: (6) 58.2% of respondents think that physics teachers should connect theoretical concepts to practical applications, while 41.8% disagree, (7) 41.8% of respondents agreed that teachers don't reply to students' inquiries, while 58.2% disagreed with this statement, (8) There are insufficient physics teachers in schools, both in quantity as well as quality, according to the respondents' responses, with a 23.6% agreement rate to 76.4% disagreement, (9) Only 38.2% of respondents disagree, with the majority (61.8%) believing that instructors' methods of instruction are ineffective and (10) also, They agreed that teachers do not moderately prepare for the physics lesson due to a huge workload, having scored 56.4% in favor of this assertion comparison to 43.6% of the opposing respondents. The following figure 2, which serves as a visual depiction of the analysis of the data acquired above, shows the viewpoints of students on the teacher-related problem of physics teaching and learning.

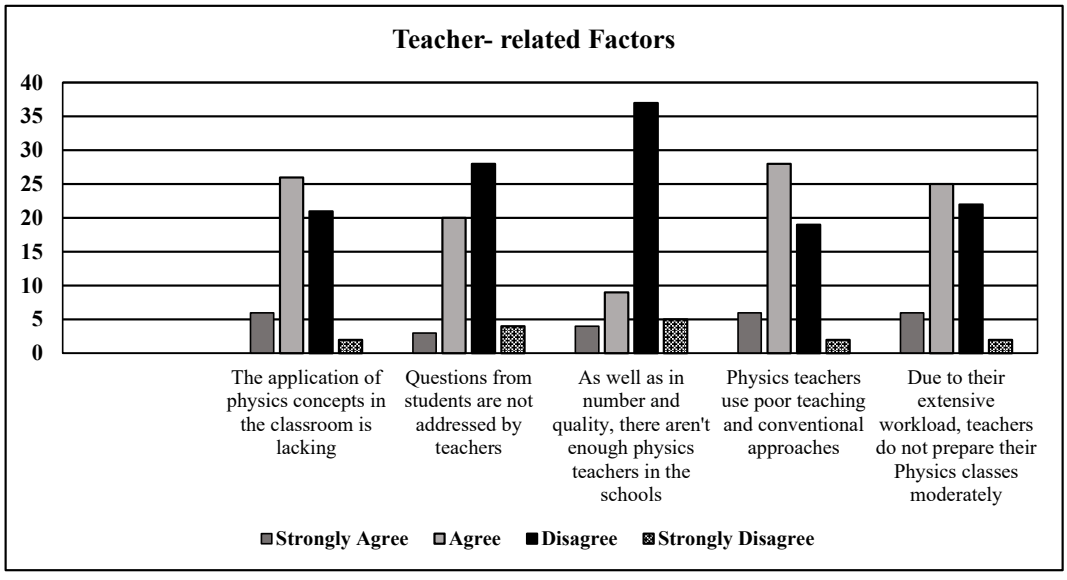

Figure 2: Study of students' opinions of how physics is taught and learned in relation to teachers

Figure 2 illustrates the analysis of the student responses to the query about physics teaching and learning in relation to teachers. According to these findings, all of the concerns listed, with the exception of numbers seven (7) and eight (8) as viewed by the student, are issues that influence the successful teaching and learning of physics.

Table 3 *Other- factors*

Other factors	SA	A	D	SD	Mean	Agreement (%)	Disagree (%)
Class room is very full	6	17	27	5	2.44	41.8%	58.2%
There aren't enough teaching materials	12	27	13	3	2.87	70.9%	29.1%
Lack of a library	1	16	33	5	2.24	30.9%	69.1%
Materials for teaching physics to children are out of budget for many parents	0	9	33	13	1.93	16.4%	83.6%
Motivational lack	19	27	6	3	3.13	83.6%	16.4%

Table 3 lists additional factors that impact physics instruction and learning at the secondary level, including: (11) overcrowding in schools is a problem, with 41.8% of respondents agreeing with this assertion, compared to 58.2% who disagree, (12) the agreed-upon participant percentage score for absence of instructional materials is 70.9%, compared to the disagreed-upon participant percentage score of 29.1%, (13) There are 30.9% of respondents who believe there is no library, while 69.1% of respondents disagree with this assertion, (14) 16.4% of respondents believe that parents cannot afford to buy physics study materials for their children, whereas 83.6% of respondents disagree with this claim and (15) 83.6% of respondents believe that there is a lack of motivation among students, while 16.4% of respondents disagree. The student perspectives on the additional challenges of physics learning and instruction are shown in the accompanying figure 3, which acts as a visual representation of the evaluation of the information gathered above.

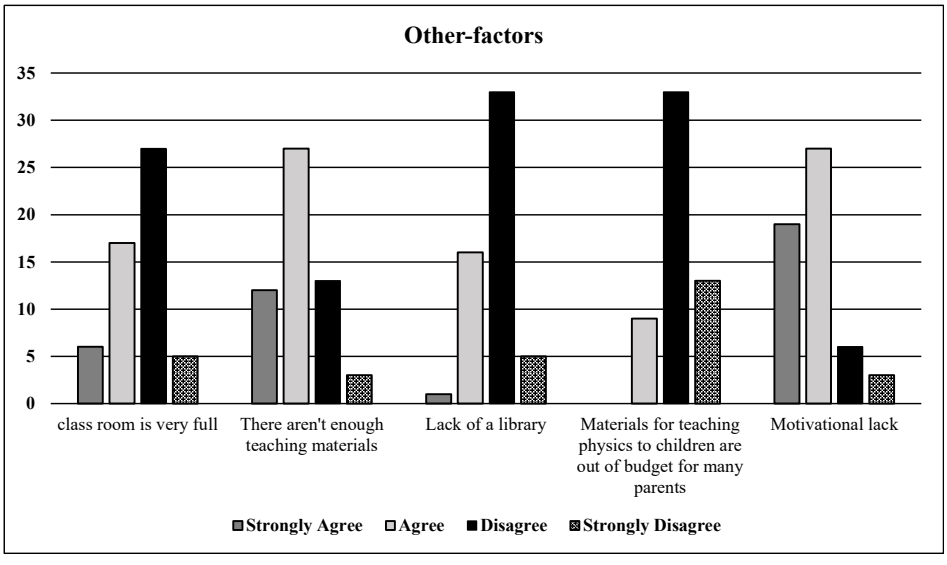

Figure 3: Analysis of student opinions regarding physics learning and instruction in relation to other factors

Figure 3 shows the evaluation of the student comments to the query regarding the relationship between additional factors and physics teaching and learning. From these results, it was also noted that, with the exception of items eleven, thirteen, and fourteen, all the issues identified are issues that affect the efficient learning and instruction of physics as regarded by students.

Research question 2

What do teachers think about the issue of teaching and learning physics?

Table 4: *Students-related factors*

Student-related factors	SA	A	D	SD	Mean	Agreement (%)	Disagree (%)
Physics foundations among students are weak	2	3	2	0	3.00	71.45%	28.58%
A psychological dread of physics exists among students	0	6	1	0	2.86	85.74%	14.29%
Even when examples are provided, students struggle to solve physics problems	2	2	3	0	2.86	57.16%	42.87%
Students are no longer as motivated to work hard	0	3	3	1	2.29	42.87%	57.16%
The absence of a tutor prevents students from attempting to do their physics assignments at home	2	2	2	1	2.71	57.16%	42.87%

According to Table 4 above, the following issues can hinder successful physics teaching and learning: (1) 71.45% of respondents agreed that pupils have a weak background in physics, compared to 28.58% who disagreed, (2) 85.74% of respondents believed that students' psychological dread of physics existed, whereas just 14.29% disagreed, (3) students struggle to solve physics issues even when related documentation are given, according to 57.16% of respondents, contrasted to 42.87% who disagreed, (4) 42.87% of respondents agreed, while 57.16% disagreed, saying students are no longer driven by effort, and (5) 57.16% of respondents agreed that pupils aren't able to finish their physics assignments at home because they don't have a mentor, compared to 42.87% who disagreed. Figure 4, which is a graphic depiction of the analysis of the data acquired above, shows the viewpoints of teachers on the student-related problems of physics teaching and learning.

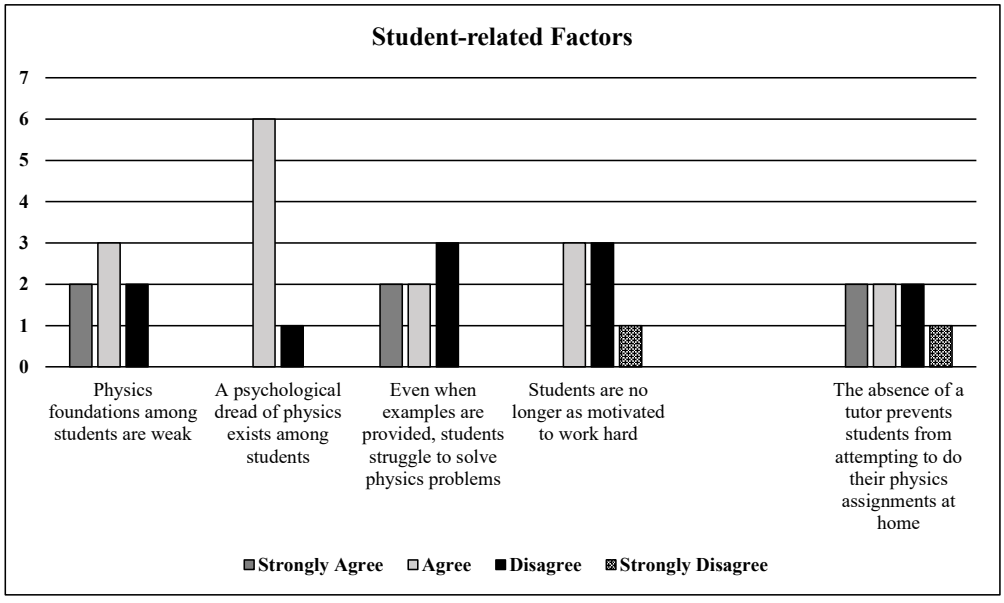

Figure 4: Analysis of teacher views regarding the topic of physics learning and instruction in connection with student factors

Figure 4 shows the teacher's responses to the question about physics learning and instruction in relation to students. From these, it was observed that all the items were the problems affecting effective teaching and learning of physics except item number five (4) i.e., students are no longer interested in hard work, as perceived by physics teachers teaching at class twelve.

Table 5: *Teacher-related factors*

Teacher- related factors	SA	A	D	SD	Mean	Agreement (%)	Disagree (%)
The application of physics concepts in the classroom is lacking	0	4	3	0	2.57	57.16%	42.87%
Questions from students are not addressed by teachers	6	1	0	0	3.86	100%	0%
As well as in number and quality, there aren't enough physics teachers in the schools	2	2	2	1	2.71	57.16%	42.87%
Physics teachers use poor teaching and conventional approaches	0	5	1	1	2.57	71.45%	28.58%
Due to their extensive workload, teachers do not prepare their Physics classes moderately	1	1	4	1	2.29	28.58%	71.45%

According to Table 5 above, the following factors are deemed by teachers to be the main causes of problems in physics teaching and learning: (6) a majority of respondents (57.16%) agree that physics teachers should connect theoretical concepts to practical applications, while just 42.87% disagree, (7) teachers do not answer queries from students if the percentage of respondents who agreed with them was 100% as compared to the percentage of respondents who disagreed, (8) With a 57.16% agreed respondents percentage score compared to a 42.87% disagreed respondents percentage score, it can be said that there aren't enough physics teachers in schools, both in terms of quantity and quality, (9) the majority of respondents (71.45%) agreed that instructors' teaching approaches were ineffective, while just 28.58% disagreed, and (10) they also gave a percentage score of 28.58% in agreement with the statement that teachers do not moderately plan for physics classes because to a work overload, as opposed to a percentage of 71.45% for disagreeing respondents. Figure 5 shows how the teacher replies to the question about physics learning and instruction in connection to teachers were analyzed.

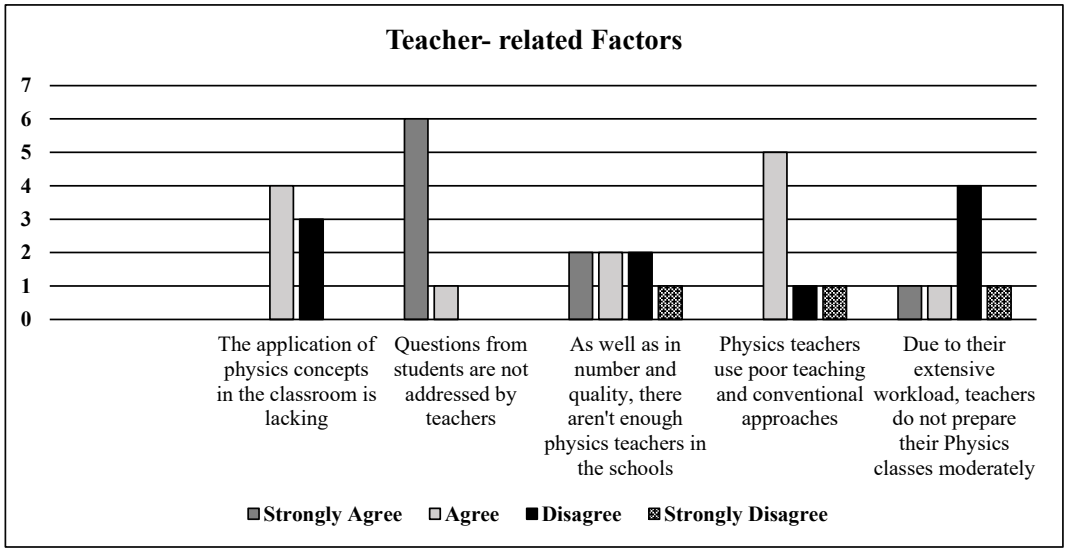

Figure 5: Analysis of teachers' opinions regarding the topic of physics learning and instruction in connection to teachers

Figure 5 shows how the teacher replies to the question about physics learning and instruction in connection to teachers were analyzed. All of the issues stated are issues that impede effective physics teaching and learning, with the exception of issue number ten (10), which is that teachers do not moderately plan for the physics lesson because of the heavy workload in schools, as viewed by teachers.

Table 6: *Other- factors*

Other- factors	SA	A	D	SD	Mean	Agreement (%)	Disagree (%)
Class room is very full	1	3	3	0	2.71	57.16%	42.87%
There aren't enough teaching materials	0	5	2	0	2.71	71.45%	28.58%
Lack of a library	0	4	2	1	2.43	57.16%	42.87%
Materials for teaching physics to children are out of budget for many parents	3	2	2	0	3.14	71.45%	28.58%
Motivational lack	2	3	2	0	3.00	71.45%	28.58%

Table 6 lists extra components that have an impact on how physics is taught and learned in secondary schools as: (11) a majority of respondents (57.16%) think that overcrowded classrooms are a problem, compared to a majority (42.87%) who disagree, (12) lack of teaching materials had a 71.45% agreed-upon respondent score, compared to a 28.58% disagreed-upon respondent score, (13) absence of a library has a percentage of agreed answers of 57.16% as contrasted to a percentage of disagreed respondents of 42.87%, (14) 71.45% of participants believed that parents cannot buy physics learning tools for their kids, whereas only 28.58% of respondents disagreed with this statement, and (15) lack of motivation received a 71.45% agreed-upon respondents percentage score, compared to a 28.58% disagreed-upon respondents percentage score. In the following figure 6, which serves as a visual depiction of the assessment of the material acquired above, the teacher viewpoints on the additional problems involved with physics instruction and learning are presented.

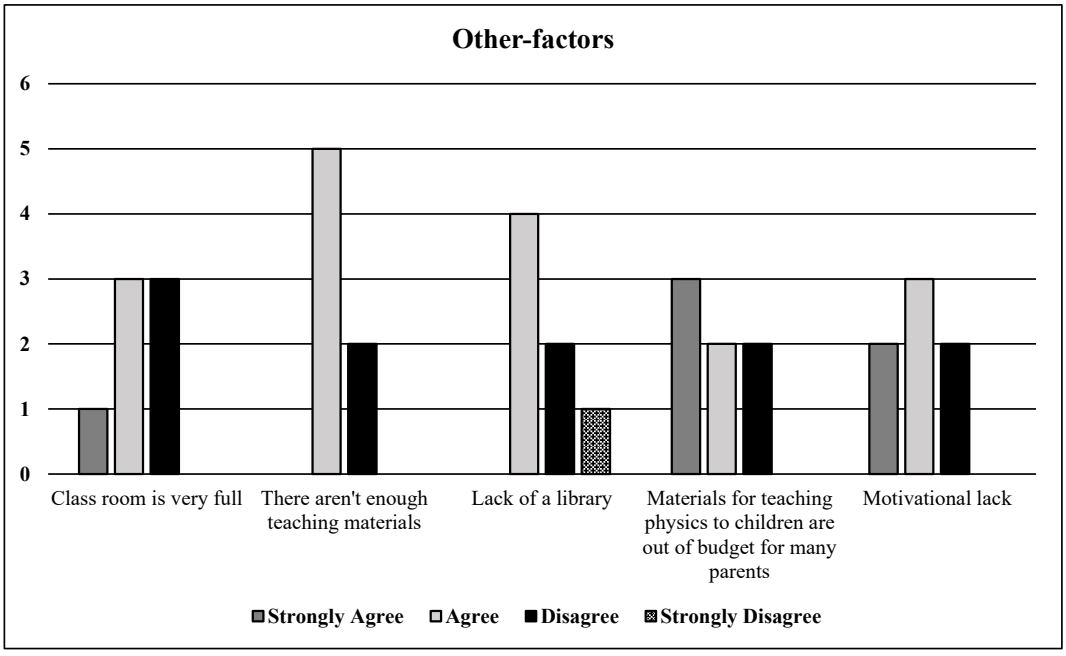

Figure 6: Analyzing the views of teachers in connection to other problems pertaining physics learning and instruction

Figure 6 illustrates how the teacher responses to the question about the connection between other factors and physics learning and instruction were evaluated. From these findings, it was also observed that all the problems itemized are problems affecting effective teaching and learning of physics as perceived by teachers.

Results and discussion

The study's findings showed that students avoid studying physics, despite the subject's importance in the secondary science curriculum. This study has sparked more investigation into how secondary school students and teachers see physics due to their failure to comprehend the subject's fundamental concepts, the principles of physics. These findings generally conflict with those of Checkley (2010), Wenno (2015), and Mushinzimana and de la Croix Sinaruguliye (2016), who reported on students' positive attitudes or perceptions of physics, but they are in line with those of Gimba, Hassan, Yaki, and Chado (2018); Ogunleye (2009); and Akhter, Majeed, Naseer, and Din (2019), who investigated students' perceptions on the challenges of effective teaching and learning of physics. Additionally, these findings appear to be at odds with those of Afzal, Safdar, and Ambreen (2015), who investigated how advancements in technology have allowed education to transcend the confines of the classroom but concur with the conclusions of Dorji, Jatsho, Choden, and Tshering (2022); and Agommuoh (2014) who examined teachers' perceptions of the challenges of effective

teaching and learning because of the abstract nature of the subject completely irrelevant to real-life situations and traditional methods of teaching and learning.

This study therefore reveals the negative views of students and instructors about physics in terms of the students' individual causes, pedagogical concerns, and academic facilities. These factors impede pupils' ability to learn physics. Each student should be provided enough time and opportunities to complete the physics issues while learning physics in order to get past these challenges.

Conclusion

The results of the study show that students have weak physics background from previous grades, most of physics instructors lack good teaching credentials, and many teachers do not properly plan for their physics lessons because of heavy workload. Also, the conditions for learning and teaching are unfavorable, and they lack motivation and a desire to learn. As a result, physics teachers need regular professional development in order to prepare students for the global competitiveness in their chosen fields.

References

Adedayo, J. (2008). Effects of electronics artisan's background and competence in science and technology advancement in Nigeria. *Research in Curriculum Studies, 5*(1), 132-136.

Adeyemo, S. A. (2003). *Studies of the effects of aptitude, instructional leadership styles and learning; Environment on students' achievement in physics.* (Unpublished Doctoral thesis), Unilag, Nigeria.

Adeyemo, S. A. (2010). Teaching/learning physics in Nigerian secondary school: The curriculum transformation, issues, problems and prospects. *International Journal of Educational Research Technology, 1*(1), 99-111.

Afzal, M. T., Safdar, A., & Ambreen, M. (2015). Teachers perceptions and needs towards the use of e-learning in teaching of physics at secondary level. *American Journal of Educational Research, 3*(8), 1045-1051.

Agommuoh, P. C. (2014). Physics Teachers Perception of Effective Teaching/Learning of Physics jn Senior Secondary School for Global Competitiveness. *Journal of Research Method in Education, 4*(1), 20-24.

Aigbomian, D. (1994). Students' perception of technical words in the learning of physics. *Studies in education, 2*(1), 86-92.

Aina, J. K. (2013). Instructional materials and improvisation in physics class: Implications for teaching and learning. *Computer, 2*(20), 8.

Aina, J. K., & Akintunde, Z. T. (2013). Analysis of gender performance in physics in colleges of education, Nigeria. *Journal of Education Practice, 4*(6), 1-5.

Aina, J. K., & Philip, Y. J. (2013). Imperative of environment in science learning. *Open Science Journal of Education, 1*(1), 1-6.

Aiyelabegan, A. (2003). Effect of physics practical on Students' Academic performance in Senior School Certificate Physics Examination in kwara state. *Lafiagi Journal of Science Education, 5*, 84-89.

Ajayi, P. (2007). *Evaluation of the implementation of senior secondary school physics curriculum in south west Nigeria.* (An Unpublished Ph. D thesis), University of Ado-Ekiti, Nigeria.

Akanbi, A. (2003). An investigation into students' performance in senior secondary school physics. *Journal of Teacher education trends, 1*(1), 58-64.

Akhter, N., Majeed, A., Naseer, M., & Din, U. (2019). High School Students' Perception of Challenges in Physics Learning and Relevance of Field Dependency. *Global Social Sciences Review, 4*(2), 336-343.

Bahar, M., & Polat, M. (2007). The Science Topics Perceived Difficult by Pupils at Primary 6-8 Classes: Diagnosing the Problems and Remedy Suggestions. *Educational Sciences: Theory Practice, 7*(3).

Bamidele, O. (2001). Promoting Science and MathematicsEducation Amongst females in Nigeria. A paper presented at The NCCE. In: UNESCO.

Baran, M. (2016). An Analysis on High School Students' Perceptions of Physics Courses in Terms of Gender (A Sample from Turkey). *Journal of EducationTraining Studies, 4*(3), 150-160.

Checkley, D. (2010). *High school students' perceptions of physics.* (Master Level Thesis), University of Lethbridge, Lethbridge, Alta.

Chinyere, A. (2014). Physics teachers' perception of effective teaching/learning of physics in senior secondary school for global competitiveness. *Journal of Research Method in Education, 4*(1), 20-24.

Dieck, P. A. (1997). *The effect of a newsletter on children's interest in and attitude toward science*: Arizona State University.

Dorji, K., Jatsho, S., Choden, P., & Tshering, P. (2022). Bhutanese science teachers' perceptions of the nature of science: a cross-sectional study. *Disciplinary and Interdisciplinary Science Education Research, 4*(1), 1-18.

Fishbein, M., & Ajzen, I. (1977). Belief, attitude, intention, and behavior: An introduction to theory and research. *Philosophy Rhetoric, 10*(2).

Gimba, R., Hassan, A., Yaki, A., & Chado, A. (2018). Teachers' and Students' Perceptions on the Problems of Effective Teaching and Learning of Science and Technology in Junior Secondary Schools. *Malaysian Online Journal of Educational Sciences, 6*(1), 34-42.

Gök, T., & Silay, I. (2008). Effects of Problem-solving Strategies Teaching on the Problem-solving Attitudes of Co-operative Learning Groups in Physics Education. *Journal of Theory Practice in Education, 4*(2).

Koirala, K. P., Gurung, G. P., & Wagle, P. (2020). Impact of teacher qualification on students' achievement in Science. *Scholars' Journal, 3*, 61-79.

Mattern, N., & Schau, C. (2002). Gender differences in science attitude-achievement relationships over time among white middle-school students. *Journal of Research in Science Teaching: The Official Journal of the National Association for Research in Science Teaching, 39*(4), 324-340.

Mushinzimana, X., & de la Croix Sinaruguliye, J. (2016). Attitude of physics students towards physics at College of Science and Technology–University of Rwanda. *Rwandan Journal of Education, 3*(2), 1-10.

NIRT. (2016). *Nepal education sector analysis. National Institute for Research and Training (NIRT) & American Institute of Research (AIR)*. Retrieved from Kathmandu, Nepal:

Nwona, H., & Akogun, N. (2015). Breaking gender barrier in science, technology and mathematics education. *Nigeria Journal of Research in Education*, 98-108.

Ogunleye, A. O. (2009). Teachers and students perceptions of students problem-solving difficulties in physics: Implications for remediation. *Journal of College Teaching Learning, 6*(7).

Oladejo, M. A., Olosunde, G. R., Ojebisi, A. O., & Isola, O. M. (2011). Instructional materials and students' academic achievement in physics: Some policy implications. *European Journal of Humanities Social Sciences, 2*(1).

Olatoye, R. (2002). *A causal model of school factors as determinants of science achievement in Lagos State Secondary Schools.* (An Unpublished PhD Thesis), University of Ibadan, Nigeria.

Onasanya, S., & Omosewo, E. (2011). Effect of improvised and standard instructional materials on secondary school students' academic performance in physics in Ilorin, Nigeria. *Singapore Journal of Scientific Research, 1*(1), 68-76.

Rivard, L. P., & Straw, S. B. (2000). The effect of talk and writing on learning science: An exploratory study. *Science Education, 84*(5), 566-593.

Semela, T. (2010). Who Is Joining Physics and Why? Factors Influencing the Choice of Physics among Ethiopian University Students. *International Journal of Environmental Science Education, 5*(3), 319-340.

Wenno, I. H. (2015). The correlation study of interest at physics and knowledge of mathematics basic concepts towards the ability to solve physics problems of 7th grade students at junior high school in Ambon Maluku Province, Indonesia. *Education Research International, 2015*.