ADDRESSING CHALLENGES TO EFFECTIVE LEARNING OF CHEMISTRY SUBJECT IN REMOTE REGIONS OF AFGHNISTAN

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ABSTRACT

Chemistry ought to be taught in high schools and universities because it is one of the basic foundations of the nation's economic prosperity. This study looks for practical barriers to chemistry instruction in high schools in remote regions of Afghanistan. This project involved 586 participants from 11 different high schools. Principals, teachers, lab employees, and students of these high schools have conducted interviews. The study of the data from their interviews makes it clear that significant barriers to learning chemistry have been brought by issues relating to teachers, students, and the environment. To resolve this challenging issue as soon as possible, chemistry teachers, students, school administrators, curriculum developers, non-governmental organizations (NGOs), and the government must work together.

Keywords: Chemistry, Learning; Laboratory, Performance, Variable, Science, Teachers, Students.

Introduction

Education, especially science and technical education, serves as a "factory" for producing the technologists, technicians, craftsmen, and skilled artisans needed to revive the economy of a country and bring about the desired technological advancement, which is crucial for raising the Afghan nation from a "consumer nation" to a "producer nation" and from a "developing nation" to a "developed nation" [1].

Since chemistry is an applied science and comprises the fundamentals of many concepts and occurrences, it is essential to the growth of science and technology. Additionally, it aids people in comprehending a

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culture that is undergoing a technological revolution. Chemistry is a subject that is important in many different fields, including medical and healthcare, environmental science, energy production, materials science, food science, agriculture, engineering cosmetics and personal care products, industrial operations, and education and research. Chemistry is taught at the high school level in Afghanistan for three periods per week to accomplish the following goals: To promote basic literacy in chemistry for socially functional living; to acquire basic chemistry concepts and principles as a presentation for further study; to acquire basic scientific skills and an attitude as a preparation for the industrial and technological applications of chemistry; and to foster and enhance creativity [4]. In summary, chemistry education in Afghanistan offers students the ability to acquire crucial skills and knowledge that can advance their personal growth and that of the country.

An adequate level of scientific and technological skills must be attaining to meet the challenge posed by the constantly changing requirements of the modern workplace in industries and the non-formal sector. Therefore, systems of education and training that successfully address these demands will enhance efforts to combat rising unemployment and the marginalization of the majority of people. By providing the right learning opportunities, we can significantly improve the lives of the unemployed, increase productivity, and lower poverty and unemployment among our young people.

Because of these, science education has been given a top priority on a global scale. Chemistry has been recognized as a very important science subject in the framework of science education, and its significance in the scientific and technical advancement of any country has been widely reported [2]. Chemistry was deemed a required subject among the natural sciences and other science-related courses in the Afghan educational system as a result of the recognition given to it in the development of the individual and the nation [2].

Chemistry instruction should be goal-oriented and student-centered, and this can only be done when the students are willing, the teachers are in good spirits, and the students are being taught utilizing materials and methods [2]. Since students are naturally curious, they must actively participate in the learning process, constantly preparing, testing, speculating, and constructing their particular construct and knowledge, such knowledge can be made valid, significant, and beneficial to people by personalizing it. Students must actively create their awareness and purpose in chemistry [3]. Based on [4], the brain is not a passive consumer of information order to learn with comprehension, the learner must

actively make meaning of what is to be learned in order to support the claim.

Students still do poorly in chemistry and other disciplines, despite the prominence of chemistry in our educational system and researchers' best attempts to raise achievement levels. The lack of resources, limited access to high-quality education, language obstacles, inadequate labs, teachers' attitudes, lack of interest or motivation, lack of syllabus covering, class size, unprofessionalism, teaching methods, and environment are some causes for this failure.

Practical science school allow students to study in a meaningful way, cultivate the abilities and attitudes required to live successfully, and contribute to the growth of society.

Statement of the Problem

The mentioned problems are views as obstacles to efficiently teaching chemistry in high schools. If these difficulties resolved, students will be enthusiastic about the topic of chemistry and will do well in it.

The goal of this study is to examine the obstacles that prevent the effective teaching of chemistry in a 11 chosen schools in Kandahar, Ghazni and Paktika provinces. These obstacles include teacher variables (attitude, training, attendance at chemistry workshops, condition of service), student variables (career choice and attitude), and environmental variables (class size, school location, and lab facilities). The factors mentioned earlier, believed to be some of the causes of the continued decline in student performance in chemistry, should be considered.

Methodology

This work was conducted via a questionnaire. Questionnaires were distributed to 11 administrators, 8 chemistry lab technicians, and 14 chemistry teachers from 11 selected schools in different remote regions of Kandahar, Ghazni and Paktika provinces in Afghanistan. 553 students of same 11 schools also took part in interviews who were chosen randomly. Teachers were asked a series of questions about their qualifications, attitudes, retraining, student discipline preferences, attitudes, and environmental variables, and their responses were recorded and analyzed.

Findings

Attitudes: The attitude of teachers has a significant impact on the success of chemistry instruction through inspiring students, maintaining a good learning atmosphere, offering assistance, adapting to individual needs, never stopping learning, motivating students, and serving as role models.

It was found that the majority of teachers perceive their careers as educators to be temporary stepping stones to greater employment. Some students had the following to say about their attitudes toward chemistry: "I sometimes fail chemistry because it's hard to understand so I don't have much time for it"; "I don't like it too much; I prefer Biology to it".

Non-professionalism: Although it may not be the only factor, non-professionalism among Afghan teachers may be a factor in the country's low success levels. Educational performance of any nation can be influenced by a number of variables, including socioeconomic problems, a lack of funding, shoddy infrastructure, and unstable political conditions. While it is true that a teacher's lack of professionalism can have a negative effect on students' academic performance, it is vital to take the larger Afghani society into account.

According to this study, some teachers who instruct chemistry are not chemistry majors. Another teacher replied, "I read agriculture but was asked to teach chemistry because there were no other teachers," and "I graduated from physics but teach chemistry." There is little doubt that a teacher's lack of professionalism can harm students' academic performance.

Time Constraint:

Time constraints are a serious issue that can keep a syllabus from being finished. Many educational institutions allot a defined amount of time for each subject or course, and if the syllabus is excessively lengthy or difficult, it might not be possible to cover all the material within the allotted time.

When there are additional conflicting goals or subjects that need to be taught, this can be more difficult. To make sure that crucial concepts are taught, teachers and instructors frequently have to make difficult judgments regarding what subject to prioritize and what topics to discard or skim over.

In certain high schools with sizable student populations, courses are organized into sets (class A, B, C, etc.) and have two encounters lasting 35–40 minutes each. Some teachers responded, "It is not possible to cover unless you do some extra work outside of your normal schedule, but I am not ready to do that now," when asked if they could finish their syllabus before the students took their final exams.

The amount of instructional time can also be reduced by unforeseen interruptions like holidays, school closings, or unforeseen incidents. Due to these interruptions, there may be even less time for instruction and learning, which will make it harder to finish the curriculum.

In these situations, teachers may need to modify their pedagogical approaches and come up with novel ways to make the most of

their allotted time. This could entail putting important ideas first, employing effective teaching techniques, offering more materials for independent study, or changing assessment procedures to concentrate on crucial information and abilities.

Overall, when developing their curricula and lesson plans, educators must take time constraints into account. To guarantee that children receive a well-rounded education despite the limitations imposed by time constraints, rigorous planning and adaptability are required.

Chemistry Workshop: A chemistry workshop for chemistry teachers is crucial since it helps them advance their understanding and proficiency in the field. These are some of the main justifications why such workshops are crucial:

1. Knowledge update: The discipline of chemistry is rapidly developing, with new breakthroughs and discoveries being discovered on a regular basis. Workshops give teachers the chance to learn about the most recent advancements in the field, ensuring that they have current information to impart to their students.

2. Developing practical abilities: Chemistry workshops frequently include interactive activities and experiments that help teachers hone their practical skills. As a result, they can carry out experiments and effectively show topics in their own classrooms, which makes studying more interesting for the students.

3. Opportunities for networking: Workshops bring together chemistry professors from various institutions and areas, offering a setting for interaction and cooperation. Teachers can share best practices, learn from one another's experiences, and exchange ideas to ultimately improve their teaching techniques.

4. Pedagogical strategies: Chemistry seminars frequently concentrate on cutting-edge teaching techniques and approaches that can be utilized to help students better understand difficult ideas. Teachers can discover fresh methods for engrossing students, encouraging critical thought, and fostering a deeper comprehension of chemistry concepts.

5. Professional advancement: Attending workshops displays a dedication to one's own professional advancement as a chemistry instructor. It demonstrates a commitment to keeping abreast of professional developments and advancing instructional techniques.

6. Resource sharing: Workshops frequently offer access to resources, like lesson plans, instructional materials, textbooks, software tools, or online learning environments, that can help teachers give excellent chemistry instruction.

7. Motivation and inspiration: Attending a chemistry workshop helps rekindle teachers' passion for their subject by introducing them to fresh viewpoints, ideas, and scientific

discoveries. It can encourage them to investigate various chemistry topics or try out cutting-edge instruction methods.

In general, chemistry workshops are extremely important for equipping chemistry teachers with the most recent information, real-world skills, networking opportunities, pedagogical strategies, and resources. Teachers can improve the quality of chemistry education and eventually encourage students to pursue professions in the subject by making an investment in their professional development.

Five teachers who were conducted interviewed had participated in chemistry-related workshops and seminars. In their opinion, these workshops were highly beneficial for chemistry instructors and should continue in the future. However, three teachers had attended a few workshops, while the others had not. These teachers claim that competent teachers are not introduced to workshops at high schools, but rather that workshops are frequently offered to teachers based on friendship and acquaintance.

Class Size: Depending on a number of variables, the impact of student class size on chemistry learning can vary. Here are a few possible outcomes:

1. Individual Attention: Teachers may provide each student more one-on-one time in smaller classes. This enables individualized training, the resolution of questions, and focused feedback, all of which can improve learning results.

2. Active Participation: Smaller class sizes frequently encourage more student involvement and participation. A stronger knowledge of chemical subjects may result from students feeling more at ease while asking questions, sharing opinions, and taking part in discussions.

3. Opportunities for Collaboration: When there are fewer people in a class, there may be more chances for collaborative learning activities like group projects or peer interactions. This can improve teamwork abilities and present several angles on problem-solving.

4. Smaller class sizes enable teachers to develop stronger connections with their students. This can foster a positive learning atmosphere where students feel appreciated and inspired to succeed in chemistry.

5. Classroom management: It can be difficult for teachers to control larger classes, which results in less time being spent on providing specialized education or attending to particular student needs. Smaller class sizes may provide teachers more control over the dynamics of the classroom, allowing them to adjust their teaching methods as necessary.

6. Resource Distribution: Smaller class sizes might make it possible to distribute resources like lab supplies or experiment-

related supplies more effectively. Students may have access to more relevant resources and more hands-on experiences, which will help them better comprehend the applications of chemistry.

In this study, teachers were questioned about how much the size of their class affected their ability to teach. Their remarks were as follows: "I teach three classes with an average of 50 students each, which has a negative impact on my efficiency because, first, class management is a challenge, and second, I can't be certain whether each student is understanding or participating in the learning process." A different teacher retorted, "I have a total of 60 students in each of the classes I teach, so I spend a lot of time controlling the class and the actual time for teaching is very small, and this affects the students' performances in their final exams."

Conditions of service/ Remunerations: Most teachers' morale has been ruined by poor pay and employee welfare. Poor working and wage conditions for teachers are a severe issue in many countries, particularly Afghanistan. Here are some problems that teachers run through regularly:

1. Low salary: Compared to other occupations with comparable educational requirements, teachers frequently make less money. Financial hardships and instructor unhappiness may result from this.

2. Lack of benefits: Many instructors do not receive enough perks like paid time off or health insurance. Their general well-being may be negatively impacted by this lack of assistance.

3. Overwhelming workload: Teachers frequently face overwhelming workloads, which include extended working hours, in-depth lesson planning, evaluating assignments, and extracurricular activities. Despite the difficulty of their work, individuals might not get paid fairly for the extra time and effort they put in.

4. There may occasionally be few chances for teachers to expand their careers or pursue professional development. This lack of opportunities for progress may result in demotivation and a drop in job satisfaction.

5. Inadequate resources: Many schools lack the necessary supplies, including books, teaching aids, computers, and classroom equipment. This makes it difficult for teachers to provide high-quality instruction and has an influence on their capacity to engage students successfully.

6. Lack of support staff: Teachers frequently have to do administrative duties like clerical work or addressing student behavior issues that may be assigned to support staff. Teachers' workloads are increased and their ability to concentrate on teaching is hampered by a lack of sufficient support personnel.

A multifaceted strategy including government regulations, educational authorities, school boards, and teacher unions is necessary to address these problems. Prioritizing teachers' well-being and professional development requires fair compensation packages, improved working conditions, opportunities for career advancement and professional development, access to necessary resources, and appreciation of their contributions to society.

Inadequate infrastructure: Inadequate infrastructure, such as schools and educational institutions, is lacking in many rural parts of Afghanistan. Due of this, it is difficult to hire and keep talented teachers because they often choose to work in locations with superior amenities and resources.

Laboratory Adequacy: Chemistry is a subject that necessitates a lot of demonstrations and is best taught in a laboratory for easy access to instructional materials; yet, the majority of schools lack the necessary equipment. Lab adequacy in chemistry education refers to the availability and caliber of laboratory materials, apparatus, and facilities that facilitate practical learning experiences and hands-on experimentation. Adequate labs can have a big impact on students' understanding, engagement, and overall learning results in chemistry classes. A few of the results are:

1. Enhanced understanding: Laboratory exercises provide students the chance to put the theoretical ideas they've learned in class to use in practical settings. Students can witness chemical reactions, control factors, gather data, and assess outcomes through hands-on experimentation. This active participation encourages a deeper comprehension of ideas and principles.

2. Improved retention: When compared to passive learning techniques, laboratory activities in the classroom help students remember material better. Conducting experiments involves visual observation, tactile experience, and critical thinking, which improves memory retention.

3. Development of scientific skills: Students can learn crucial scientific skills including observation, measurement, data analysis, problem-solving, critical thinking, and teamwork by having adequate labs. These abilities are essential for success in chemistry as well as other scientific fields.

4. Increased motivation and interest: Students' curiosity and interest can be stimulated in well-stocked laboratories with cutting-edge equipment and resources. Participating in practical activities piques their interest in chemical phenomena and motivates them to learn more. This heightened curiosity may inspire greater motivation to learn chemistry.

5. Preparation for future careers: A well-equipped lab environment gives students the hands-on training they need to be ready for professions in chemistry-related fields or scientific research. They have a competitive advantage while pursuing higher education or entering the workforce since they are familiar with laboratory procedures and tools.

6. Safety awareness: Adequate labs have safety features like sufficient ventilation systems, protective gear like goggles, emergency procedures, and trained staff. When working with chemicals or carrying out experiments on their own, students who learn chemistry in well-equipped labs develop a strong sense of safety awareness.

7. Enhanced problem-solving abilities: It's common practice in laboratories to troubleshoot and overcome obstacles. Students gain knowledge on how to spot mistakes, fix them, make changes, and resolve issues that arise during experiments. These problem-solving abilities can be used to many facets of life.

In conclusion, adequate labs in chemistry classes benefit students' comprehension, retention, development of scientific skills, enthusiasm, and motivation as well as their readiness for careers, knowledge of safety issues, and problem-solving skills. It fosters a thorough and useful comprehension of the subject, which is vital.

One of the students said “I started offering chemistry because I wanted to study science, but there is no lab and no teacher here. Regarding the same subject, another student stated, "I am about to graduate from 12th grade and we have just been introduced to the lab, but I cannot stand the experiment because the place is not favorable. We simply heard about a chemistry lab. Some students at the same school claimed there was no lab because "it's still being built and we've never done any practical since we started teaching sciences."

Some teachers stated, "We have a temporary laboratory and it's not well equipped, the place is not conducive and this makes the student not to concentrate during practical lessons."

Discussion

From the results, it is clear that teaching has become little more than a transportation job. They lack passion for teaching because they are waiting for better careers. The manner they teach their courses reflects this mentality, which has a negative impact on the performance of the students. The study clearly shows that students' poor attitudes toward chemistry were

frequently the cause of the poor performance we see now, which is in line with the claims made by Ojo [5] and Adesokan [6].

The study also demonstrated that one of the primary challenge for chemistry teaching is time restrictions. It is the cause of the lack of science practical and the neglect of the curricula. Students are also discouraged by the level of concentration necessary since they are unwilling to give up time that could be spent doing other things. Because the teacher is unable to complete any worthwhile practical within the time permitted, the time allotted for each session and the number of times devoted to chemistry each week are often insufficient for successful learning. Chemistry student performance is alleged to suffer as a result of the environment, or laboratory suitability [7].

According to this survey, some students believed that if they had been introduced to practical learning earlier, they would have performed better. This is consistent with Farounbi's [8] claim that using laboratories in the scientific classroom helps students comprehend and retain what they see more so than what they hear, but that most schools lack functional laboratories.

Regarding the impact of examination dishonesty, some respondents claimed that it has negatively impacted students' performance in the sciences in general as well as in chemistry. It is clear that students who did not learn cannot perform, and since exams are still a common way to gauge performance, particularly in our society. As a result, teachers who did not do their work well—possibly due to a lack of time—but wanted to please the school and the parents engaged in exam malpractice, resulting in students who appeared colorful but lacked solid subject knowledge. The students are aware that even if they are not serious and diligent in their studies, their parents or teachers will nonetheless require them to pass the final exam. These results support those of Almulla [9].

The majority of respondents also cited class size as a significant barrier to effective teaching and learning. In order for the majority of the issues in chemistry to be fully comprehended, it is necessary to engage the students. However, this is extremely challenging in large classes. This is in line with what Onocha [10] discovered, which is that big class sizes discourage serious academic effort.

Particularly in chemistry, non-professionalism is the norm. Most graduates either declare they are teachers or are required to teach any topic. There have been instances where engineers have claimed they can teach physics, math, and chemistry more effectively than people who have had formal training in the subject and are often required to do so.

One of the variables that causes most instructors to divert from their core task and engage in other pursuits that will raise their standard of living has also been recognized as poor remuneration. People who are incapable of working in the commercial world are discouraged; they keep complaining and looking for better jobs. Private school students believe they are being taken advantage of. Such a mindset makes it impossible for anyone to work effectively, which ostensibly leads to the kids performing poorly.

Conclusion

This study has shown that the school environment and teacher-related elements, such as attitude, time, compensation, and laboratory suitability, pose significant obstacles to effective chemistry instruction and have a significant impact on students' success in the subject. These elements both directly and indirectly highlight problems that must be solved in order to improve students' chemistry learning results. Student achievement will undoubtedly increase if the government and other education sector stakeholders can enhance the learning environment for students and inspire the teachers who carry out the curriculum.

In conclusion, there are a number of challenges that prevent effective education delivery when teaching chemistry in high schools in remote regions of Afghanistan.

Recommendations

Several possible recommendations can be put into practice in order to properly handle these challenges.

1. Increased funding is required for infrastructure development, including the construction of modern laboratories and the allocation of necessary materials. This would make it possible for students to conduct real-world experiments and improve their comprehension of chemistry ideas.

2. In rural places, efforts should be made to recruit and keep qualified chemistry teachers. Incentives including increased pay, chances for professional growth, and better living conditions can assist educators decide to work in these areas despite their reluctance.

In addition, community involvement initiatives should be started to spread the word about the value of chemistry education for both boys and girls. More students can be inspired to study science by removing cultural obstacles and encouraging diversity.

3. Ensuring a safe learning environment through enhanced security measures is crucial. Collaborative efforts between local

communities, educational institutions, and government authorities can help mitigate security concerns and provide a conducive atmosphere for teaching and learning.

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