



The Importance of Teaching Electromagnetic Radiation Interaction in High Schools

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Abstract

The advantages of including electromagnetic radiation interaction in the high school curriculum are thoroughly analyzed in this work. The possible effects on students' knowledge of fundamental physics ideas and their capacity to apply these ideas in practical situations are investigated in this study. The study underlines the need to arm pupils with a thorough knowledge of electromagnetic radiation by analyzing the present educational scene and high school science teachers' difficulties. The methods used in this paper include a critical review of the literature with a qualitative approach, an examination of educational impacts, a discussion of practical applications, an analysis of future implications, and educational recommendations. Moreover, the conversation will cover the possible consequences for academic interests and future professional paths for students with a strong background in this field. Using critical analysis of current literature and instructional strategies, this paper seeks to promote a more solid way to teach electromagnetic radiation interaction at the high school level. Therefore, the article will lead readers through a rational sequence of ideas and data to support this significant educational project.

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INTRODUCTION

Students often face significant challenges in understanding electromagnetic radiation due to its abstract nature and the complexity of its interactions with matter. One major problem is the difficulty in grasping the fundamental characteristics of electromagnetic waves, such as wavelength, frequency, and speed, and how these properties interrelate through the wave equation. Misunderstandings about the electromagnetic spectrum and the behavior of different types of electromagnetic radiation, from radio waves to gamma rays, further complicate their learning process. Additionally, students struggle with the practical applications and real-world examples of electromagnetic radiation, which are crucial for developing analytical and problem-solving skills. For instance, understanding how various light wavelengths are used in astronomy to explore the

universe can be challenging without proper instructional interventions. Conceptual difficulties are also evident in interpreting electromagnetic spectrum diagrams, which can hinder students' ability to appreciate the broader implications of electromagnetic radiation. To address these issues, focused instructional strategies, such as the Electromagnetic Spectrum Literacy Rubric, can help improve students' comprehension and overcome these conceptual barriers. By integrating these strategies into the high school curriculum, educators can enhance scientific literacy and prepare students for future academic and professional endeavors in STEM fields.

Given modern society's increasing reliance on technology, high school students must comprehensively understand electromagnetic radiation interaction. From using X-rays in medical

imaging to radio waves for communication, electromagnetic radiation is pivotal in numerous aspects of our daily lives. By teaching students how electromagnetic radiation interacts with matter, we can equip them with a deeper understanding of the world around them and prepare them for future careers in science and technology. Concepts such as electromagnetic waves' absorption, reflection, and refraction are theoretical ideas and practical applications that students can appreciate. Therefore, integrating courses on electromagnetic radiation interaction into the high school curriculum can lay a solid foundation for students to pursue further studies in STEM subjects. This, in turn, can inspire and empower them, instilling confidence and motivation to contribute to future technological advancements and fostering a sense of hope and inspiration about the impact of the curriculum change.

Awareness of electromagnetic radiation's relevance in high school education requires an awareness of its baseline data. As (Savage and Gilbertson, 2023) clarify, electromagnetic radiation spans a broad spectrum of energy waves, from radio to gamma rays, each with unique characteristics and interactions. Through interacting with this fundamental knowledge, students can recognize the possible hazards and advantages of contact with different forms of electromagnetic radiation. It is about knowing the science and knowing how to use it sensibly. Furthermore, (Sholichah et al., 2023) stress integrating digital resources in teaching material on electromagnetic radiation, thereby underlining the changing function of digitalization in education. This junction of science education and technology gives students creative means to investigate electromagnetic radiation interaction, improving their knowledge of practical uses and safety issues. Therefore, a thorough awareness of the prior knowledge of electromagnetic radiation provides a solid basis for high school pupils to negotiate the complexity of this fundamental scientific idea efficiently.

One must be aware of electromagnetic radiation interaction if one is to have a complete comprehension of many scientific principles. Under this framework, students can study the behavior of light, the characteristics of waves, and the principles of electricity and magnetism. Students can understand practical applications in technology, communication, and medical images by exploring the complex interaction between electromagnetic waves and materials. Moreover, a thorough knowledge of electromagnetic radiation interaction prepares one for more sophisticated physics, engineering, and astronomy research. High school exposure to this idea sharpens critical thinking and problem-solving abilities necessary for academic

and professional success in STEM subjects, enhancing knowledge. Our teachers must provide pupils with the means to understand and use electromagnetic radiation for the next invention and discovery.

High school pupils' scientific literacy and knowledge of the natural world depend on their being exposed to electromagnetic radiation interaction (Zloklikovits & Hopf, 2021). Examining the behavior of light, the features of different kinds of waves, and the interaction between electromagnetic radiation and matter helps students build a strong basis in physics and chemistry. This knowledge is helpful for everyone trying to make wise decisions regarding their health, technology use, and environmental impact, as well as those working in the STEM disciplines. Furthermore, including this subject in high school can inspire pupils to investigate the basic ideas controlling the universe and develop their critical thinking abilities (Zloklikovits & Hopf, 2019). It teaches pupils to be knowledgeable citizens in an ever-technologically complicated environment and lays the foundation for further advanced college courses (Suárez et al., 2023).

Students who want to understand the basic scientific ideas guiding our civilization must first master electromagnetic radiation interaction in high school. Students must be ready to negotiate and understand their environment since their dependence on technology and the ubiquity of electromagnetic radiation define their daily lives. Learning about the characteristics of light, the electromagnetic spectrum, and how different materials interact with radiation helps students better value these ideas' uses in many spheres, including medical imaging and telecommunications. Furthermore, including this subject in high school develops analytical skills, critical thinking, and problem-solving abilities necessary for success in the twenty-first-century workforce. It enables students to probe questions, look for answers, and consider critically how electromagnetic radiation could affect the environment and society (National Research Council, 2012). Teaching high school pupils about electromagnetic radiation interaction is essential and necessary for producing a scientifically educated and critical-thinking populace.

Teachers can pique interest, foster analytical thinking, and set the foundation for the next academic and career success by exposing pupils to the basic ideas of physics and chemistry connected to electromagnetic radiation. This subject gives students the tools to comprehend and negotiate our technologically driven society, enabling them to make wise choices about their use of technology, environment, and health. Including electromagnetic

radiation interaction in high school, courses help us invest in our country's intellectual and scientific capacity.

A research question for this study is how the inclusion of electromagnetic radiation interaction in high school curricula impacts students' critical thinking, problem-solving skills, and preparation for further STEM education. Another question is whether the practical applications of electromagnetic radiation must be effectively integrated into high school education.

RESEARCH METHOD

The significance and effects of adding electromagnetic radiation interaction in high school curricula are investigated in this work using different methods. These methods are meant to give a complete awareness of the topic and its consequences for students' academic and career paths. This work mainly employs a critical study of present literature using a qualitative approach and instructional methodologies as one of the main tools. Reviewing the current research and teaching strategies has helped to find areas of weakness and potential for high school-level electromagnetic radiation instruction. This approach clarifies the present scene of education and the difficulties high school science teachers face. The research also looks at how teaching electromagnetic radiation to students could affect their grasp of basic physics ideas and their capacity to be applied in functional contexts. Examining how exposure to these concepts might improve students' critical thinking, problem-solving skills, and preparation for further STEM degrees is part of this.

Another method was to examine the valuable applications of electromagnetic radiation in many spheres, including medical imaging, environmental monitoring, and communication technology. The article seeks to make the subject more relevant and exciting for students by showing how these ideas are applied in practical situations. This strategy also emphasizes the value of these technologies in society and their capacity to pique curiosity in allied employment disciplines.

In summary, this study began by critically reviewing existing literature using a qualitative approach. This helped identify weaknesses and potential areas for improvement in high school-level electromagnetic radiation instruction. It follows an examination of the current teaching strategies and the challenges high school science teachers face in conveying electromagnetic radiation concepts. In the next step, the study assessed how teaching electromagnetic radiation affects students' understanding of fundamental physics concepts and their application in practical contexts. Finally, the study advises including

electromagnetic radiation interaction in the high school curriculum. These suggestions rely on evaluating present teaching strategies and the advantages of teaching this topic. Techniques have been proposed for educators to properly transmit these ideas and produce a critical-thinking, scientifically minded population.

RESULT AND DISCUSSION

Electromagnetic Radiation

To grasp many scientific fields, students must first understand the basics of electromagnetic radiation. Students who understand ideas like the electromagnetic spectrum, wavelength, frequency, and the behavior of light will be able to value better the interactions among physics, chemistry, and biology. For example, knowing how electromagnetic radiation interacts with materials is vital for medical imaging, environmental science, and telecommunications. Students would struggle to grasp complicated events such as the greenhouse effect, radio wave propagation, or MRI machine operation without a strong basis in electromagnetic radiation. Thus, including courses on electromagnetic radiation interaction in high school curricula helps to promote scientific literacy and prepares the foundation for the next academic endeavors and professional paths in STEM sectors. Moreover, teaching pupils about electromagnetic radiation's characteristics and actions might help them develop critical thinking and problem-solving capacities. Real-world examples and valuable applications of electromagnetic radiation help students acquire analytical abilities to assess and understand complicated data. For example, knowing how various light wavelengths are utilized in astronomy to investigate the universe will inspire students to use scientific ideas imaginatively and apply them to complex challenges. Furthermore, knowledge of the interaction of electromagnetic radiation with matter might inspire students to consider critically how technology shapes their surroundings and society (Pathak & Burkholder, 2021). Including electromagnetic radiation in high school courses can help teachers improve the scientific understanding of their pupils and foster their capacity for critical thinking, creativity, and adaptation to a constantly changing world.

From radio waves to gamma rays, electromagnetic radiation is defined as a broad spectrum of events all driven across space at the speed of light. One of its main features is the capacity of electromagnetic radiation to pass across a vacuum—that is, outer space—without requiring a medium. Unlike mechanical waves—like sound waves—which depend on a material medium for propagation—this characteristic distinguishes it. Furthermore, electromagnetic radiation can show

wave-like and particle-like behavior depending on the experiment. An essential feature of quantum physics that underlies our present knowledge of the behavior of electromagnetic radiation, wave-particle duality captures this duality. Appreciating the consequences of electromagnetic radiation interaction in several scientific fields requires an awareness of these defining traits. The dual nature of electromagnetic radiation—behavior as waves and particles depending on the context of observation—defines it. The well-known double-slit experiment, in which photons, particles of light, show wave-like interference patterns when passed between a pair of slits, wonderfully shows this duality. A fundamental characteristic of quantum physics, this wave-particle duality questions conventional ideas of particle behavior and generates fresh theoretical models to explain the quantum-level behavior of electromagnetic radiation. Understanding and investigating this dual nature helps students to value the variety and richness of electromagnetic radiation and its interactions with matter (National Research Council, 2012).

Students who want to understand the spectrum of events occurring in the natural environment must first grasp the several forms of electromagnetic radiation. The only form of radiation the human eye detects is visible light, a tiny fraction of the electromagnetic spectrum. Because they can travel great distances over the atmosphere, radio waves—used in radar systems and communication—have quite different properties. Conversely, X-rays are perfect for medical imaging applications such as tumor or fracture detection since they have the shortest wavelengths and most excellent frequencies. Understanding these several forms of electromagnetic radiation helps pupils to appreciate their part in daily life and scientific progress. Including this information in the high school course will help pupils prepare for their future in scientific and technology domains.

The fundamental characteristics of electromagnetic waves—which define them—are wavelength, frequency, and speed. In a wave, the wavelength is its spatial extent—the distance between two successive crests or troughs. Conversely, frequency—which defines the wave's intensity—is the count of wave cycles passing a particular spot in one second. Commonly expressed as the speed of light in a vacuum, electromagnetic waves' speed is a constant value crucial in many physical events. The wave equation links these characteristics by having a speed equal to frequency times wavelength. Knowing these characteristics helps one to manipulate and control electromagnetic waves, facilitating communication, technology, and scientific growth of knowledge.

Teaching high school students these ideas help them to understand the electromagnetic spectrum and its consequences on the surroundings. Understanding these characteristics lays a strong platform for future scientific activities and helps one explore the interaction between electromagnetic radiation and other elements.

The basic ideas of physics depend on an awareness of the behavior of electromagnetic radiation in many media. Because of the different qualities of the media, electromagnetic radiation—including light—travels from one medium to another with changes in speed and direction. Snell's Law connects the angles of incidence and refraction to the refractive indices of the media involved, controlling this phenomenon known as refraction. Furthermore, the absorption and transmission of electromagnetic radiation in various materials are influenced by frequency, polarization, and temperature. Studying these interactions helps students to understand the complicated character of electromagnetic waves and their propagation over several media. High school education must stress these ideas to lay a strong basis for later study in advanced physics and other disciplines.

Applications of Electromagnetic Radiation

Students who want to understand the more significant consequences of this fundamental scientific idea must first know the uses of electromagnetic radiation. As shown by (Quebedeaux, 2007), students' capacity to properly appreciate the several applications of electromagnetic radiation might be hampered by misunderstandings and difficulties grasping electromagnetic spectrum diagrams. Teachers can assist students in overcoming conceptual difficulties and improving their knowledge of electromagnetic waves by including focused instructional interventions such as the Electromagnetic Spectrum Literacy Rubric created in the study. Moreover, legislative initiatives such as those described in (Office of the Dean, 2016) might offer direction and encouragement for applying successful teaching practices linked with electromagnetic radiation in high school curricula. Teachers can equip their students to interact with and help contribute to an incredible spectrum of scientific and technical developments in the future by arming them with a strong basis in electromagnetic theory and its practical applications.

Medical applications (e.g., X-rays, MRI, radiation therapy)

In high school, a knowledge of the uses of electromagnetic radiation in medicine is crucial. Among medical imaging technologies, X-rays and magnetic resonance imaging (MRI) (Hussain et al., 2021) generate detailed images for diagnostic needs using the interaction of electromagnetic waves with the human body. Teaching pupils about these technologies exposes them to practical physics applications and helps them appreciate the significance of medical developments. Furthermore, radiation therapy is utilized in cancer treatment to target and eliminate cancer cells while limiting damage to healthy tissue (Glide-Hurst et al., 2021), another significant medical application of electromagnetic radiation. By teaching students the ideas behind these medical applications (Dhar et al., 2021), we can motivate the next generations to seek professions in science or healthcare, thus enabling ongoing developments in medical technology. Finally, including the study of electromagnetic radiation interaction in high school courses helps students to be ready for a better awareness of the significant part physics contributes to the field of medicine (Podgorsak, 2005).

Communication technologies (e.g., radio waves, microwaves, fiber optics)

With an eye toward communication technology, electromagnetic radiation is crucial in delivering information (Ishimaru, 2017). Radio waves are used extensively for broadcasting radio and television transmissions, mobile phones, and other wireless devices for communication. Conversely, microwave ovens and satellite communication take advantage of microwaves. Furthermore, fiber optics have transformed telecommunications by allowing high-speed data transfer between thin glass fibers (Willner, 2019). Students must grasp the operation of contemporary communication systems by first knowing how electromagnetic radiation interacts with these technologies. Including courses on electromagnetic radiation in high school curricula helps pupils understand the importance of these technologies in society and maybe inspire interest in related fields of work. These technologies largely shape our linked environment and student readiness to negotiate the complexity of the digital age.

Environmental Monitoring (e.g., Remote Sensing, Satellite Imaging)

Analyzing environmental monitoring methods, including satellite imaging and remote sensing, helps one to understand their critical importance in evaluating the state of ecosystems. Using electromagnetic radiation to collect data on the

Earth's surface (Elachi & Van Zyl, 2021), these technologies help researchers monitor variations in urban growth patterns, water quality, and vegetation cover.

Remote sensing, for example, can track changes in land use over time, helping to discover urban sprawl or deforestation. Conversely, satellite images provide ongoing observation of coral reef conditions and coastal erosion rates. Examining electromagnetic radiation interactions with the environment (Liu et al., 2024) helps one to identify areas of concern for remedial projects or conservation efforts. Teaching these monitoring techniques in high school courses helps to produce a generation of environmentally conscious people ready to handle urgent environmental problems (Barrett, 2013).

Industrial and scientific Uses (e.g., Spectroscopy, Material Testing)

Moreover, different industrial and scientific applications depend on a knowledge of electromagnetic radiation interaction (Baiz et al., 2020). Analyzing the chemical makeup of materials depends much on spectroscopy, a method using the interaction of light with matter (Morrissey et al., 2013). Understanding how various materials absorb and emit electromagnetic radiation at particular wavelengths helps scientists identify a sample's components or compounds. Furthermore, electromagnetic radiation interaction concepts form the foundation of material testing in several sectors. For example, X-ray diffraction methods are applied to investigate the crystal structure of materials, guaranteeing their quality and integrity (Bunaciu et al., 2015). Without a strong basis in the basic ideas of electromagnetic radiation interaction, students could find it challenging to understand the nuances of these fundamental approaches in practical uses. Therefore, teaching this subject in high school is essential to equip the following engineers and scientists for success in industrial and scientific domains.

Studies on Misconceptions about Electromagnetic Radiation

Without instruction on electromagnetic radiation interaction in high school, some research examining the incorrect perceptions of students on this topic (Plotz, 2016; Mishchenko, 2011) abound. Examining the terrain of radiation literacy among pre-service teachers reveals that alternative notions and misunderstandings distort a correct knowledge of this critical scientific subject (Migdanalevros & Kotsis, 2021). The study reveals the ignorance among students seeking degrees in education, illuminating the depth of misunderstandings that endure even with intellectual development. Given

the possibility of spreading false information from teachers to their future pupils, this study emphasizes the need for focused educational interventions addressing these misunderstandings early on in teacher preparation programs. Teachers can build a more substantial basis of scientific literacy among pre-service teachers by spotting and clearing radioactivity misunderstandings, promoting the correct spread of scientific knowledge in educational environments.

Promoting accurate scientific knowledge depends first on pre-service teachers identifying and correcting misunderstandings about electromagnetic radiation. Research (Gavrilas & Kotsis, 2023a) has highlighted common misconceptions in this field and underlined the requirement of focused instructional interventions to destroy false ideas and guarantee the correct information transmission to students. Acknowledging the intricacy of adequately addressing and correcting these misconceptions using gender, academic background, and educational experiences on individuals' grasp of electromagnetic radiation ideas emphasizes that Future teachers can help greatly promote scientific literacy and a generation of scientifically aware people by improving educators' comprehension and resolving fundamental misunderstandings. Therefore, a scientifically literate society depends on focused attempts to improve pre-service teachers' knowledge of electromagnetic radiation and dispel false beliefs.

In electromagnetic radiation interaction (Tsoumanis et al., 2023), scientific literacy is essential in dispelling misunderstandings and encouraging correct knowledge among pre-service instructors. In science education courses, it is imperative to address misunderstandings regarding complex scientific events such as radioactivity so that future teachers have the tools and information required to refute and stop the spread of false knowledge. Emphasizing the need for focused educational interventions to correct these misconceptions, research (Gavrilas & Kotsis, 2023b) has revealed that pupils often retain misunderstandings about subjects, including radioactivity, notwithstanding their academic development. By integrating electromagnetic radiation interaction courses emphasizing pragmatic applications and real-world consequences of scientific ideas, educational programs can significantly raise scientific literacy among pre-service teachers, producing a cohort of teachers ready to support accurate understanding and critical thinking in the next generation of students.

Teaching Strategies for Electromagnetic Radiation Interaction

High school teachers of electromagnetic radiation interaction must use several techniques to involve students and improve their grasp of complex ideas. Including practical experiments and demonstrations in the course will help students see how electromagnetic waves behave in various surroundings. Real-world examples—like the use of microwave ovens or the broadcast of radio signals—help students better understand these ideas' valuable applications. Including multimedia tools, including interactive simulations and videos, will also assist visual learners in grasping abstract ideas. Furthermore, encouraging group projects and critical thinking among students can help them better grasp electromagnetic radiation interaction. Using these several teaching approaches helps teachers make sure that students not only grasp the content but also grow to deeply value the part electromagnetic radiation plays in our daily lives.

Hands-on experiments and demonstrations significantly improve high school students' knowledge of electromagnetic radiation interaction (Dori & Belcher, 2005). Practical exercises provide students the chance to put their classroom theoretical knowledge to use in the real world. These tests make learning more exciting and enjoyable, enabling pupils to acquire critical thinking and problem-solving techniques. Students might, for example, use mirrors and lenses to examine the behavior of light waves, therefore observing the ideas of reflection and refraction in action (Ozdemir et al., 2020). Furthermore, by letting students physically see events that are challenging to grasp through lectures alone, practical exercises can help them enhance their knowledge of complex ideas. Including practical experiments in the course will help teachers give their pupils a more all-encompassing and enriching educational environment.

Improving student involvement and knowledge requires including technology and simulations to teach electromagnetic radiation interaction in high school (Iskander, 2002). Using simulations helps students see abstract ideas and engage with virtual models, strengthening their knowledge of the subject. Technology enables interactive learning opportunities that fit various learning styles, offering a more individualized approach to education (Alamri et al., 2021). Including simulations in the course can also assist in closing the gap between theoretical understanding and practical applications, therefore arming students for future academic and professional endeavors in disciplines allied to electromagnetic radiation. Studies have found that students remember material better when

participating actively in the learning process; thus, technology-enhanced simulations provide a dynamic approach to reach this aim (Bower, 2017). Integrating technology and simulations provides a good path for improving the efficacy of teaching electromagnetic radiation interaction in high school as teachers try to fit into the digital age (National Research Council, 2012).

Comprehensive knowledge of electromagnetic radiation interaction depends on an interdisciplinary approach that includes physics, chemistry, and biology. The basic ideas of radiation—wave-particle duality and electromagnetic spectrum analysis are derived from physics. Explaining ideas like absorption and emission spectra, chemistry investigates at the molecular level interactions between radiation and matter. At last, biology investigates how radiation exposure affects DNA damage and mutation. Students may understand the complex interaction between electromagnetic radiation and living entities by integrating several disciplines, preparing for future studies and inventions in domains such as radiation treatment and medical imaging. This all-encompassing approach helps students to develop critical thinking abilities and to recognize the interdependence of many scientific fields, therefore arming them for complex tasks in the always-changing scientific scene.

Illustration of the relevance of teaching electromagnetic radiation interaction in high school depends on real-world examples and case studies. For example, studying how UV radiation interacts with the ozone layer can show pupils the effects of human activities on the Earth's atmosphere. Students can appreciate the need to know about electromagnetic radiation by looking at statistics on the loss of the ozone layer and its effects on health and ecosystems. Moreover, case studies on the use of electromagnetic radiation in medical imaging technologies such as X-rays and MRIs might highlight the valuable applications of this idea in the medical field. These practical illustrations improve students' knowledge of electromagnetic radiation and underline its importance in many different sectors, motivating them to recognize the topic's relevance outside the lab. Students can understand the significance of high school-level knowledge on electromagnetic radiation interaction and its effects on the surroundings using exciting case studies and real-world examples.

STEM and Misconceptions about Electromagnetic Radiation

The paper is based on the misconceptions about electromagnetic radiation, particularly among pre-service teachers. These misconceptions persist despite academic progress and can be inadvertently

passed on to future students, highlighting the need for targeted educational interventions early in teacher preparation programs. Integrating hands-on experiments and digital resources into the curriculum can significantly enhance students' understanding of electromagnetic radiation. Practical exercises and multimedia tools help students apply theoretical knowledge to real-world situations, fostering critical thinking and problem-solving skills. A thorough understanding of electromagnetic radiation interaction prepares students for advanced studies in physics, engineering, and other STEM fields, enhancing their academic and professional prospects. By focusing on these strategies, educators can build a scientifically literate society capable of making informed decisions about technology and its applications.

Comprehensive knowledge of the basic ideas of physics depends on pupils, including teaching electromagnetic radiation interaction in the high school curriculum. Students can deepen their awareness of their surroundings by covering the behavior of light, the electromagnetic spectrum, and how electromagnetic waves interact with matter. This information prepares pupils for more physics classes and provides critical thinking abilities necessary for success in many scientific disciplines. Moreover, knowing the interaction of electromagnetic radiation helps pupils understand complex ideas in technology, engineering, and even medical sciences. Thus, high schools should prioritize this topic in their science courses so that a generation of scientifically educated people can benefit society.

For high school pupils, knowing the interaction of electromagnetic radiation is essential as many scientific ideas build on it. Understanding how electromagnetic waves interact with matter can help pupils grasp events ranging from object colors to operating technologies like MRI machines. Instruction in this interaction also prepares one for more engineering, chemistry, and physics studies. Furthermore, knowledge of electromagnetic radiation is crucial for handling practical problems, including environmental ones concerning radiation exposure and the advancement of communication technology. Thus, teachers should give teaching pupils about electromagnetic radiation interaction top priority in order to equip them for a variety of scientific activities and to promote a closer knowledge of the surroundings. Including this idea in high school courses would help to produce a society informed and scientifically literate by nature (Goldsmith, 2018).

This study emphasizes the need to include instruction on electromagnetic radiation interaction in high school science curricula. The main ideas

covered are the relevance of electromagnetic radiation in many spheres of daily life, the need to know electromagnetic waves for technological developments, and the possible employment prospects in disciplines connected to electromagnetic radiation. The article underlines the need for pupils to understand basic ideas, including the behavior of electromagnetic waves, the features of various electromagnetic radiations,

and the uses of electromagnetic radiation in contemporary society. Early introduction of these ideas will help high school pupils establish a firm basis in STEM disciplines and equip them for future employment in science and technology and higher education. The main characteristics of the educating electromagnetic radiation interaction for the STEM are shown in Table 1.

Table 1. Electromagnetic Radiation and Material Interactions: STEM Details

Aspect	Details
Wave-Particle Duality (Science)	Electromagnetic radiation exhibits wave-like and particle-like behavior, as the double-slit experiment demonstrates.
Spectrum Range (Technology)	Electromagnetic radiation spans from radio waves to gamma rays, each with unique characteristics and interactions with materials.
Applications (Engineering)	Used in medical imaging (X-rays), communication (radio waves), and environmental science (greenhouse effect).
Wave Characteristics (Mathematics)	It is defined by wavelength, frequency, and speed. Wavelength is the distance between successive crests, while frequency is the number of cycles per second.
Educational Importance	Understanding these interactions is essential for students to grasp complex scientific concepts and technological applications.

Integration of electromagnetic radiation interaction into high school curricula might significantly affect pupils' academic and career growth. It can inspire curiosity and astonishment about the natural events controlling our planet by helping us to appreciate the part electromagnetic radiation plays in forming the surroundings. Educating electromagnetic radiation interaction in high school helps to produce scientifically knowledgeable people who can significantly benefit society. Teachers and legislators must prioritize the high school curriculum, including electromagnetic radiation interaction. Early on, introducing this topic will help pupils acquire the knowledge and abilities required to grasp how electromagnetic radiation affects daily life.

Teachers must make sure their pupils are knowledgeable about the possible hazards and advantages of electromagnetic radiation, enabling them to make wise choices on the use of technology. Policymakers must understand the need to include electromagnetic radiation interaction in the curriculum as they greatly influence educational policies and standards. Teachers and legislators working together will help to equip the following generation to negotiate the increasingly complicated world of technology and its interactions with electromagnetic radiation. Moreover, including electromagnetic radiation interaction in the high school syllabus helps to develop scientific investigation abilities and critical thinking. Through discussions of subjects like the impact of electromagnetic radiation on biological systems, students can acquire analytical skills and problem-solving strategies necessary for success in

the workforce of the twentieth century. This focus on critical thinking improves academic performance and develops a closer knowledge of the surroundings. Educators and legislators are laying a scientifically literate and informed society, giving the inclusion of electromagnetic radiation interaction top priority in the curriculum and top importance (Rieckmann, 2017).

To equip pupils for the demands of modern society, educators and legislators should thus prioritize electromagnetic radiation interaction in high school curricula. Emphasizing the relevance of this subject will enable students to develop critical thinking abilities necessary for success and equip them to make informed decisions regarding technology use. Using cooperation among educators and legislators, we can guarantee that the following generation is ready to negotiate the complexity of technology and its interactions with electromagnetic radiation. Recognizing the need to include electromagnetic radiation interaction into the curriculum will help educational institutions and regulating authorities construct a more scientifically educated and informed society.

CONCLUSION

In conclusion, a thorough knowledge of electromagnetic radiation will have significant future consequences for many other sectors and scientific disciplines. A complete understanding of how electromagnetic radiation interacts with matter will be crucial for maximizing efficiency and safety with technological developments, including 5G networks and medical imaging methods. The knowledge of electromagnetic radiation will be

important for communicating and identifying signals from other civilizations as we keep exploring space and searching for extraterrestrial existence. Teaching high school students about electromagnetic radiation helps equip a society ready to make wise decisions regarding the use and control of technology. It prepares the next generation of scientists and engineers. Looking ahead, the ramifications of knowing electromagnetic radiation cannot be overstated in determining the course of our planet.

Future research in electromagnetic radiation should focus on several key areas to enhance our understanding and application of this fundamental scientific concept. One critical area is the development of more effective educational interventions to address and correct misconceptions about electromagnetic radiation among pre-service teachers. This is essential to ensure accurate knowledge transmission to students and to promote scientific literacy. The role of electromagnetic radiation in environmental monitoring and communication technologies warrants further study to understand better and mitigate environmental impacts.

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