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Interest of Senior Secondary Students in Physics Topics with Biological Science.

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Abstract.

This project introduces the electricity concept from a senior secondary school physics class for biological along with health science learners. These pupils think that their future careers or professional lives are unrelated to physics. They believe that they cannot succeed in the subject unless they memorise several mathematical formulae and use them during the exam. By demonstrating the role of electricity in biological processes, we were able to demonstrate the connection between physics with biological and health sciences. The examples and situations provided in class have been found to affect how students' views. It can be quite difficult to tell if physics or biological sciences is the cause of a problem since the process of researching biological sciences in relation to physics is highly intricate. This is valid for all research techniques, including those that include observation, the identification of fresh scientific facts, measurement, and mistake correction. These issues are not included in conventional physics and biological science curriculum, despite their critical relevance.

Keywords: Physics, Interest on Physics, Biological science, Interdisciplinary Physics Learning.

Introduction

Science is a challenging subject to teach and study in senior secondary school in India, for both students and instructors. This is largely due to the misconception that science is unrelated to daily life held by the majority of students. This is further exacerbated either by propensity of several teachers to use traditional teaching methods that require the student to be a passive receiver of data while the teacher imparts knowledge.

Teaching these subjects is made more difficult by the high level of abstraction of the theoretical foundations in physics, specially electricity, and the use of mathematics as the common language for describing numerous manifestations that may be encountered in nature in addition to in daily life within a few equations. Additionally, teachers must deal with the learning issues that arise from students' experience in math classes. It is evident that new resources must be employed in the design and implementation of novel teaching methodologies, including the establishment of suitable learning settings and relevant tools like technology for information(data) and communication (ICT). This allows for both meaningful with useful learning and the motivation of students to seek out scientific explanations for what they see in their environment while attempting to make connections to their interests.

This is likely the only Physics course that Biological & Health Sciences majors will ever take; this includes those who intend to pursue jobs in biology, dentistry, pharmacy, nutrition, psychiatry, and other related fields after graduation.

Since most of the illustrations provided in subject of physics classes are connected to engineering and with physics, this group of learners generally believes that physics is neither important or beneficial for their vocations or professional lives. This kind of thinking results in a generalised lack of desire, and many of them merely attend classes in order to get a decent mark, regardless of whether they learn anything or not.

Because physics is associated with solving mathematical problem that don't require understanding to obtain the correct answer, the majority of students studying biological as well as health sciences believe that they are bad at it. Because they are only concerned with getting promoted, they easily forget everything linked to this topic of the subject.

We are aware that the learning occurs when a student/pupil has a genuine want to learn something important, is enthusiastic about the topic, and believes they are capable of comprehending and understanding the material. As a result, the teacher's first task is to persuade the students of the subject's value and their suitability for learning it.

In this approach, we suggest a course that utilises the application of physics to biological along with health sciences to enhance the development of meaningful topic learning. With the aid of this proposal, we intend to assist students in forming connections between physics with their areas of interest, enabling them to connect physics to real-world scenarios of everyday professional life. It frequently gives students the chance to work, think, and make the precise connections between Physics and Life Sciences that they need to understand to improve as professionals.

Proposal of the study

A more interesting class is recommended to pique this same students' interest. In this class, the teacher acts as a facilitator who promotes peer discussion and collaborative work, encourages learning experience based on experiences, and enables the student to comprehend the precise relationship between Physics as well as their personal and professional interests.

The important physics concepts in this work are connected to problems in the biological and health sciences. The two two-hour lessons each week for this course are separated into theory & laboratory.

The majority of the lab session are designed to introduce the subject and pique students' curiosity.

We believe that this group of students' wrong attitude and decreased standards regarding physics may be changed if the instructor provides examples of physics that can be tied to topics of interest in their jobs and exhibits significant expectations in their learning. As a result, the cornerstone of this activity is contextual relevance and good communication of a teacher's goals for student performance. This is designed to alter how they see themselves and improve how they feel about the topic.

Understanding, not information transmission or instruction, should be the focus of this problem's investigation in the educational setting. Given the way in which a teen's brain develops, several studies point out the significance of using leisure activities and emotional connections while teaching experimental sciences. According to Johan Huizinga, we learn more effectively when we are happy. The game "permeates every human representations and their relationships with the outside world, determines human behaviour and growth in social, cultural, emotional, and of course, educational abilities, all of which are tied to the production of knowledge," according to this author.

If we want to comprehend humans as playful, biological, sociological, and cultural subjects, we must entirely rethink the concept of education, which would be closely tied to that of instruction. Instead, we should emphasise education, understanding human growth, which must favour joyful group activities, and knowledge. In this project, certain exercises were put into place with the intention of inspiring the students and making it easier for them to understand topics that required a high degree of abstraction. This was done with the presumption that the use of play-based approaches may be highly beneficial in the pursuit of meaningful learning.

In order to promote meaningful learning, we use differentiated instruction, which tends to focus instruction on real teaching experiences that need to be persistent, important parameter in assessing, and where the student could perhaps learn by participating in the same types of activities as experts in many different fields of knowledge. When pupils adopt cultural practises and skills and feel at ease dealing with more seasoned individuals, learning means that the symbolism and signals of the society and culture group to which they belong are comprehended and absorbed.

The following are a few pedagogic techniques used in this work to encourage meaningful learning that are based on experience or contextual learning:

1) Case study
2) On-site or practise learning in actual situations.
3) Collaborate in teams.
4) Location of exercises, displays, and simulations

All of them emphasise the development of high-level thinking skills, engagement in social behaviours, and the production of knowledge through application to real-world circumstances.

Physics experimentation

Experimentation may be a crucial teaching tool for physics classes that promotes learning.

The experiment exposes the learner to the physical phenomena under study and inspires the creation of a formalism. Both quantitative and qualitative experimentation fosters curiosity, promotes debate, necessitates introspection, the realisation of hypotheses, as well as a critical spirit. It also fosters the capacity to accurately and thoroughly examine data. Research in general, since experimentation is important but not the primary approach, should be held responsible for the peculiarities rather than just experimentation. Additionally, it helps students expand their perspectives on science and technology.

Although it is important to incorporate experimental activity into the teaching in physics, many courses frequently separate theory and laboratory. The laboratory is the excellent setting for learning how to apply information in practical settings, as well as for quantitative demonstration through experimentation, concept clarification, and law induction or verification. On the other side, a teacher's desire to engage in experimental activities frequently wanes when he lacks the resources, time, or access to a suitable classroom.

It should be mentioned that, when done properly, experimental activities may be an effective motivator for children to develop a good attitude toward science. Through observation, teachers may help students build streamlined explanatory models that, with the aid of the instructor, can move the model closer to the scientific model. The best results are obtained when theory and practise are combined.

Working Conditions

The teacher got the kids interested right away by asking them questions about their daily lives to help them draw the dots between their ideas of what is occurring in nature and the principles of physics.

By arguing the perception of the important phrases that students used to explain the questions during the dialogue and that the instructor notes on the whiteboard, the construction of the physical concepts is ongoing. At the completion of the activity, each student enters the scientific concept and significance they learnt in class into their individual notebook.

As was said before, it is commonly recognised that playing is one of the finest methods to learn, and the laboratory makes use of activities that have an emotional component. Small obstacles provided by the teacher allow the kids to learn why that is occurring. This scenario is presented in a lab setting using reasonably priced items that are readily available. After completing the task, the student is required to interpret the situation physically. The teacher leads them throughout the entire procedure.

With a batteries, a fluorescent lamp, and some cords, the students collaborate in small groups to find out how to turn the light on. At first, they are quite intrigued since they have never encountered something like, but they work to grasp how each component behaves and how they all function together. The kids are then faced with a new problem, one that requires them to think critically and collaborate with others, as they must switch on two light bulbs using just one battery and fewer wires. We were able to determine the theory underlying those circumstances by the conclusion of the lesson. We now possess a mathematical model that can predict how the series and parallel connections behave differently, which is evident in the way they operate. The teacher allowed the pupils to relate this idea to everyday objects, such as medical equipment and the interactions of some creatures, such sharks and eels, in real life.

Two PhET Simulation models must be finished by the students as homework on a computer, laptop, or smartphone. The activities they must do in each simulation are laid out in a guide by the teacher, but they are allowed to alter any of it as they see appropriate. They also have to make observations of what they are occurring and compare them to the actual situation they observed in the lab. Although all the factors are changeable, the sole suggestion is to alter one at a time, see what occurs, and record it for discussion later.

The teacher connects these end results the with proof and phenomena and theories the student have studied in previous classes while discussing the end numbers with both the class and providing assistance with any issues that may arise.

A role-playing game called "Medical Symposium" is another activity that produced positive effects. The Gamification philosophy is used to guide this exercise, which requires students to dress as physicians by donning white lab coats. Before the exercise, the teacher assigns readings about the usage of electricity inside the medical setting to the students.

They work together as specialists in diverse teams on the day of the healthcare symposium. Discussing the topic with others, outlining significant ideas, and as much as possible simplification of the information are the objectives. The objective at this point is to educate the rest of the group on a certain subject and get to know someone else. After that, one member of each group now forms a new team with individuals who have different "specialties." A few volunteers deliver the topics to the rest of the class toward the end of the lecture. The student may then decide which Physical ideas are the most crucial and organise the data into a conceptual framework, infographic, or other type of learning resource as homework to publish to Google Classroom.

Results of the study

One pretest and one posttest were used; the posttest was administered after the conclusion of our proposal. Despite their differences, they both require the same ideas and expertise. Figure 1 below shows the improvement in idea utilisation. The student group had a mean total result of 6.30 on the pretest, and a mean total result of 8.65 on the posttest. Each examination, pretest, and also posttest had 20 questions for the group of 50 senior secondary school students we worked with, who were between the ages of 17 and 18. A Google Formula containing four response alternatives and a predetermined timeframe for receiving replies was the tool we utilised to administer the examinations.

Utilizing applications relevant to the life sciences was a very effective way to increase motivation and concentrate students' interests. The electrostatic attraction and the quantity of ions on each of the membrane's sides were related to the membrane potential. Students were astounded to discover that positive charges have the capacity to differ. The nerve impulse was related to the mathematical model created by Hodgkin as well as Huxley, which equated the membrane permeability to a capacitor as well as the sodium sensitive channel to variable resistors. The perusal of a scientific report by Lamberti and Rodriguez and the discussions of each of the numbers piqued the students' curiosity. The "Medical Symposium" included a discussion of the usage of defibrillators and the significance of the cardiac ECG.

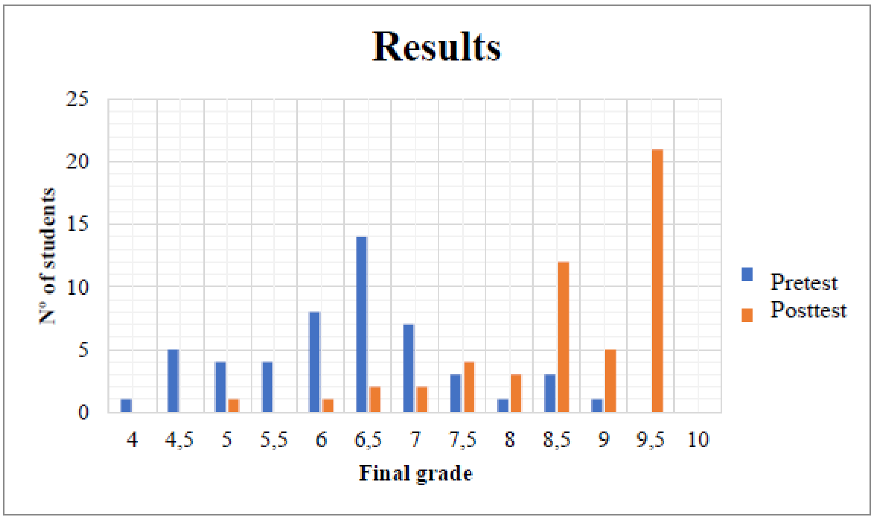

Figure 1: Results, ultimate grade for the student, both a pre- and post-test.

Students responded favourably to the idea, as seen by the end course assessment (Figure-1), which is completed anonymously and without fear that their response would effect their grade. Here are some students' last impressions of the course:

First Student "The lessons' lack of monotony pleased me. We engaged in several things. The instructor didn't just talk nonstop."

Student 2: "Compared to my prior classes, this one allowed me to have fun while being incredibly didactic, thorough, and easy to follow."

Student No. 3 "being able to learn through experiments that clarify the theoretical lessons. I enjoy learning."

Student No. 4 "The teacher's lessons on each subject were extremely clear. Different everyday life applications were taught to us. I particularly liked how the teacher connected the ideas in our subject area."

It should be noted that when students saw that they could comprehend physics principles and apply them to the fields of biology and health sciences, their apathy in physics study decreased and they gained greater self-confidence about their learning and aspirations. With regard to everything previously discussed, we believe that the inquiry line of the project has produced positive findings and is a great approach to engage students in physics since they can clearly understand how physics will affect their future professional careers.

Conclusion

It should be emphasized that students' disinterest in physics studies diminished and their self confidence in their topic learning and goals increased when they were realised they could understand physics concepts and relate them to the domains of biology & health sciences. Regarding everything previously mentioned, we think that the project's inquiry line has yielded encouraging final results and is a terrific ways to interest students/pupils in physicists since they can easily see how physics will impact their future professional jobs.

Young people find the themes most intriguing when they connect to fields that are essentially distinct from one another, including such physics and biological science. Our findings suggest that when attempting to address the interest issue, a multidisciplinary course is superior to a disciplinary one. Students are attracted to odd labs and their findings.

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Conflict of Interest

The authors declare that they have no conflicts of interest in this work.

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