Difficulties Faced by College Students in Introductory Physics: A Case Study

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Abstract

In a survey conducted at the University of Sharjah (UoS) in the United Arab Emirates (UAE), 86% of respondents from among first-year students reported that Introductory Physics was the most difficult subject they were taking. This high percentage is not limited to students at the University of Sharjah. In fact, it is internationally perceived that introductory physics is the subject college students fear the most. What is alarming is that more than 80% of the students who said that Introductory Physics was difficult believed that it had no relevance to their respective fields. This is often offered as a reason for the lower than average passing percentages obtained in Introductory Physics. Some post secondary institutions in the Middle East went so far as proposing the reduction of the number of physics courses in their curricula or cutting down on the course content in response to continuous complaints from students as well as parents.

The results of our survey will be examined with the aim of subjectively discussing the factors contributing to the struggle students have with Introductory Physics. These include inherent problems, the role of mathematical presentations of physical concepts, presentation of the subject matter, the students' study habits and assessment tools. After that, we highlight the importance of physics through various examples of applications in the respective fields in which Physics plays an integral part in understanding many functions and processes.

Finally, we propose some solutions, which we believe will assist students in learning some of seemingly difficult topics, including suggestions to make physical concepts easier and more enjoyable, without compromising the quality or the quantity of the course content.

1. Introduction

During a Conference on Engineering Education in the Arabian Gulf countries, which was held in Kuwait in 1980, several papers suggested that the number of courses in physics should be reduced and that the remaining topics should be incorporated into other non-physics courses already included in the curriculum [1]. The argument offered was partially based on the poor results students obtain in physics where a number of students end up repeating the course. This in turn tends to reduce the flow of students and limit the number of students in the later courses. In addition, it was argued that many of the physics topics could easily be fitted into other engineering courses. Another reason presented was that the number of credit hours allocated to university, college and departmental requirements leave very little time for additional courses. For example, in the College of Engineering at the University of Sharjah in the UAE, there are only two physics courses, Physics II and I, included in the program; in the Medical Colleges and College of Health Sciences, only one 3-credit-hour physics course is allocated to cover basic physics concepts and fundamentals. In the case of the College of Engineering, the two courses include classical mechanics concepts and an introduction to electricity and magnetism. Optics, light, sound, thermodynamics and modern physics are not covered. In the Colleges of Medicine and Health Sciences, the physics course covers only biomechanics, fluids and heat, depriving students of topics like sound, waves, optics, atomic and nuclear physics, radiation protection and safety, and electromagnetics. In comparison to many western universities, where the engineering curricula include physics courses (for engineering colleges), which covers all the relevant physics topics, the number of physic courses offered at the University of Sharjah leave students with a minimal exposure to many of the important physics concepts. When the issue was raised at the administration and deanship levels, the reasons offered were very similar to those presented at the Kuwait conference, which was centered on the two notions that “students find physics very difficult” "and “it is not relevant to their field of study.” In some departments Introductory Physics is not a prerequisite for advanced courses, which leads to a common phenomenon where senior engineering, medical and health sciences students delay their graduation because they have not yet passed Introductory Physics.

In light of the issues and concerns raised above, our aim in this paper is to investigate the factors contributing to college freshmen concerns with introductory college physics. In addition, we will attempt to present solutions and recommendations to deal with these issues. Our study includes conducting a survey questionnaire aimed at probing students’ perceptions, accompanied by detailed analysis of the responses in light of course outcomes and previous experiences.

2. Results and Discussion

To investigate this issue, we surveyed 326 students enrolled in various departments of the Colleges of Engineering, Medicine, and Health Sciences at the University of Sharjah in the UAE. The aim of the survey was to gauge student views on these issues and in particular the reasons behind their apparent struggle with physics courses. A list of the survey questions and student responses are found in Table 1.

Questions one to three were included to identify if the students’ prior physics background influenced their performance. The results indicated that the students had a strong background in physics, with 98% of the students having taken physics in high school. In some cases, students had taken up to three physics courses during high school. 86% of these students had obtained grades of 85% or above in high school physics while 23% of the students surveyed were “repeaters”, which included students who had taken an intro-physics course at least once before. In response to question number 5, 86% of the surveyed students ranked physics as the most difficult subject. The list included other subjects such as mathematics (including calculus and algebra) and chemistry. When students were asked to list the reasons behind their belief that physics was difficult, common answers included: "I understand the concepts, but I cannot solve the problems" and "the exams are difficult". This former response is typical of those found elsewhere and often implies the converse, which is that the students really do not understand the concepts [2]. Some students replied that physics contained a lot of math and the exams contained "indirect" questions, which they could not answer. In addition, 75% of the subjects surveyed responded that they would evade taking physics if they had a choice of taking another course instead.

While these responses may be due to several factors, what is alarming is that more than 80% of the students surveyed believed that physics had no relevance to their respective fields. The students' apparent frustration with the subject, the low grades they tend to obtain, which hover around the mid 60s, the quality of the instructors, teaching methodology and rigorous exams may contribute to this view. When coupled with continuous complaints from students and dismal outcomes, this perspective appears to be one of the main reasons behind reducing the number of physics courses in the curricula of universities in the Gulf region [1, 3].

In a separate survey of 125 graduates in the fields of engineering, medicine and health sciences, we examined their views of the difficulty and relevance of Introductory Physics to their respective fields. The results of this survey showed that more than 80% of the professionals surveyed believed that physics was very important to engineering, irrespective of their subspecialties. For graduates and professionals in the fields of medicine and health sciences, the percentage was lower but at 72% still much higher than that of freshmen students.

While these views are in line with the literature [4], the former results of the student surveys motivated us to investigate the reasons behind the struggle of students with physic with the hope of proposing solutions to address student concerns. Our research focuses on answers to the following questions:

Is physics really a difficult subject and if so, what makes it difficult to understand? Is it possible to deliver the same content in an "easier to comprehend approach?"

To answer this question effectively, we will investigate the possible factors/reasons contributing to the struggle of students with Introductory Physics, which as a result may have influenced their responses to the questions in the survey. As we will explain in the next section, some of these reasons are inherent to any physics course (e.g. subject matter, the presentation and assessment tools used to evaluate the performance of the students). Some of these factors may be independent of university and geographic location. On the one hand, a student's background and preconceived notions about the difficulty of physics courses may be influenced by local conditions and thus contribute to the above results. Examples include student study habits, which tend to overlook some of the learning outcomes of a physics course and students' perception of the non-relevance of Introductory Physics to their various fields, be it in the everyday demands of their professions or in research and development. We will argue that if students realized how important physics is to their profession, they would be motivated to take the course and be very keen to understand the subject.

Why do students think physics is difficult?

Careful examination of the poor performance of students in Introductory Physics can be traced to more deep-rooted factors rather than to the difficulty of the subject matter. One of these factors is the physics that is being taught in high school curricula. Table 1 shows that almost all of the student respondents took physics in high school, the majority of whom attained very high grades. When we looked at the content of a typical physics course in UAE high school education curricula (national or private), it was found that it contained adequate coverage of the fundamental concepts. However, when these graduates were

Table 1: Summary of student responses to the survey questions (n = 326. representing the Colleges of Medicine, Health Sciences and Engineering).

No	Question	Response	Percentage of Responses
1	Have you taken physics in high school?	Yes	98%
		No	2%
2	What was your physics grade in high school?	Above 85%	86%
		75-84%	14%
3	Do you have to take introductory physics as part of your curriculum?	Yes	100%
		No	0%
4	Have you taken introductory physics before?	Yes	23%
		No	77%
5	Among the courses you have taken/taking, introductory physics is ranked number ….in terms of its difficulty	# 1	86%
		# 2-4	10%
		> 4	4%
6	If you were given the choice to evade Introductory Physics, would you take that choice?	Yes	75%
		No	18%
		No response	7%
7	Do you think introductory physics is relevant to your specialty?	No	80%
		Yes	20 %
8	Why do you think introductory physics is difficult?	Problems are difficult to solve.	67%
		Difficult exams and exam format.	56%
		Difficult to understand and is indirect.	43%
		Too much Mathematics	72%
		Concepts are easy but applications are difficult.	23%

subjected to a placement test, designed to test their physics background, only 33% of these students met the cutoff score (set at 40%) needed to enroll in Physics I [4]. These same students had an overall average of 85% for their high school physics grade (a university admissions requirement). This huge discrepancy is attributed to the inflated grades students obtain in high school physics.

We therefore reached the conclusion that whatever the reason may be, the grades obtained in high school physics courses do not reflect the student's "true" understanding of the concepts of physics. While this argument provides convincing evidence as to why students score badly in their placement tests, the students who complained about the difficulty of physics are the ones who met the cutoff score. So why do these students still think physics is difficult?

Common sense ideas and theories:

One factor, which greatly contributes to the struggle of students with physics courses and one that hinders their comprehension and grasp of physics concepts is what is commonly referred to as *common sense theories or ideas* [2, 5, 6, 7]. As reported in [2], each student entering a first course in physics possesses a system of beliefs and intuitions about physics phenomena, which s/he derived from extensive personal experience. This system functions as a *common sense theory* of the physical world, which students use to interpret their experience, including what they use and hear in their physics courses. It is considered as a major determinant of what the student learns in the course. Yet conventional physics instruction fails almost completely to take this into account.

A student begins non-physics courses, such as Philosophy, History, etc., with unaffected minds. For example, before students take their World History course, Economics, or Philosophy, they know little or nothing about these subjects. The instructor can then help the students to implant fresh knowledge upon the palimpsest of their minds [2]. The situation in introductory physics is quite different where students arrive in their first year physics course with a set of physical theories that they have tested and refined over the years of repeated experimentation [2].

Students have spent many years of their lives exploring mechanical phenomena by walking with slow speed, climbing up a hill at varying speeds, running a marathon with maximum constant speed, kicking a ball vertically upwards to see who can kick it the farthest, and riding accelerating vehicles. They also have limited experiences with electrical phenomena, acquired while using electrical circuits at home that are related to the behavior of light, lenses and mirrors. Based on their observations, students have pieced together a set of "*common sense*" ideas about the physical universe and how it works. One might think this is an advantage, giving students studying physics a head start. On the contrary, researchers have shown that these preconceived "*common sense*" ideas are incompatible with the correct physical picture. What is worse is that these erroneous ideas are robust and difficult to dislodge from students' minds, in large measure because these ideas are not addressed by conventional physics instruction.

An example of such a situation is encountered every time we cover the concept of pressure in a pipe (or an artery) that is narrowed down to a fraction of its original cross sectional area, as shown in Figure 1 below. The question directed to the students was as follows: In which region, 1 or 2, in the figure below (Fig. 1 below) would you expect the pressure on the walls of the pipe to be the greatest? More than 90 % of the students said region 2. The students based their answer on the fact that when the pipe (or artery) is narrowed, the speed of the fluid increases, and hence so does the pressure! Some students did not believe that region 1 is under greater pressure even after pointing out that since the laws of conservation of mass tell us that velocity is greater in region 2 (i.e. going from a wide area to a narrow area the velocity increases), the fluid is accelerating in that direction. Since acceleration requires an unbalanced net force, which in this case is

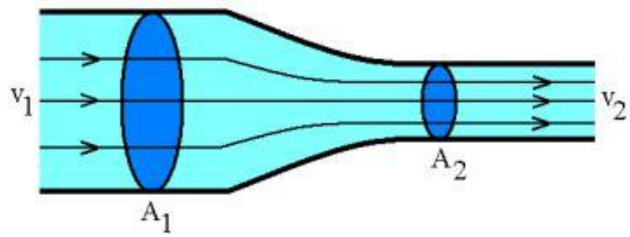

Figure 1: As the fluid flows from region 1 to region 2, its velocity increases and the pressure drops.

supplied by the pressure on the fluid by the walls, therefore the pressure in region 1 must be greater than the pressure in region 2 to accelerate the fluid.

A similar example was reported by McDermott and Shaffer [5], who conducted the following two experiments. In the first experiment, a battery was connected to two identical light bulbs in series. In the second experiment, the battery was connected to a single bulb, which is identical to the two bulbs in the first part. The authors asked the students in an introductory physics course to compare the brightness of the single bulb to that of the two bulbs in the first part. Only 10-15% of the students (some who were exposed to circuits) gave the right answer that the two bulbs in the first part are equally bright and the bulb in the second part is brighter. A number of wrong answers include, "bulb A will be the brightest because it will use all the current", or "all bulbs will be equally bright because they are exposed to the battery", which supplies each bulb with same current. Neither of these ideas were learned in the class nor were they dismissed from the minds of the students in the introductory course. The surprising result is that McDermott and Shaffer found that the result was independent from whether the question was posed before or after the introduction of electric circuits. These examples show that "*common sense*" ideas tend to hinder students' understanding of material and at times confuse them. It is therefore, the instructor's job to identify these misconceptions and try to correct them during lesson delivery.

These common sense ideas and misconceptions are found to interfere with the student's approach to answering questions and solving problems. A prime example of such a situation is encountered during the explanation of the motion of an object moving vertically upwards at constant speed [8]. A hot-balloonist is moving up at a constant speed of 5 m/s, drops an object at a height of 40 meters above the ground. Students were asked to find the time the object takes to reach the ground, 88% of these students reported the wrong answer; 2.9 sec rather than the correct answer of 3.4 sec. Students wrongfully assumed the initial speed of the object to be zero, because of their false interpretation of word "dropped", which students interpreted to mean an initial speed of zero!

Investigations of this sort show that it is not enough to merely teach students the "right" way to think and approach the solution of physics problems. Challenges facing instructors involve, in addition to introducing the concepts, identifying possible student misconceptions or misinterpretations that confront them head-on and helping the students to "unlearn" them at the same time that they are learning the correct physics. Failure to do this will inevitably leave the students with their erroneous "common sense" ideas intact. Sadly, no contemporary textbook being used in colleges today attempts to assist instructors in identifying and correcting some of these misconceptions.

Mathematical expressions: do they help or hinder students' understanding?

We now turn our attention to the reasons that are inherent in the subject matter. The most important factor, especially when it comes to applications of physics concepts, is the fact that most of these concepts are represented by mathematical expressions. As shown in Table 1, this has been cited by more than 70% of the students as a major obstacle in understanding the meaning of many physics concepts, which in turn contribute to their frustration with physics. It is a fact that physics concepts are expressed in terms of mathematical formulae and equations that contain many variables and symbols, some of which need substitutions and using extra steps that involve other concepts. Therefore, proper interpretation and understanding of each of these symbols needed to solve problems is an integral part of the solution. It is actually the first step in the solution. Oftentimes, students find themselves looking for information, which is available to them in the wording of the problem. Examples of such problems are those encountered in projectile motion, where the phrase "at the top of the trajectory", means that the vertical component of the velocity is zero. A ball is fired "horizontally", means that the initial vertical component of the velocity is zero [8].

A second concern of students is their inability to apply mathematical expressions or to properly choose the correct/right formula when attempting to solve problems. As noted above, the most reported complaint by the students in our survey was "I understand the concepts, but I do not know which formula to use when solving problems"; and "I understand the concepts but not the mathematical formulas". The mathematical expressions representing physical quantities are not well digested by students. To illustrate this, we gave students the following two expressions, which describe the same exact concept, and asked students to state the difference between the two expressions.

$$W_{net} = \Delta KE \qquad (1)$$

$$W_{NC} = \Delta KE + \Delta PE \qquad (2)$$

Where W_{net} is the work done by the net force acting on the object and ΔKE is the change is kinetic energy (energy due to change in speed). W_{NC} in equation (2) is the work done by non-conservative forces acting on the object (e.g. friction) and ΔPE is the change potential energy. The latter represents the change in the energy of the object due to change in its elevation with respect to the surface of the earth. This is commonly referred to as the work done by the force of gravity.

More than 75% of the students said that these two expressions were different and they described different concepts; failing to realize that these expressions are exactly the same! Students did not recall that the work net is simply the sum of the work done by conservative and non-conservative forces.

$$W_{net} = W_C + W_{NC} = \Delta KE \qquad (3)$$

Since the force due to gravity (the weight of the object) is a conservative force equal to change in potential energy, i.e. $W_C = -\Delta PE$. By substituting for W_C, equation (3) becomes,

$$W_{NC} = \Delta KE + \Delta PE \qquad (4)$$

Hence the equations (1) and (2) are exactly the same. It should be noted that students were asked this question after they covered the topic of conservation of energy in class.

Another example, which illustrates students' inability to translate the meaning of mathematical expressions, is that of Newton's second law of motion [5]:

$$\sum \vec{F} = m\vec{a}$$

Where $\sum\vec{F}$ is the net force acting on the mass *m*, and *a* is the acceleration of the object. It is common for students to interpret this equation to mean that the product of mass and its acceleration is itself a force. In other words, they fail to interpret or realize that a mathematical equality between two quantities does not imply the two quantities are conceptually distinct. As a result, students do not appreciate the fact that acceleration is a consequence of the presence of a net force. Hence, students fail to see the difference between $\sum\vec{F}=0$ and $\sum\vec{F}\neq 0$, the latter of which indicates that the forces acting on the mass are unbalanced, that cause the object to move with a uniform acceleration, which means that its velocity changes at a constant rate. It should be noted that in a homework problem, students solved the questions if given all the information, even though the concept was not fully understood by the students.

Another important factor that contributes to students' inability to translate mathematical expressions is the fact that students tend to focus on mathematical definitions rather than on the physics meaning of the mathematical expressions. An example of such phenomena, is demonstrated by the following example, see Fig. 2, where we asked students which of the two children does more work against gravity in moving the box a height *h* above the ground (neglecting air resistance and frictional affects). Almost all students said the boy on the inclined plane does more work than the other boy, while they both do the same exact amount of work. In arriving at this answer, students used the definition of work, which states $W=F\Delta d\cos\theta$, where *F* is the applied force, Δd is the distance travelled and θ is the angle between *F* and Δd. Hence since the distance, Δd, is longer for the boy along the inclined plane, then he did more work.

Similar examples have been reported by Lawson and McDermott [4]. The conclusion here is that students based their answer on the mathematical expression rather than on the concept; failing to properly interpret the formulae describing the situation at hand.

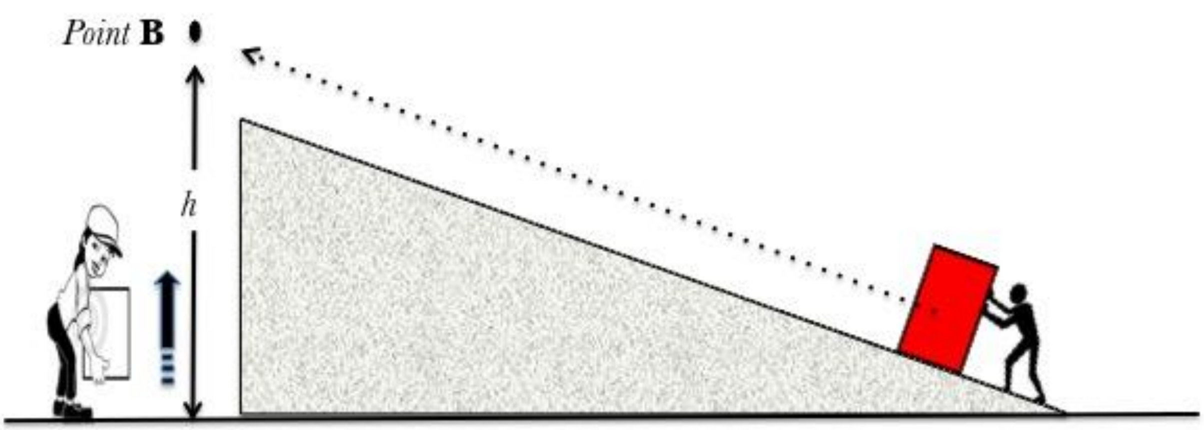

Figure 2: In absence of air resistance and friction, the work done by the boy and the girl against gravity is exactly the same.

The above discussion highlights the fact that introducing basic physics concepts using mathematical expressions contributes to students' frustration with Introductory Physics. A student may fully understand free fall motion, yet s/he gets the wrong answer to the hot-balloonist problem. Similarly, with the work question, students fail to apply the expression representing to the two situations. In fact, solving problems in physics is in itself a skill that can only be learnt in physics courses. Through problem solving skills, students are able to breakdown physics situations into a set of symbols that are represented by mathematical formulae that can be either measured or calculated. This skill is gained and refined by solving as many problems as possible. Suffice to say that the onus is on physics educators to meet these challenges and come up with a strategy by which to incorporate these important components into physics teaching in order to achieve our objectives and learning outcomes.

Student study habits:

The second factor we investigated is that of student study habits and how students prepare for quizzes and exams. Research shows that students begin the semester pursuing a conceptual understanding of the subject matter but quickly become overwhelmed by the base of the course and revert to *rote* learning in order to catch up with the instructor to solve homework and prepare for quizzes and exams. Rote learning is a learning technique, which avoids understanding of a subject and instead focuses on memorization. The major practice involved in rote learning is learning by repetition. The idea is that one will be able to quickly recall the meaning of the material the more one repeats it. While this technique may work in other subjects like history, biology and various other courses, it is not an effective method for studying physics. In preparing for a physics exam, students often rely on the end-of-chapter problems, which if not approached with the understanding of all concepts involved in their solutions may not serve as a good tool for preparing for exams. Students are advised that studying physics should be done in two stages. First, they have to understand the concepts, followed by the second stage during which they practice applying these concepts to solve various examples in real-life situations. Students tend to rely on using rote learning to "memorize" the solution to old exam problems or end-of-chapter problems with the hope that they will encounter a similar problem in the exam. Such students are found to have little grasp of the concepts covered by these problems [8]. To investigate the validity of this conclusion, two problems were given to a pool of 60 students to solve as an in-class quiz. The problems were selected from end-of-chapter questions and old exam problems. Students scores were satisfactory with more than half of the class obtaining 75% or higher. Later, these students were asked conceptual questions, which were covered by the two problems and very few students were able to answer these questions. The majority of the students were able to calculate the amount of heat flow in a metal of a specific heat capacity as a result of temperature increase, yet many of them failed to distinguish between the concept of heat and temperature.

These examples clearly demonstrate that the majority of students do not study or prepare properly for physics quizzes and exams. The consequence of this is that students find themselves either getting the grades, yet they do not fully understand the concepts, or understanding the concepts which they cannot apply it to real life situations. For a student to strike a balance, s/he must do well in both stages mentioned at the beginning of this paragraph.

Teaching methodology

The third factor, which may have a great impact on students' perception of introductory physics, is teaching methodology. It was found that the method by which concepts are delivered influences students' comprehension. Students' definition of a good physics instructor was found to depend on factors that go beyond s/his understanding of the concepts. Suleiman and Elmehdi [9] investigated the effects of new teaching approaches that rely on technology such Course Managing Systems (CMS) [10], implementation of the Internet, and employing new approaches, such as Guided Critical Thinking [11]. They found that such approaches have greatly improved the performance of students. Classical approaches, where the instructor fills the board with long derivations and diagrams that are difficult to follow, should be replaced by well-organized and colorful multimedia slides that deliver the same message but in a more unique and attractive way. Animations are also a great tool to show students "dynamic" applications of physics concepts. The CMS course page may also be used to post supplementary material and communicate with students. In addition, student grades can also be posted on the CMS course page, which allows the students to follow and assess their progress their progress throughout the semester.

Other teaching approaches include student study groups, which allow students to learn from each other and discuss solutions. This method was found to be very effective, especially for students who tend to be very shy and do not participate or answer questions during the class time.

Assessment tools

The last factor that contributes to the students' frustration and the subsequent struggle with Introductory Physics is that of assessment tools, which are mainly comprised of problem-based quizzes, tests and exams. A typical physics assessment test is made up of long answer questions and multiple choice questions, most of which are based on solving problems designed to test student understanding of physics concepts covered in class. Judging from the student responses (Table 1), 56% of the students thought that exams and exam formats are the main reason for the difficulty of physics. The problem is more pronounced for students in Medicine and Health Sciences, where students are used to essay type questions, which rely on memorization and recall. The solution to this problem may take more than a short paragraph to discuss. There are attempts to deal with this issue, especially with the presentation of the questions. For example, Suleiman and Elmehdi [9] suggested that the application of the "Guided Critical Thinking" approach to help students breakdown the problem was successful in raising their grades by 32%. The approach is based on breaking down questions into several sub questions that serve to guide the student to the solution. Whatever the solution may be, we have to understand that physics assessment tools need to be revised. Among the suggestions [9] discussed are research-based assignments, presentations and essay questions, which may give students the freedom to go beyond having to worry about finding the numerical solution to a specific problem.

Realizing the importance and relevance of physics:

The last factor to be discussed in this paper is to investigate student motivation and the encouragement they receive to take Physics courses, because of the importance and relevance of physics to their field of study. As indicated in Table (1), 80% of the students did not think physics was relevant to their field of study. Such a high percentage is shared by many administrative personnel who are unaware of the importance of physics to these disciplines, prompting several authors to write articles on the relevance of physics to non-major disciplines such as medicine, health sciences and engineering. For example, Ahmed [1] details the role of physics in engineering education. The author argued that engineers should take at least four physics courses, covering areas such as classical mechanics; optics, sound and heat; electricity and magnetism; and modern physics. He listed some of the high caliber universities in the USA and Europe that have included this many physics courses into their curriculum. The author adds that these courses should be supplemented by laboratory sessions to strengthen and facilitate the student understanding of physics concepts.

Even though there is a unanimous agreement among educators on the importance and relevance of Introductory Physics to non-physics majors, such as engineering, students fail to see its relevance. To highlight the importance of physics and its relevance to the engineering profession, instructors are encouraged to review two of the famous architectural disasters that took place in the world in the past few decades. These include the Collapse of the Hyatt Regency Hotel in Kansas City, 1981 [12, 13], and the Collapse of the Bridge in Washington State, 1940 [13,14]. After careful examination of the reasons behind these tragic accidents, it becomes apparent that negligence of basic physics phenomena was behind these disasters [12,13,14]. In both cases, the results of the investigation revealed that induced oscillations approached the natural frequencies of both structures causing resonance (the process by which the frequency on an object matches its natural frequency causing a dramatic increase in amplitude) [13]. The resulting large amplitude oscillations went beyond the range of the restoring force, causing a spectacular collapse. There are innumerable other examples of how the lack of physics understanding has led to costly and unfortunate consequences [13]. Additional examples of engineering disasters were also reported by Bartlett [14,15] and Ross [12]. These examples clearly demonstrate how important basic physics is in engineering education.

In medicine and health sciences, Suleiman [16] provided a comprehensive review of the relevance and role of physics concepts in these disciplines. He argued that most biological systems and processes, such as muscle motion, blood flow, vision and hearing, etc., can be better understood using basic physics concepts such as forces, torque, fluid flow, light and optics, waves, etc. In a similar article, Varmus (1999) [17] highlights the impact of physics on biology and medicine. He presented a table of 25 basic physics concepts, which are directly correlated to medical applications, including those involved in diagnostic and therapeutic applications. He continues to add that the recent advances in molecular genetics could not have been achieved without the analytical as well as computational imaging tools of the physicist, saying that medical and health scientists should not only be exposed to such tools, but learn to use them.

A third review is that of Mackay and Santillan (2005) [18], who highlighted the role and importance of physics to the medical field throughout the 18th and 19th centuries. They reviewed the advances in science and technology related to medicine and health sciences, including imaging modalities, radiotherapy and ultrasound.

3. Conclusion

The factors attributing to the struggle of students with Introductory Physics include misconceptions and common sense knowledge, which students bring with them to the class; weak physics background; difficulty in properly interpreting mathematical expressions that describe physics concepts and situations; and study habits, which tend to be most suitable for subjects such as history, biology etc., where students are required to memorize and list a set of functions and steps. In addition, teaching methodology and assessment tools are found to contribute to the frustration and struggle that students have with Introductory Physics. It is suggested that introducing approaches that employ IT tools such as CMS tend to improve student performance. As a motivating factor for students, the relevance of physics to the professions of engineering, medicine and health sciences should be highlighted not only to students, but also to program administrators and curriculum designers. Even though professionals in the field recognize the importance of physics in engineering education, students should be reminded of this fact during their early college years.

With a common understanding of the importance and relevance of physics in the disciplines of engineering, medicine and health sciences, curriculum designers should make sure that students take an adequate number of physics courses, which provide full coverage of basic physic concepts and are consistent with what is being taught at internationally. To help students overcome their difficulty with physics, collective effort from instructors and administrators is needed with the aim of delivering high quality education to students enrolled in various university programs.

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