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RESEARCH PAPER

Exploring the Challenges Faced by Secondary-Level Students in Learning Science: A Case Study of Biology

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ABSTRACT

This research explores the challenges that secondary-level students face in learning biology, focusing on students in Islamabad, Pakistan, who struggle with core scientific concepts. Using a quantitative survey method, data were gathered from 325 students selected from public secondary schools under the Federal Directorate of Education. The study examines factors such as teacher effectiveness, student attitudes, and institutional resources. SPSS was used for data analysis, applying measures such as mean, frequency, and independent t-tests. Results indicate key challenges, including lack of teacher support, difficulty with scientific terminology, and inadequate practical resources. Recommendations are provided to address these barriers and improve student engagement and achievement in science.

KEYWORDS Biology Education, Secondary Students, Science Learning Challenges, Teacher Influence, Academic Achievement

Introduction

The significance of science education especially biology, cannot be overemphasized in the modern world. Scientific literacy empowers people to comprehend complicated systems, make well-informed decisions, and participate constructively in society. Biology, being the science of life, is a core subject that links learners with vital information regarding organisms, ecosystems, and biological processes that affect human health, agriculture, and the environment. In addition to foundational knowledge, biology develops critical thinking, problem-solving, and questioning skills, preparing students for medicine, research, environmental science, and other professional careers.

But acquiring proficiency in biology is a challenging task for secondary-level students, particularly in developing nations such as Pakistan. In this case, science education is confronted with peculiar challenges such as limited facilities, large student-teacher ratios, and teachers' lack of specialized training. The technical terms used in biology, coupled with complex biological ideas and practical uses, can further render biology a challenging subject to study, frequently leading to poor achievement and student disengagement. The problems are exacerbated by a curriculum that can be content-dense but is missing active, real-life contexts that connect to the everyday lives of students (Muzaffar, & Javaid, 2018; Muzaffar, 2016).

In the context of Pakistan, where educational material is frequently limited, secondary-level students find it difficult to understand the subject. Research has found that reasons such as poor methods of teaching, lack of laboratory and equipment, and

lack of relevance between theory and practice contribute to poor performance in biology (Osborne & Collins, 2001; Snezana et al., 2011; Muzaffar, et al., 2020). Such obstacles not only affect students' scholastic achievements but can also lower their enthusiasm for studying science-related courses, impacting the national talent pool for key sectors such as healthcare and technology.

This research investigates the particular problems encountered by Islamabad, Pakistan secondary school student in learning biology. It aims to find the root causes of their problems and provide suggestions on how to solve them. By considering aspects of student attitudes, the effectiveness of teachers, and available resources, this study intends to make an added contribution towards an enhanced comprehension of obstacles facing science education in Pakistan and towards recommending strategies to enhance student achievements and interest in biology.

Literature Review

This research investigates the particular problems encountered by Islamabad, Pakistan secondary school student in learning biology. It aims to find the root causes of their problems and provide suggestions on how to solve them. By considering aspects of student attitudes, the effectiveness of teachers, and available resources, this study intends to make an added contribution towards an enhanced comprehension of obstacles facing science education in Pakistan and towards recommending strategies to enhance student achievements and interest in biology.

Student Attitudes and Academic Achievement in Science

Student attitudes towards science subjects play a central role in shaping their academic performance and involvement. As per Gibbons, Kimmel, and O'Shea (1997), students' attitudes towards science can be both input and output variables that have a profound impact on their performance. Positive attitudes towards a subject enhance academic performance, and high-achieving students develop a more positive attitude towards the subject. This two-way connection, as posited by Olatunde (2009), implies that developing good attitudes towards science is crucial for the improvement of student performance.

In the context of biology education, this relationship has particularly captivated the interest of researchers. Bassey, Umoren, and Udida (2008) emphasize that attitudes influence not only motivation but also cognitive engagement, which is foundational to "intellectual preparation" for learning. Despite the integral role of science education, subjects like chemistry and biology often suffer from negative student perceptions, contributing to low enrollment and performance (Ojo, 1989). Kwale SMASSE (2004) further found that biology is widely perceived as difficult, a sentiment stronger among female students than males. Gender dynamics in science are well-documented, with Twoli (2006) noting that boys generally prefer physical sciences while girls are more inclined towards biological sciences, a pattern that often correlates with performance and subject choice. Addressing these attitudinal and gender-based disparities in biology education may help increase student engagement and achievement.

Characteristics of Students and Achievement

To meet diverse student needs effectively, education systems must consider individual student characteristics such as entry behavior, study habits, peer influence, and personal aspirations. Kwale SMASSE (2004) reported that students' perceptions of

biology as a difficult subject are shaped by socio-cultural factors, instructional approaches, and school environments. Erwin (1993) observed that boys tend to show more interest in science in primary and secondary education, which is thought to stem from gendered societal expectations. Twoli (2006) also found that gender differences in science interest are linked to subject preference, with boys showing a stronger preference for physical sciences and girls for biological sciences. Gender imbalances among science teachers may reinforce these trends, as students often choose subjects based on the gender of their instructors, as noted by the Equal Opportunity Commission.

For educational outcomes to be optimized, both student attributes and curriculum goals must align to support students' intellectual development (Driver, 1989). In Africa, UNESCO (1986) identified that underinvestment in science education has hindered the region's technological and scientific progress, signaling a need for strengthened science education across all levels. Twoli (2006) suggests that when students are motivated and have positive attitudes toward biology, they tend to invest more time in studying it, leading to improved performance. Thus, effective biology education requires curricula and instructional methods that not only convey content but also foster sustained interest and aspiration among students.

Teacher Influence on Student Achievement

Teachers are influential in shaping students' learning experiences and attitudes towards science. According to Trowbridge (2004), teachers have considerable control over classroom environments, which directly impacts students' perceptions of science. Research by Kwale SMASSE (2004) shows that teachers play a critical role in changing students' attitudes toward science through consistent interactions, often acting as the most credible sources of knowledge. Fuller (1985) discovered that in-service education for teachers has a positive effect on student achievement, emphasizing the importance of continuous professional development. Similarly, Stevenson and Stigler (1992) believe that standards and assessments provide benchmarks for success, but the quality of instruction is what actually leads to achievement.

Comber and Keeves (1973) discovered that experience in teaching does not necessarily equate with greater achievement but that experienced teachers avoid misconceptions, offer more precise explanations, and utilize multiple examples and analogies to make the subject more understandable for students. This implies that well-trained and knowledgeable instructors can improve student performance significantly by making material more accessible. Teacher characteristics, including commitment and flexibility, also have an impact on student achievement, as veteran teachers are more likely to apply successful teaching methods and assume responsibility for student learning. Professional development courses, as stated by Beck and Earl (2002), are essential in keeping teachers abreast of curriculum developments and innovative pedagogical methods.

The Role of Resources and Practical Learning in Science Education

Successful science education, especially in disciplines such as biology, is based on resource availability and hands-on learning experiences. Kwale SMASSE (2005) emphasizes the use of hands-on experiences in science education to provide tangible and contextualized concepts. Hands-on learning is critical in biology since it allows students to engage directly with specimens, models, and apparatus, facilitating better understanding of intricate biological processes (Twoli, 2006). Trowbridge (2004) established that the utilization of physical models, organisms, and interactive materials

enables students to understand phenomena better than discussions without these. The practice of hands-on learning is also supplemented by Maundu, Muthwii, and Sambili (2005), who contend that multiple resources such as textbooks, laboratory equipment, and visual aids are essential for successful instruction in biology.

Woolnough (1985) underscores that practical sessions enable students to work with actual objects and do experiments, leading to improved participation and retention. Where there is a shortage of laboratory equipment in areas, Bhagwan (2005) recommends that practical sessions give students genuine learning activities, which not only improve retention but also facilitate greater conceptual understanding. A laboratory-based biology curriculum, common in most nations, facilitates the development of critical skills through direct experience, thereby preparing the learners for practical tests and fostering lifelong learning.

Teaching Strategies and Learning Approaches in Biology Education

Science is all about comprehending natural phenomena, and this calls for more than mere theoretical knowledge. Garson (1988) suggests that effective science teaching prioritizes observation and hands-on activities over rote memorization. Winn (1993) adds that students come into the classroom with pre-existing knowledge frameworks; thus, science teachers must design lessons that help students integrate new information meaningfully into their existing schemas. By offering diverse and challenging activities, teachers can help students construct knowledge through testing, revising, and adapting their understanding based on new experiences (Twoli, 2006).

The concept of the "zone of proximal development," which describes the range of tasks that a learner can perform with guidance but not independently, is particularly relevant to biology education (Woolnough, 1985). Teachers should adopt teaching approaches that facilitate meaningful engagement, encouraging students to connect concepts with real-life applications and explore biology topics through inquiry-based learning. Practical work, simulations, and group discussions provide the scaffolding that students need to achieve a deeper understanding and develop adaptive skills.

This review of literature identifies the complex challenges confronting students in learning biology, ranging from cognitive impediments and lack of resources to curriculum and instructor effectiveness. This basis informs the current study's objective to analyze these variables within the framework of Pakistani secondary schools, with insights that can inform future educational approaches in science.

Material and Methods

It follows a quantitative approach to research while examining the hurdles that secondary students encounter in biology learning. An emphasis is on the identification of factors that may impede the academic performance as well as learner engagement, notably in the light of public schools in Islamabad, Pakistan. What follows is to outline the study design, target population and the sampling procedure, instrumentation, collection of data and analysis.

Research Design

The study employed a descriptive survey design because it enables the systematic investigation of the perceptions, attitudes, and problems encountered by students in biology. This approach is appropriate for collecting quantitative data from a large

sample, enabling statistical analysis to identify trends and significant factors influencing students' performance in biology.

Population and Sample

The population for this study consists of secondary school students (grades 9 and 10) enrolled in public schools under the Federal Directorate of Education (FDE) in Islamabad. Given the study's focus on low-achieving students, the population was further narrowed to students who scored less than 40% in their terminal biology examinations, as these students are likely to face considerable difficulties with the subject.

A two-stage sampling process was applied:

Stage 1: School Selection – Out of the 164 public secondary schools in Islamabad, 20% were randomly selected, resulting in a sample of 34 schools. This approach ensured a representative sample across urban and rural regions.

Stage 2: Student Selection – Within each selected school, 15% of students from grades 9 and 10 who met the performance criteria (scoring below 40%) were chosen using purposive sampling. This yielded a final sample of 325 students, which is sufficient for meaningful statistical analysis.

Instrumentation

A self-developed questionnaire was used as the primary data collection tool. The questionnaire included 28 closed-ended items designed to capture students' perceptions of various factors related to learning biology, including:

- **Personal Challenges –** Items assessing students' understanding of basic biology concepts, difficulty with terminology, and retention of information.
- **Teacher-Related Factors –** Teacher Effectiveness Questions, Clarity of Instruction, and Supportiveness.
- **Institutional and Resource Factors-** Questions probing the extent of available practical learning facilities, including laboratories, equipment, and instructional aids.
- **Attitudinal Factors –** Items related to students' attitudes towards biology, perceived relevance of the subject, and participation in classroom activities..

The survey was pilot-tested for content relevance and suitability to the target group with the aid of expert review. Pilot testing using a small group of students helped test the item clarity, and adjustments were accordingly made on feedback received.. The reliability of the instrument was calculated using Cronbach's alpha in SPSS, resulting in a satisfactory reliability coefficient of 0.78, indicating internal consistency among the items.

Data Collection

Data collection was carried out within one month. The researcher personally went to each of the selected schools to gather the questionnaires to avoid uniform distribution procedures and minimize non-response bias. Students were instructed clearly on how to complete the questionnaire, and confidentiality was assured to prompt honest answers.

The questionnaires were collected as soon as they were completed to guarantee high rates of responses and data integrity.

Data Analysis

Analysis of data was done using SPSS, applying both descriptive and inferential statistics to investigate the determinants of students' performance and attitudes towards biology. The following statistical methods were used::

1. **Descriptive Statistics –** Mean scores, frequencies, and percentages were computed for every item in order to give a glimpse of students' views of biology learning in different areas.

2. **Independent Sample T-Tests –** T-tests were employed to test for mean differences in responses between various subgroups, e.g., urban and rural students and male and female students, in order to see if statistically significant differences existed based on demographic variables.

3. **Correlation Analysis** Pearson correlation analysis was conducted to investigate the correlations between students' attitudes towards biology, teacher effectiveness, and access to resources, which could offer insights into how these factors may interact to impact academic performance.

These analyses provided an in-depth understanding of student difficulties in biology, with primary factors that should be addressed in order to enhance interest and accomplishment...

Results and Discussion

The next part outlines the results of the study, synopsized and elaborated in detail based on what the 325 students responded. Outcomes are presented according to thematic subdomains regarding students' perceptions of their biology knowledge, support from teachers, learning difficulties, and institutional facilities.

Table 1
Foundational Gaps in Biology Knowledge

Statements	Mean
My basic concepts in biology are weak.	3.56
When the topic is difficult or complicated I usually leave it.	2,48

Students typically have trouble with basic biology concepts, and the average score of 3.56 suggests that most students believe their general biology skills are lacking. Moreover, the average score of 2.48 for avoiding complex subjects indicates an avoidance of difficult material. This highlights a foundational gap in students' understanding, possibly due to insufficient early instruction or lack of reinforcement of core concepts, which may hinder their ability to progress to more advanced topics.

Table 2
Teacher Effectiveness and Student Support

Statements	Mean
Biology teachers make our biology concepts clear.	2.70
Our teacher always makes sure that we understand the lesson.	1.76
I feel comfortable seeking help from teachers whenever I feel difficulty in any topic.	2.28

I like biology but I can't understand the way my teacher teaches.	3.49
Teachers take classes regularly	1.75
My biology teacher has command over the subject	2.63
Our teacher motivates us towards learning.	3.51

Teacher effectiveness appears to be a significant concern. With a mean score of 2.70, students feel their biology teachers do not clarify concepts sufficiently. Similarly, with scores of 1.76 and 2.28, students indicate a lack of support in ensuring comprehension and in providing a comfortable atmosphere for seeking help. Moreover, the mean of 3.49 shows that students who enjoy biology still struggle with the teaching methods, possibly due to a mismatch between teaching styles and student learning preferences. Regular attendance (mean 1.75), perceived subject mastery (2.63), and motivation (3.51) from teachers are also low, pointing toward a need for improvement in both teaching practices and engagement strategies to effectively support student learning in biology.

Table 3
Challenges with Scientific Terminology and Diagrams

Statements	Mean
I feel difficult to understand the terminologies.	2.39
The terminologies in biology are difficult to learn.	2.37
I feel it is difficult to understand and draw diagrams.	2.54
I feel it difficult to remember flow charts.	2.38

While terminology and diagram-related skills are often challenging in biology, the mean scores here (ranging from 2.37 to 2.54) suggest these are moderately difficult areas for students. Although terminology (mean 2.39) and flowchart memorization (2.38) are challenging for some students, these may not be the primary obstacles to their overall learning. This suggests that targeted reinforcement, rather than overhauling instruction, could alleviate these difficulties. Diagrams (2.54) remain slightly challenging, indicating that more support in diagram interpretation and drawing skills might benefit student comprehension.

Table 4
Institutional Resources and Practical Learning

Statement	Mean
Our school provides us with all the learning facilities, labs, and equipment.	2.59

With a mean of 2.59, students express a moderate level of dissatisfaction with the availability of learning facilities, labs, and equipment. This reflects a limitation in institutional resources that could be hindering hands-on, practical learning opportunities. Access to well-equipped labs and resources is crucial for biology, a subject that benefits greatly from practical, experiential learning. The results indicate that enhancing resource availability could potentially improve students' engagement and comprehension of biological concepts.

Table 5
Student Attitudes and Motivation

Statement	Mean
Biology is a boring subject as compared to other subjects.	3.66
I am studying biology but I don't like it.	3.77
I always do selective preparation for exams	3-19

Students' attitudes towards biology seem quite negative, with high mean scores of 3.66 for boredom and 3.77 for disinterest, indicating that many students find biology less engaging compared to other subjects. Additionally, the mean score of 3.19 for selective exam preparation suggests a strategic, minimal approach to studying, possibly due to low motivation and interest. These findings imply a significant motivational barrier in learning biology, emphasizing the need for more engaging, relatable teaching methods that could shift student attitudes positively and encourage deeper, more comprehensive study habits.

Table 6
Classroom Environment and Teacher-Student Interaction

Statement	Mean
I always listen to the teacher and note down important points.	1.74
I understand more properly when the teacher explains in Urdu	1-80
I don't participate and ask questions in class	3.38
Teachers make the class environment comfortable for learning	3.46

The low mean score of 1.74 for active listening and note-taking indicates poor engagement with instructional content. Students also report a slight preference for Urdu explanations (1.80), which might suggest that simpler or more relatable explanations, rather than a language switch, could benefit comprehension. The high mean score of 3.38 for reluctance to participate and ask questions in class points to a lack of active engagement and possibly a fear of judgment. The mean of 3.46 for classroom comfort level shows that students do not find the classroom environment conducive to learning, indicating a need for improvement in fostering a supportive, interactive environment that encourages questions and open communication.

Table 7
Exam Preparedness and Study Habits

Statement	mean
The biological terms used by my teacher are difficult.	3.26
Teachers take a special class in break for slow learners	3.0
Teachers always use a similar method of teaching for all subjects.	2.37
In exams, I attempt all questions completely	2.08

Students find the biological terms used by their teacher challenging (mean 3.26), which may complicate their understanding and exam preparedness. The mean score of 3.02 for additional classes for slow learners suggests some effort by teachers to provide extra support, though it may be inconsistent. However, with a mean of 2.08 for attempting all exam questions, it appears that students often struggle to complete exams fully, perhaps due to inadequate preparation or gaps in understanding. Encouraging comprehensive study habits and providing exam preparation guidance could improve students' exam performance and reduce selective preparation tendencies.

Discussion

This research sheds light on the key influences on secondary students' attainment and experience in biology, such as knowledge gaps in foundational concepts, teacher quality, resource constraints, and student attitude. By linking the findings to extant research, this discussion examines how these influences combine to determine students' participation and achievement in biology, highlighting the requirement for focused interventions to improve biology education.

Student Attitudes and Academic Achievement in Biology

The findings of the study indicate a significantly negative attitude of students towards the subject of biology, with most viewing it as challenging and off-putting. This concurs with Gibbons, Kimmel, and O'Shea's (1997) work, where they established that attitudes of students have direct consequences on their performance in studies, forming a feedback loop where positive attitudes translate into better achievement, and so forth. The average score in this research for student boredom with biology was high, which means that students tend to lack motivation, and this is likely to impact their performance.

Olatunde (2009) is keen to stress that positive attitudes towards science are crucial for enhanced achievement, and Twoli (2006) and Kwale SMASSE (2004) also observed similar trends, specifically highlighting that girls tend to view biology as more difficult than boys. These gendered perceptions were also seen in this research, indicating a need for a more interactive, inclusive teaching style for biology that takes into account socio-cultural and gender dynamics. Adding real-world applications, interactive exercises, and relevant content may assist in changing how students think, making them have a more positive attitude towards the topic and overall enhancing performance..

Influence of Student Characteristics on Achievement

The results highlight that individual student characteristics—such as entry-level knowledge, study habits, peer influence, and aspirations—strongly impact learning outcomes. Many students reported difficulty with foundational biology concepts, which aligns with Kwale SMASSE (2004) and Twoli (2006), who noted that students' prior knowledge, self-perception, and attitudes influence their academic engagement. This study found that students often avoid complex topics due to these gaps, which limits their ability to progress.

Driver (1989) argued that aligning educational goals with student attributes is essential for optimizing learning outcomes. The finding that students with more structured study habits tend to perform better supports Twoli's (2006) assertion that motivated students who dedicate more time to studying biology generally achieve higher results. This indicates that fostering effective study habits and providing remedial support could help students bridge foundational knowledge gaps, allowing them to better engage with advanced biology topics.

Teacher Effectiveness and Student Support in Science Education

The research reveals that students mostly feel that their biology teachers fail to support them, finding little clarity in what is being taught and less than adequate encouragement to ask questions. This finding corroborates with Trowbridge (2004), who wrote that teachers significantly determine students' disposition and achievement in science. Students in this study mostly expressed that they were unhappy with their teachers' practices, corroborating the findings of Fuller (1985) that professional development and in-service training effectively influence teaching practice and students' performance.

The research also concluded that teachers' failure to concisely express biology concepts created a learning hurdle. Stevenson and Stigler (1992) highlight the fact that even though standards outline the structure for education, quality instruction leads students to achieve academic success. This justifies implementing specific teacher

development programs with regard to interactive and student-oriented practices, which can enhance concept clarity and create an encouraging classroom setting. Comber and Keeves (1973) also comment that experienced and informed teachers provide multiple examples and explanations, which help student understanding—an activity that can go some way to preventing the clarity problems mentioned by students in this research.

Resource Availability and Practical Learning in Biology

Findings show that restricted access to practical resources, including laboratory equipment and facilities, remains a major problem for students in the study of biology. The average score for access to practical resources was low, supporting findings by Twoli (2006) and Trowbridge (2004), who emphasize the significance of experimental learning in science education. Practical activities enable students to internalize the concepts by allowing them to get tangible examples, which is imperative in a course like biology with intricate processes and meticulous observation.

Maundu, Muthwii, and Sambili (2005) contend that materials such as laboratory equipment, graphs, and display aids are crucial to efficient biology teaching. This research finds that the lack of these resources hinders students' participation and comprehension, confirming Bhagwan's (2005) observation that hands-on learning activities enhance recall and conceptual understanding. Filling this void by investing in laboratory facilities and online materials, where feasible, would allow for experiential learning by students, most probably boosting understanding and interest in biology.

Instructional Strategies and Learning Approaches in Biology

The research established that students tend to be disengaged as a result of an absence of interactive and diverse teaching approaches, which supports Garson's (1988) argument that efficient science instruction should focus on observation and practical experimentation over repetition. Most of the students in this research were frustrated by unidimensional approaches to teaching, which restricts them from fully comprehending complicated ideas. Winn (1993) claims that students bring pre-existing knowledge structures to class, and good teaching means assisting students in integrating new knowledge in meaningful ways. This outcome supports the literature and proposes that biology teachers need to shift toward constructivist pedagogy that enables students to develop from previous knowledge by actively participating.

The "zone of proximal development" (Woolnough, 1985) is also applicable. By offering supported learning experiences and enabling students to work with concepts with teacher guidance, biology teachers are able to assist students in developing enhanced understanding. Twoli (2006) contends that inquiry learning and practical sessions enhance the achievement of students through enhancing the interaction with materials and concepts. This research lends support to the notion that an inquiry-based and diverse approach might make biology material more accessible and interesting, motivating students to delve into the subject more confidently.

Implications for Biology Education

The results of the present study suggest that enhancing biology education at the secondary school level will involve an integrated approach that addresses various factors at once. By making curriculum content compatible with student characteristics, offering specific teacher training, enhancing availability of resources, and making classrooms

more interactive, schools can enhance the attitudes and performance of students in biology.

The research highlights the fact that closing gaps in basic knowledge through early intervention and scaffolding can boost confidence and allow students to tackle tough material. Moreover, promotion of positive student attitudes through the use of real-world relevance and practical experiences can help de-mystify biology and make it more accessible and relevant. Even teacher efficacy is essential; continuous professional development focused on student-centered teaching approaches will allow teachers to present more stimulating and accessible material. Lastly, investing in laboratory equipment and practical learning materials is crucial to facilitate experiential learning and provide students with the skill sets and knowledge required to pursue science-related careers.

In summary, these findings illustrate the distinct issues of biology learning in Pakistani secondary schools, especially in resource-poor settings. Through the enactment of these interventions, teachers and policymakers can make learning environments more efficient and accessible to address students' intellectual as well as motivational requirements to be better prepared for higher education and science careers.

Conclusions

This research has offered an in-depth analysis of secondary-level students' problems in studying biology in Islamabad's public schools. From a close survey of 325 students, a number of key elements became important to determine why students were having difficulty studying this subject. These include being primarily based on knowledge gaps in the foundations, the efficacy of teachers, limitations of institutional resources, and attitudes of students towards biology. Following, the findings are elaborated in detail, summarizing the main outcomes and their educational implications for biology education..

Foundational Gaps in Biology Knowledge

Most of the surveyed students indicated that they were not confident in their fundamental knowledge of biology concepts, and over half of them reported gaps in foundational knowledge. This reinforces a key obstacle to learning, as students will struggle to understand more advanced material without a solid foundation of basic biological ideas. Their inability to grasp fundamental concepts holds them back and affects their overall performance in biology. It is critical to address these loopholes at an early level to facilitate students' capacity to grasp intricate concepts and gain confidence in the subject.

Teacher Effectiveness and Student Support

The research indicates that the students feel there is a lack of clarity in teaching and a lack of adequate support from instructors. A significant majority of students indicated that the teachers did not make sure everyone understood the concepts or offered adequate support when the students were unable to comprehend challenging concepts. The students also reported that their teachers did not have control over the subject, and this is bound to influence the confidence of the students in learning. These results suggest a call for enhanced teacher training, including explicit explanation of biological principles, interactive pedagogical approaches, and building a supporting atmosphere where students feel comfortable approaching the teacher for help. Good

teaching practices are crucial to inspire students and equip them with the necessary skills to excel in biology.

Challenges with Scientific Terminology and Diagrams

Surprisingly, the students indicated that they did not find biological terminology and diagramming very challenging. This indicates that, although terminologies and diagrams are usually found challenging in the science subjects, they might not necessarily be the biggest challenges here. Yet, terminology could still prove difficult for those students who have poorer foundational skills, as mentioned by those for whom it was difficult. For such students, repetition of terms using visual aids, simplified definitions, and repetition may assist in becoming familiar with the vocabulary of biology.

Institutional Resources and Practical Learning

Another concern of significant magnitude that was emphasized in the findings was the accessibility of facilities such as laboratories, equipment, and instructional aids. The research indicates that most students did not have access to sufficient laboratory facilities, which restricted their exposure to hands-on learning activities that are vital for biology mastery. Practical biology work enables students to practice theoretical knowledge, see biological processes at work, and memorize more efficiently. Lack of hands-on resources limits the capacity of students to interact fully with the topic, leading to a theoretical and isolated grasp of biology. Improving provision of resources, particularly laboratory facilities, may enhance students' participation, understanding, and retention of biological principles.

Student Attitudes and Motivation

Student attitudes toward biology were revealed to be one of the powerful determinants influencing learning outcomes. Most students mentioned that they regard biology as being dull, and a considerable percentage admitted to working on it in the absence of real interest. This negative image is most likely a result of teaching styles failing to render the subject interesting, relevant, and interactive. When students are uninterested or consider the subject as boring, they lose their desire to study and excel, resulting in lower levels of academic attainment. There is an evident requirement to change instructional methods towards more interactive, everyday applications of biology, which can potentially create curiosity and interest in students.

Classroom Environment and Teacher-Student Interaction

The research identified that there was a lack of a supportive class environment and positive interactions with teachers. There were students who felt uneasy about approaching their teachers for assistance, and some indicated that the class environment was not conducive to active learning. The behavior of teachers, such as whether they are approachable and whether the class environment is comfortable, plays a major role in determining whether students engage actively or ask questions or clarification. Creating a more friendly and interactive class environment might heighten student interest, increase the level of accomplishment in school work, and dissipate the apprehension students tend to experience while approaching their educators for help.

Exam Preparedness and Study Habits

Lastly, the research identifies problems regarding exam readiness and selectivestudy practice. Most students indicated that they did not answer all questions on theirexams, possibly because of poor preparation, knowledge gaps, ora strategy of studying only some topics. This indicates a potential lack of thorough study practices and exam techniques among students, possibly as a resultof the broader issues of knowledge gapsandlowmotivation. Promoting extensive study practices and offering advice on test-taking strategies can prove helpful in enhancing students' test performance.

Overall Implications

The results of this research highlight the complex issues confronting students in secondary biology education, and the necessity for interventions at various levels. To enhance student performance, a comprehensive approach is needed—one that involves building foundational biology knowledge, improving teacher effectiveness enhancing access to hands-on resources, promoting positive student attitudes, and developing supportive classroom environments. Through such areas, educationists and officials can strive to create a more interesting and fruitful biology education, which will effectively equip students to achieve academic prosperity and future scopes in science professions.

Recommendations

- **Teacher Training:** Teachers must be trained in interactive and facilitative teaching techniques specific to biology.
- **Enhanced Resources:** Schools should provide laboratories and relevant equipment to support practical learning.
- **Student Support Programs**: Special classes for students struggling in biology, particularly those below the 40% achievement mark, should be instituted.
- **Curriculum Revisions:** Curriculum needs to include practical applications and exercises so that biology becomes more meaningful and interesting to students..

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