Physics curricula and students' reluctance to study them .. Physics is a way of life

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Abstract

This paper discussed the nature of physics and its importance as one of the most prominent sciences in the progress and prosperity of countries. There is no aspect of life, whether current or future, that is not controlled by one of the applications of physics. Physics is a way of life because of its many fields aimed at understanding and interpreting the natural phenomena of the universe and scientific laws. Due to the importance of its studies, many international projects were conducted to develop physics curricula at the secondary level in order to address its shortcomings and focus on the intersection between science, technology, and society, and include investigative skills and scientific technological processes. Despite this, the results of the studies indicated students' reluctance to study physics or enroll. In physics departments in university colleges, these reasons were discussed, and the current paper recommended reconsidering the design of physics curricula so that they are based on the integration of physics and mathematics curricula, taking into account the logical organization of scientific content, and including in the content topics closely related to the lives of learners, their environment, and society, and that the content reflect the nature of the relationship between Science, environment, society and technology

Keywords: Physics curricula - students' reluctance to study physics - physics is a way of life

Introduction:

The natural sciences curricula, especially physics, are among the most prominent sciences in the progress and prosperity of countries. Physics is due to most of the

scientific progress that has contributed to the interpretation of many natural phenomena and the emergence of technological applications that have contributed to the development of the structure of the natural sciences. It has become clear that in order for the learner to understand the other branches of The natural sciences must have an understanding of physics, or at least the basics of this science.

There is no aspect of our lives, whether present or future, that is not controlled by one of the applications of physics. For example, if it were not for controlling the electron and explaining its behavior thanks to quantum physics, the technology of solid-state electrons would not have developed, based on which integrated circuits (ICs) were developed, which are the basis of the computer. Thanks to its use, the science of genetic engineering (the human genome) was established, and scientific research applications using computers have multiplied, and this leads us to say that physics is truly responsible for the progress occurring in other natural sciences and of course their technological applications

Despite the importance of physics in the lives of individuals and the development of societies, and since physics curricula are the tool to highlight its importance as a way of life, the results of studies have indicated students' reluctance to study physics, and their lack of enrollment in physics departments in university colleges, especially colleges of education, which are responsible for Physics teacher preparation program.

Among these studies are (Al-Kalbani & Al-Adili, 2020), (Mason & Singh, 2017), (Hadzigeorgiou & Schulz,

2017),(Korur & Eryilmaz), 2016), (Al-Haj. et al., 2014), (Al-Saadani, 2007),(Al-Shuaili & Al-Balushi, 2006), which confirmed All of them are based on the low grades of students in academic achievement in physics at the secondary level, the reluctance of students to study it or join physics departments in university colleges, and the formation of negative attitudes towards it .

This paper comes in an attempt to identify the importance and nature of physics as a way of life, the movements for developing physics curricula, identifying the reasons for students' reluctance to study it, and presenting proposals to improve physics education .

Physics and natural sciences:

The science curricula in the preparatory stage were characterized by integration and generality, while in the secondary stage they were differentiated into basic branches (natural sciences), namely: physics, chemistry, biology, astronomy, and earth sciences. The view of physics has evolved from being merely a branch of the natural sciences because it has become It is intertwined with the other branches of these sciences, and most of the scientific progress that contributed to the interpretation of many natural phenomena and the emergence of technological applications that contributed to the development of the structure of the natural sciences is due to it. It has become clear that in order for the student to understand the other branches of the natural sciences, he must have an understanding of physics or science. At least the basics of this science have been acquired.

What is physics?

The word physics comes from the Greek word (physis), which means the essence of truth or the final formula of truth. Therefore, physics is sometimes called (natural philosophy) or the philosophy of nature. Physics is an experimental science. Physicists observe the phenomena of nature, and strive to find patterns and rules in order to relate or explain them. These phenomena, these patterns, are called theories, or when they are well prepared and comprehensively coordinated, they are called laws of physics. Developing a physical theory requires innovation at every stage.

Theory in physics:

Scientific theory represents the most abstract form of scientific knowledge. In the natural sciences, it refers to sentences and phrases that are used to describe natural phenomena qualitatively and quantitatively, or both. Scientific theory consists of concepts and assumptions that represent the relationships between concepts. Scientific theory aims to describe the phenomenon. Natural theory, its interpretation and prediction. Examples of scientific theory include the theory of atomic essence, molecular theory, and molecular motion theory. The basis on which scientific knowledge in its various forms is based is scientific facts, which represent the basis for building other forms of scientific knowledge, most importantly scientific theory. Scientific facts also provide clarification and support for scientific theory and work to modify it and rebuild other new scientific theories when old theories fail. In explaining natural phenomena in its field, or proving its error through scientific experimentation, a scientific theory is subjected to proving its validity by careful scientific experimentation and the extent of its agreement with the

scientific facts in its context, which support the theory and prove its validity. The scientific theory may be subject to modification or development, or scientists may abandon it completely in favor of... A new theory in light of the new evidence and new scientific evidence. Therefore, the scientific theory is correct in light of the current scientific situation and the available scientific evidence and facts that support and support it.

The modern view and the traditional view of physics:

Physics is the science of matter and energy and the relationship between them. The development of this science at the end of the twentieth century represents a comprehensive revolution in our concepts of the nature of the entire universe.

Physics is concerned with studying and interpreting natural phenomena and the basic interactions responsible for them, and trying to formulate the relationships and laws that express them, and the physical properties related to them, using the particle model and the wave model, or both.

Physics is now researched at two levels: the Macrocosmic world: it begins with how the universe came into being, to the study of all the cosmic and astronomical phenomena that have been observed and those that have not yet been observed, to the possibilities with which the universe could end. The Microcosmic world of particles: this is done by studying the depths of matter to identify The finest structure it consists of, not at the level of the atom and its components, but at the level of components whose existence is difficult for a non-specialized individual to realize.

The modern view of physics rejects the traditional philosophy of this science, which divides the physics

approach into: properties of matter - sound - light - heat - electricity - magnetism - atomicity...etc. What is wrong with this division is that it is concerned with each section separately, and it is... As a result, the concepts of physics are not integrated and interconnected. Division in this way also makes the process of linking and integrating basic physical concepts a difficult process to achieve. The modern view of physics also rejects the philosophy of integration between physics and chemistry because it is not consistent with our perception of physics as taking the place of the origin of chemistry. Moreover, this integration between physics and chemistry is often It is at the expense of integration between physics and mathematics.

The relationship between physics and mathematics:

Through the modern view of physics, the integration between it and mathematics becomes clear. The science of physics in its modern sense is the science of studying particles and waves, as in the current century a re-study of physics began in light of the microscopic structure of matter. In light of that, it was possible to understand many of the physical phenomena that were previously understood, and this view of physics as particles. We cannot ignore the role of mathematics in understanding and comprehending the physical structure, as to understand the nature of particles and waves, we must understand the mechanics and dynamics of each of them. The interference between particles and waves also led to the necessity of the emergence of quantum "mathematics" that addresses these two dual properties.

Modern physics curricula:

The modern physics curriculum at the secondary level has become based on principles that may not find an echo

in the traditional physics curriculum, and if they exist, they are scattered and unconnected. It also does not start from a specific rule, nor does it move towards a specific goal. Among those principles are: matter exists in basic states in nature (the kinetic partial theory), the structure of matter is the result of the organization of its basic particles, matter and its properties depend on the electrical atomic structure in its essence, and the change in Thermal energy and its transfer depend on many properties of matter. All matter is electrical in nature. Radiant energy is electromagnetic. The theories of particles and waves are necessary to understand the properties of light energy and its applications. The mutual influence between matter and energy results in continuous change in the universe. The universe consists of moving celestial bodies spaced apart that generate There are magnetic forces between them that are directly proportional to their mass and inversely proportional to the square of the distance between them.

In general, modern physics curricula have already abandoned the traditional division of branches of physics, which helps the student to develop his awareness of the unity of physical phenomena, such as the trend towards integration between time, space, matter, and energy, and to develop the basic goal of teaching physics for all age levels, which is to achieve scientific culture in physics through real understanding. The nature of physics, including its cognitive structure, skills, and research methodology, in addition to the applied and human component and its role in the development of physics.

Historical development of physics:

The development of physics began with the beginning of the scientific renaissance in the sixteenth century, when

scientists and thinkers began turning to nature to try to understand its secrets and explain its phenomena in the light of observation and experimentation. Interest was focused on studying astronomical and physical activities. The prevailing theory was the geocentric model, and due to the failure of This model was introduced by Copernicus, the heliocentric model, and Kepler was able to provide the quantitative mathematical formula that expresses the movement of the planets according to this model.

The scientific movement continued into the seventeenth century, and among the most prominent scientists who played a major role in this scientific movement were Torricelli (Italy), Pascal and Descartes (France), Boyle, Hooke, Newton (England), and Huygens (Netherlands). This century also witnessed important developments in "the science of light and optics," and the emergence of the particle theory at the hands of the scientist Newton. With the entry of the eighteenth century, interest in mathematical physics began, and during the nineteenth century another progress occurred in the science of physics, which was the arrival of an important principle that forms the basis for explaining most phenomena. It is the principle of conservation of energy, and in the late nineteenth century the assumptions of Einstein's theory of relativity appeared. In fact, if we are recounting some of the history of physics, then in order to advance in modern physics, we must address the research of Madame Curie and Rutherford, those researches that revealed the nuclear structure of the various nuclei, and identifying the properties of the components of the atomic structure led to knowing the numbers of particles that make up those components. Atoms, followed by a study of nuclear reactions, and those nuclear studies developed until they led to the construction of the atomic reactor.

Evaluation of physics curricula at the secondary level:

As a reflection of the importance of physics and in light of the development of natural sciences curricula in general and physics curricula in particular, many studies have been conducted to evaluate physics curricula and identify their reality and role in preparing a scientifically enlightened person, based on the fact that evaluation is the first step in developing the curriculum. The results of the studies indicate that there are deficiencies in teaching physics at this stage. Secondary school is represented by the fact that teaching physics does not encourage students to think deductively, and the lack of interest of physics teachers in students' problems in class while studying physics, and some results have concluded that physics curricula in the secondary stage do not take into account the foundations of building the curriculum, and the low grades of students in physics, and the handling of issues. By studying the reality of physics curricula at the secondary level in light of the requirements of the twenty-first century in the Arab world, I also concluded that physical information is not presented in the form of situations and problems that stimulate students' thinking, does not develop the reading of scientific books, and does not encourage problem solving. The lack of interconnectedness between them discourages students from using them in explaining natural phenomena. The language of the book is dry. In addition, physics books do not include applied activities that stimulate students' thinking and develop their creative abilities. The book also does not include questions that measure higher levels of thinking.

International projects to develop physics curricula:

One of the most prominent global natural sciences curricula projects is the Harvard project for teaching physics to address the deficiencies in the physics

curriculum and the difficulty of learning physics and the reluctance of many high school students to study physics (Anderson ,1978). The National Science Foundation (NSF) in England also presented the Nuffield Physics Project. With the aim of students understanding physics terminology and helping them learn through scouting activities and developing their physics problem-solving skills (NSF, 1977), the Arab League Educational, Scientific and Cultural Organization also presented a pilot project to develop the teaching of physics at the secondary level in Arab countries (Arab League Educational, Scientific and Cultural Organization, 1976).

Natural sciences curriculum reform movements in the 1980s focused on the intersection between science, technology, and society, scientific and technological processes and investigation skills, scientific and technological skills and information related to personal and societal decisions, and attitudes, values, and appreciation of both science and technology.

In the same context, several contemporary movements to reform science curricula emerged during the 1990s and beyond, the most widespread and influential of which was the reformulation of natural science curricula and reforming them to keep pace with scientific and technological development - the draft National Science Education Standards (NSES), which was issued by the National Research Council. Affiliated with the National Research Council (NRS) and the National Academy of Sciences (NAOS), the Council has adopted a slogan for building these standards: a commitment to teaching science to all students worldwide, and achieving scientific enlightenment for all citizens .

Reasons for students' reluctance to study physics:

The concept of abstinence:

The concept of aversion is characterized by clarity and accuracy in meaning and significance in language dictionaries. Aversion is defined idiomatically as reluctance, abstention, aversion, and turning away from something. From there, the concept of aversion can be formulated as a specific orientation as a result of experience (cognitive, economic, social, etc.) that the individual possessed and through which he made the choice. By staying away and abstaining from something, in order to gain stability on the other side that is opposite to what is avoided.

By examining the literature, the factors that are classified as reasons for students' reluctance to study physics, whether at the secondary level, or to join physics departments in university colleges, are summarized, including the following:

External factors :

Course: The course is represented as a factor leading to reluctance through the content, its structure, and the integration of its topics with each other and with other curricula related to it. It must also focus on the nature of the learner's cognitive, physical, mental, and other characteristics, and that the lack of suitability of the course for the students and their aspirations is one of the biggest obstacles that limit the achievement of good learning and its continuity. This is confirmed by the results of the study (Al-Shuaili & Al-Mahrouqi, 2012), (Abdel-Radi, 2006) on its lack of standards. Science from a personal and social

perspective, and the Earth and Space standard. The study recommended including national standards in science and physics curricula and distributing them in a balanced, comprehensive and integrated manner. The integrated curriculum means that the content is coherent and gradual and not separate or fragmented in covering topics through concepts and information. This, in addition to the density of the content of the physics textbook, greatly affects students' achievement and their readiness to continue studying in this course.

Mathematical problems are one of the obstacles facing students in the tenth grade and the post-basic education stage, as the student at this stage deals with content that focuses on abstract concepts and facts, and this creates tension on the students, and thus reflects negatively on the students in terms of their level of achievement and motivation towards this course. And continuity in his studies .

Also, the belief in the difficulty of physics arises from abstract quantities in physics that are not seen in reality but are dealt with only by imagination. Likewise, the size of the theoretical course and the absence of linking the content to the practical, applied aspect could contribute to the type of students' inclinations toward science.

Mathematics overlaps with physics, as it is deeply woven into all processes of teaching and practicing physics. Mathematics is often used in practical practices in chemistry and biology, but it is closely related to physics and its topics.

School students also face many difficulties related to the relationship of physics and mathematics, and they

constitute obstacles that reduce the level of achievement, achievement, and motivation. Since the lack of success in understanding reduced mathematics in physics is the result of the failure to transfer mathematical skills from mathematics to physics due to the difference in the language of numbers and drawing symbols, and that students find it more difficult to solve physics problems with symbols instead of solving those problems with numbers, they prefer to deal with numbers early in their dealings with problems instead of first starting to solve them using symbols, studies point out the necessity of learning mathematics in physics in a language similar to numbers and symbols and paying attention to the distinctive experiences of each of them, as experience in one does not guarantee experience in the other, and this is confirmed. Results of the study of (Mason & Singh, 2017) , (Redish & Kuo ,2015).

In addition to the above, there is a relationship between the labor market and education, which affects the interest of students, parents, educators, employment officials and others in various countries of the developed and developing world. There is no doubt about the quality and quantity of education that students obtain and its impact on their academic path and the future career they seek to achieve income. appropriate for them. This is confirmed by the results of the study (Al-Suwailan and Al-Kandari, 2017), which found that students tend to choose specializations in colleges of education that are appropriate for the labor market and that guarantee them employment, as students tend towards specializations whose outputs the labor market is still absorbing and they refrain from other specializations.

Internal factors:

The student's inclinations and desires are considered matters related to conscience and feeling that must be met in the educational process. Through what the student learns in the academic courses and the school in general, what is linked to his academic and professional orientations and ambitions in the future, and for this reason the curriculum must be based on two approaches: the activity approach. Or the experience, curriculum, need, interest and inclinations of the student.

One of the important characteristics associated with the student at his current age stage is the difference in the level of mental abilities as well as desires and readiness. This difference affects the type of study for each of them, and is reflected in the extent of benefit and results that each of them achieves in the different courses and subjects offered to them.

In the same context, the results of some studies, such as (Jawhar, 2019), Mnoica0, 2017), indicated other reasons for students' reluctance to study physics, some of which are attributed to the students, which are limited physics concepts, weak practical skills, and their physics problem-solving skills, including What is related to the educational environment, which is represented by the lack of laboratory materials and tools in the physics laboratory, and what is related to the teacher, which is represented by a weakness in the teacher's skills in using laboratory equipment, and his failure to use modern physics teaching strategies, including what is related to the school curriculum, which is represented by not linking physics concepts to life. The process is the abundance of educational material in the

textbook, failure to take into account the logical organization of the scientific content, and failure to take into account the standards for preparing drawings and illustrations.

In confirmation of the above, the results of some studies, such as (Al-Mulla, 2022), (Jaafar, 2016), Gonzalez) (2016, and (Al-Khudari, 2015), indicate that physical concepts and perceptions are characterized as having a high degree of abstraction and difficulty in visualization, which hinders learners in Understanding it, as well as the difficulty of the learner distinguishing the concepts contained in the phrase and the confusion between the meaning of the physics concept and its verbal connotation, which causes anxiety among the learners towards the subject of physics, and this affects their achievement and their emotional state and increases their tension and fear when studying physics, practicing its experiences, and performing its tests, and this may lead to an opposite trend. Towards learning in general and avoiding joining scientific fields and working in their profession, and physics in particular.

The results of several studies, such as (Al-Shoubaki & Mahmoud, 2022), (Al-Shukri & Suhail, 2021), (Al-Shehri & Shammaghi, 2021), (Sarhid, 2021), (Al-Badri & Al-Jabri, 2019) (Al-Subaie & Al-Shayegh, 2018), also indicated that the main reason for the reluctance of... What keeps students from studying physics is their weak skills in solving physics problems, which are: difficulty reading and understanding the problem and converting it from the verbal form to the symbolic form, difficulty identifying data and determining what is required, difficulty employing mathematical concepts and laws, their inability to choose

the appropriate method for the solution, inability to remember the laws. And performing the mathematical operations involved in the solution, the difficulty of linking more than one law to solve the problem, the inability to distinguish between the units of measurement for the required physical quantity and standardizing them, the lack of their skills in verifying the logic of the mathematical estimate of the result that has been reached, their lack of ability to interpret the physical meaning of the final result, Difficulty distinguishing between the variables on the graph and the relationship that links them. They do not have the ability to find the final result of the problem appropriately, which leads to their lack of interest in studying physics.

Physics is a way of life:

Physics is not a difficult subject, it is just a special subject. Physics is our reality, our life, and our actions It is the spinning wheel of our day. Physics is not typical. It is fun and entertaining, and it shows the power of the Almighty Creator in the universe. It is considered one of the basic sciences that we can use every day and at all times. It is not limited only to space stations, but is used in the study of matter and energy as well. It is A large field of science, aiming to understand and explain the natural phenomena of the universe and many scientific laws.

The oldest historical documents that refer to physical studies date back to the era of the Pharaohs, and in 1800 BC, the Babylonians contributed to the development of modern physics. They were interested in formulating a set of physical equations, and in the first century AD, Arab-Islamic physical studies appeared. Muslim scholars

contributed by presenting a set of studies in physics that contributed to changing many physical laws and theories and writing a set of books that relied on precise scientific study that contributed to the development of Physics and its scientific fields.

Physics is one of the sciences that each of us has encountered at least once during his studies, and there has always been a pressing question for everyone, which is what is the importance of physics? What is the purpose of studying the laws related to light and time? Do these laws have a clear impact on our lives?

The answer is very simple, which is that everything in our lives follows the laws of physics because they are not only scientific laws. Rather, this is a group of natural studies aimed at answering the major questions of the universe, which are how it began, when it began, and what is the comprehensive law that all life follows.

Therefore, it is possible to say that physics is one of the most important sciences that is not easy to neglect, and all major countries have been able to develop their civilization using technologies based on physics. If the matter departs from the boring laws of academic subjects, we will discover that physics is very interesting.

Thanks to some of the theories that we have, physicists were able to measure the amount of matter currently present in the universe in addition to measuring the amount of matter that we see, but there is a small problem. These two numbers, which are precisely measured for the total amount of matter in the universe, do not match. In fact, the total masses in the universe are much greater than The total that we were able to monitor. This prompted physicists to

offer some explanations for this contradiction through a pioneering theory that assumes the existence of dark matter.

This mysterious dark matter does not emit light, and it represents 95% of the mass of the universe. While we have not been able to prove its existence yet, because we simply cannot see it, there is a huge amount of evidence proving that it exists, in addition to the importance of its presence in one form or another to explain the properties of the universe.

In our daily life, we hardly find a device that does not involve the laws of physics, for example: pulleys used to lift heavy loads, means of transportation such as cars, planes, trains and bicycles, electrical energy used to obtain light, thermal and mechanical energy. Household appliances such as air conditioners, electric refrigerators, microwaves, and computers, means of communication such as radio, television, telephone, and computers are the result of physical applications.

The branches of physics are multiple and involve in all our life's activities. We find modern physics: the branch of physics that deals with the theory of relativity and quantum mechanics. Chemical physics: the science of studying the physical relationships in which chemistry is involved. Biophysics: is the branch of physics that deals with biological problems and natural phenomena. Using physics techniques. Engineering physics: is the branch that is concerned with studying the fields of physics and engineering. Astrophysics: is the branch that is concerned with studying the universe and its components such as stars, planets, and galaxies. Health physics: is the branch of

physics that involves protecting people who are exposed to radiation.

Based on the above, physics is considered one of the most important human sciences, as it has many benefits in human life. For example, some sciences are only studied through physics, and thanks to physics, man was able to learn about outer space and discover many parts of the universe, and also thanks to it, the invention of Many of the tools, systems, devices and equipment that people use in order to facilitate their lives, and they have many applications and benefits in life.

In light of the above, the current paper recommends the following:

- Analysis of physics and mathematics curricula by specialists in the educational and scientific fields, and redesigning, planning and building them in a way that suits scientific development and students' levels in accordance with international standards that provide integration between the two courses.
- Reconsidering all science curricula at the various educational levels, to revise them and reduce the educational burden in them, especially dry theoretical information; Focusing on topics closely related to the life of the student and his community, and its content reflects the nature of the interaction between science, environment, society and technology. Then the learner realizes the function of science in his life and the life of his community.
- Employing modern educational technology in teaching science in our schools and relying on electronic

curricula, virtual classes and electronic simulation programs.

- Reconsidering university admission policy and expanding the number of admissions to practical colleges; In proportion to the number of successful students from the science section in high school, and supporting scientific equipment and laboratories in these colleges in a way that encourages parents to direct their children to study scientific subjects.
- Creating suitable job opportunities and providing them for graduates of scientific colleges, in a way that also encourages parents to direct their children to enroll in the scientific section of high school.
- Directing teachers to adopt methods and strategies for solving physics problems, helping students use them to confront difficulties, and linking physics problems to students' life problems.
- It is necessary to pay more attention to abstract thinking skills, given that they are among the basic skills for learning science in general and physics in particular, as they make learners able to reach sound scientific explanations for scientific phenomena related to various scientific concepts by linking these new concepts to their cognitive structure, and then applying them in New life situations; Emphasizing it in the stages of curriculum implementation, especially during the teaching and evaluation process. So that it has a fixed percentage of all physics tests in the secondary stage.
- Working to encourage students to take physics and working to achieve positive attitudes in them by using modern teaching strategies, focusing on the element of suspense in presenting physics topics and linking

theoretical information to life situations and students' needs

- Paying attention to providing laboratories and laboratory technicians in schools and equipping them with modern laboratory equipment and tools required to achieve the highest level of understanding among students in physics
- Focus on increasing training sessions for physics teachers, which focus on dealing with laboratory devices and tools.

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