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How Selected Universities Treat Physical Education Courses in Their Engineering Curricula

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Abstract

Engineering curricula at different institutes of higher education vary in the ways in which they treat physical education courses. This paper made a survey in this regard. It classifies engineering programs into four categories. The categories range from mandating to total exclusion of PE courses. Examples of each category are given. Some details for several institutes in each category are provided. A special category in which a swim test needs to be passed is included with some examples and details. The significance of this study is outlined. A short comparison between the categories is made, and a few recommendations are provided.

Introduction

Kinesiology is the science of human movement [1]. Many institutes of higher education have a kinesiology department offering both undergraduate and graduate programs. Examples include University of Texas Austin, Penn State University, University of Pittsburgh, Arizona State University, University of Michigan, and the University of Maryland. This science of Kinesiology is very broad as it encompasses many areas within its borders. For instance, the Department of Kinesiology & Health Education at the University of Texas Austin offers majors in: Health Promotion and Fitness, Kinesiology, Athletic Training, and Sport Management.

Kinesiology within its framework has branches that are concerned with educating other individuals about physical activities. For instance, students at the Department of Kinesiology & Health Education at the University of Texas Austin can choose Teacher Certification as one of two options in their studies. The other option is the non-certification General Kinesiology.

Physical education is a standing program by itself within the science of Kinesiology. The Wikipedia Encyclopedia [1] defines Physical education as "the interdisciplinary study of all areas of science relating to the transmission of physical knowledge and skills to an individual or a group, the application of these skills, and their results. Included, among other subjects, are aspects of anthropology, biology, chemistry, physics, psychology, and sociology. Some treatments of the discipline also include spirituality as an important aspect." Many institutes of higher education have a specific Physical Education department. These departments require four year of education for graduation. Examples in this regard include Seattle Pacific University. Several programs even exist within physical education itself. For instance, the University of Maine at Presque Isle offers B. S. degrees in three physical education options. These include physical education teaching, physical education non-teaching: fitness and wellness, and physical education: Cross Country Ski Coaching and Self-Designed.

Generally speaking there are four types in which kinesiology departments and physical education departments offer courses. The interest of this paper is on one of them only, but the other three types are briefly stated for clarity. First, the kinesiology departments and physical education departments offer courses at all levels for students who are majoring in kinesiology or physical education. Second, they offer courses to many students in some majors which require deep or even superficial knowledge of certain aspects of human movement. Sports medicine is the best example in this regard. Thirdly, they offer classical theoretical courses on certain aspects of the science of kinesiology itself to many students in many other majors which are not involved in the sciences of kinesiology and physical education themselves. Students take such courses to fulfill humanity requirements for their degrees. Examples include the majors of business, education, journalism, and engineering. Based on the investigation of this paper, these courses are rare.

The fourth type is practical courses on physical activities in which students engage in actual physical activities. Students in these majors know such courses as physical education (PE) although other titles are being used like gym, physical training, and fitness to designate such courses. The focus of this paper is on these specific PE courses in the engineering curriculum.

Physical Activities in the Education Process in General

Physical activity is defined [2-3] as "any bodily movement produced by skeletal and muscles that result in energy expenditure." It is well known that various physical activities improve the health of individuals [4]. This includes both physical [5] and mental fitness [6]. This is not the place to prove the importance of physical activities in our lives for it is well established elsewhere in the literature.

Physical inactivity on the other hand leads to many physical and mental diseases and disorders like depression and obesity. This is why the Center for Disease Control (CDS) classifies physical inactivity among major health problems for students besides other known diseases and orders like HIV, AIDS, heart disease, poor nutrition and obesity [7].

Accordingly, students who are physically active are likely to succeed more in their education because they are more fit mentally. In other words, physical activities promote the education process of students. The fact that we are increasingly becoming more dependent on machines to

perform our daily activities adds a sense of importance to the need for new measurements to increase our physical and mental fitness. It follows then that requiring or strongly encouraging physical education courses at all levels of education will improve the learning process of the students.

For its profound importance as explained above, pre-college education puts a lot of emphasis on physical education. Almost all schools at the elementary, intermediate and high school levels require or strongly encourage their students to undertake various courses of physical education. This seems to be universal in all countries around the world. In the USA, more than 95% of schools do so [7]. The fact that 85% of all USA schools have a designated person to coordinate all physical activities [7] supports the importance of physical activities in education.

Unfortunately however and despite its extreme importance as explained above, the above notion on physical education is different for various curricula at the college level in all majors outside kinesiology including all fields of the engineering discipline. The old debate of what to include in and what to exclude out of the engineering curricula has a profound impact in this regard. The norm among university administrations in general and among engineering administrators in particular nowadays seems to encourage the elimination of existing courses and to discourage the addition of other courses to attract new and retain current engineering students. Physical education courses are at the top of this list.

Non-Technical Courses in the Engineering Curricula

Including and updating non-technical courses in the engineering education has been a dynamic process for a long time [8]. There are many fields which have the potential to improve the education process in the engineering field. Criterion 4c of the Accreditation Board for Engineering and Engineering Technology (ABET) [9] states that engineering programs should include a non-technical component to augment the technical component. This non-technical component has been traditionally in Humanities, Social Sciences, and Arts in almost all engineering programs. Very few institutes include courses from other fields like Theology and Physical Education. Physical Education is a non-technical field worthy of inclusion in the engineering curricula.

Engineering Curricula and Physical Education Courses

There is a great variance in the ways in which different engineering curricula treat physical education courses. On one hand, many engineering departments require a certain number of physical education courses from their students. On the other hand, many engineering departments do not have any reference to physical education courses in their curricula. Some engineering departments will not even accept PE courses as electives. Many other engineering departments fall in between these two extremes.

A Comparison Study

This paper investigated the ways in which different engineering curricula at different national and international universities treat PE courses in their curricula. It is extremely difficult and

almost impossible to include all universities. Accordingly, only a sample of universities and colleges was chosen. This sample included close to one hundred engineering departments and programs although not all of them are specifically mentioned in this paper. Subsequent studies may be performed later on bigger and more inclusive samples. For each engineering program, information about PE courses was collected. The information was analyzed and a comparative analysis was made.

The Significance of this Study

Statistics about PE courses in pre-college education exist [7]. However, no statistics about PE courses at the college level were found. This paper is an initial step in this regard.

As explained above, physical activities improve the physical and mental health of individuals including students. Various engineering departments may use this study in their decisions on PE courses. It may help some departments in keeping existing required PE courses in the engineering curricula.

This study may support initiatives and motions to include PE courses for those engineering educators whose curricula do not currently require PE courses from their students. As put by Gretchen Kalonji [10], "As we move forward, we must boldly reformulate engineering education. To put it bluntly, by sticking to existing models, we are losing the battle for imaginations of young people."

As engineering educators, we always strive to improve the learning capacities of our engineering students. One way of doing so is by engaging them in various physical activities. This paper aims to increase the awareness of engineering educators on the importance of physical activities to the engineering curriculum.

This and similar articles may increase the awareness of our engineering students about the relevance and need to include PE courses in the engineering curricula at their institutes. Engineering students who wish to take PE courses for credit can use such information to convince their advisors and administrators.

How Do Various Engineering Departments Treat Physical Education Courses

As stated above, engineering departments vary in the ways in which their curricula treat physical education courses. Based on this study, five distinct categories were found to exist in this regard. Table One summarizes these categories.

There is also a wide variation even within each category. Each category is identified next with some details. Examples for each category are included. A comparison of these categories from an educational point of view follows.

Table 1. Classifying Engineering Departments
Based on the Ways in which They Treat PE Courses

Category	Description
I	PE courses are required from engineering students.
II	PE courses are accepted as electives from engineering students. PE courses are available.
III	PE courses are accepted as electives from engineering students. PE courses are not available.
IV	PE courses are not accepted from engineering students.
Special	Engineering students must pass a swimming test

Category I

In this category, the engineering curriculum states specifically that students must complete a certain number of PE courses. The nature of these courses varies widely from an institute to another. These courses are graded normally in some institutes, but they are pass/fail courses in other institutes. That is, they carry credits in some institutes, but have zero credits in others. Some institutes require four PE courses while others require only one. Some institutes require specific PE courses while others allow their students to choose from a list of available PE courses. Some institutes have both mandatory specific courses and mandatory elective PE courses at the same time. Various institutes have unique and interesting features in this regard.

Notre Dame University falls in this category. The curricula in the engineering departments at this institute specifically require students to complete two PE courses. These courses have zero credits but they are mandatory and have to be taken before graduation but preferably in the first year. The PE Department offers two tracks for students to choose PE courses from. The Lifetime Sports Track is on skills and performance of sports and similar activities like American Ballroom Dance, Downhill Skiing, Snowboarding, Golf, Hiking, Latin Ball Dance, Soccer, Tennis, Cross County Skiing, Fencing, Handball, Ice Skating, Racquetball, Team Handball, and Volleyball. The Wellness Track is on activities related to personal wellness like Self-Defense, Swimming, Weight Training, Life guarding, First Aid/CPR, Walking and Jogging, Yoga, Self-Paced Fitness, and Fitness for Life.

Like other engineering curricula at Alfred University, the Glass Engineering Science curriculum specifically states that the total requirements for graduation is: 133 credits + PE. A student must take two physical education activity courses (PHED 100-level or specific Dance courses only) to satisfy PE requirements. These courses are two credit courses. Alternatively however, a student may satisfy such requirements by participation in a varsity sport for two entire seasons. Another option to satisfy PE requirements is to successfully pass a lifetime sports proficiency examination made of both written and physical tests. It is interesting to note that students who are of the age of 25 years or more upon at matriculation are exempt from these requirements. It is interesting because older students are usually less active physically, and older groups of

population need to be engaged more in physical activities.

The Mechanical engineering curriculum at the University of Wisconsin Platteville includes two PE courses. The first is the specific mandatory course of PE 1000 Fitness Assessment and Management. The other is mandatory, but it can be chosen from a long list of one-credit courses. Each course in this list is on a specific physical activity or a specific aspect of physical activities. For instance, PE 1110 Weight Training belongs to the first group of these options while PE 3360 Fitness Evaluation fits in the second group.

The philosophy of the Massachusetts Institute of Technology (MIT) puts high emphasis on physical activities. They require PE classes to involve students in physical activities while pursuing academic studies. The mission is to develop skills which are needed for lifetime fitness engagement. Each engineering student at MIT must complete a total of four classes. These classes are not normal courses however. Each of these is a 12-session class offered during a period of only six weeks. That is, a student is able to satisfy PE requirements in the first year. However, the student must satisfy PE requirements by the end of the Sophomore year. It is interesting though to note that transfer students are required to take only two classes instead of four. It is also interesting to note that a student may repeat the same class as many times as he/she wishes. Repeated classes count towards the PE requirements.

Some of these PE classes at the MIT are unique and interesting. A few of these classes are briefly cited next. The class of Body SMARTS which is described as a "Mission Possible: Turning Geeks into Athletes in Three Short Weeks, " fits this special group of classes. Another class is the Self Defense RAD class which teaches women practical defense techniques, as well as providing basic information on personal safety, awareness, risk reduction and avoidance. MIT Police offers this class. The class of Jiu-Jitsu is interesting because the techniques of the Jiu-Jitsu uses mental preparedness and biological information to defeat an attacker instead of sheer physical force. Those students who are not physically strong can utilize the techniques of this class. Another interesting class is the class of Physical Intelligence which combines human intelligence in physical activities. The Upgrade your Health and Happiness in 7 Short Days class accomplishes its mission through Healthy Diet, Physical Activity, Enough Sleep, Stress Management, and Healthy Relationships.

Some of the MIT PE classes are on dancing. Examples include: Dance-Middle Eastern, Dance-Intro, Dance-Ballroom, Dance-Technique and Choreography, Dance-Contra American Folk, Dance-Modern Squares, and Dance-Tap.

The other PE classes at MIT which offer students other varieties of physical activities include: Aquatics-Beginner Swimming, Aquatics-Advanced Beginner Swimming, Aquatics-Intermediate Swimming, Aquatics-Advanced Techniques, Aquatics-Diving, Aquatics-SCUBA Diving, Aikido, Archery, Badminton, Baseball: How to Hit, Basketball, Climbing - Indoor Bouldering, Fencing - Foil & Sabre, Field Hockey-Indoor, Figure Skating, Golf, Group X Aerobics - Step 1 and Step 2, Group X Aerobics - Cardio Kickboxing, Group X Aerobics -Boot Camp 1 and Boot Camp 2, Group X Aerobics – Kickbox, Group X Aerobics Intro to Kickboxing I, Group X Aerobics-Kickbox Interval Training II, Group X Aerobics Kickbox - Interval Training III, Group X Aerobics Kickbox - Interval Training IV, Group X Aerobics-Pilates, Group X Aerobics-Pilates

1, Group X Aerobics- Pilates 2, Group X Aerobics -Intro to Step, Group X Aerobics – Step, Group X Aerobics - Advanced Step, Group X Aerobics -Step Variety, Group X - Yoga Ice Hockey – Beginning, Ice Hockey – Intermediate, Juggling, Karate – Shokotan, Lacrosse, Beginning Pistol, Jogging/Running, Ropes Adventure, Sailing , Sailing - Advanced / Intro to Sailboat Racing, Self-Defense for Everyone, Skating, Skiing-Downhill / Snowboarding, Soccer-Indoor, Sport Taekwondo, Squash, Table Tennis, Tae Kwon Do, Tennis, Tennis – Intermediate, Tennis – Advanced, Volleyball, Volleyball – Intermediate, and Weight Training.

Washington and Lee University falls in this category as well. The Physics-Engineering program at Washington and Lee University requires its students to pass five terms of physical education. Students select from various 100 and 200 level courses offered by the PE department. The courses are on individual sports, team sports, fitness activities, and recreational activities. These include courses on Fundamentals (101), Cross County (200), Football (152 and 201), Soccer (156 and 202), Basketball (165 and 203), Swimming and Aerobic Swimming (111 and 205), Softball (171), Baseball (208), Golf (151 and 209), Lacrosse (157 and 210), Tennis Beginning and Intermediate (158), Tennis (211), Aerobic Running (154), Track and Field (212), Volleyball (160 and 214), Horsemanship (170), and Riding (215).

Oregon State University falls also in Category I. The Civil, Construction, and Environmental Engineering Program at this University requires its students to complete a total of three credits of fitness classes [11]. Either one of the following two-credit courses must be taken: HHS 231 Lifetime Fitness for Health, and NFM 232 Nutrition and Lifetime Fitness. Additionally, one of the following one-credit lab/activity course must be taken: HHS 241, HHS 242, HHS 243, HHS 244, HHS 245, HHS 246, HHS 247, HHS 248, and HHS 251.

The following describes the two two-credit fitness courses [12] at Oregon State University from which a student must take one. The HHS 231 is on "Physical activity and positive health behaviors in human health; topics include physical fitness, nutrition, weight control, stress management, addictive behaviors, and sexually transmitted infections." The NFM 232 is on "role of foods, nutrition and physical activity in developing and maintaining fitness and health."

The following describes some of the one-credit fitness courses [12] from which a student at Oregon State University must take one. The HHS 241 is on "Assessment, evaluation and practice of physical fitness and health behaviors leading to the development of a personal fitness program." The HHS 242 is on "Assessment, evaluation and practice of physical fitness and health behaviors; development of a personal fitness program with a focus on aerobic exercise." The HHS 243 is on "Assessment, evaluation and practice of physical fitness and health behaviors; development of a personal fitness program with a focus on muscular fitness." The HHS 244 is on "Assessment, evaluation and practice of physical fitness and health behaviors; development of a personal fitness program focusing on maintaining or achieving a healthy body composition." The HHS 251 is on "Designing and implementing a personal activity program that emphasizes moderate-intensity physical activity and utilizes effective behavior change techniques."

Rice University is in this category. All engineering departments require their students to complete two noncredit LPAP courses. LPAP stands for Lifetime Physical Activity Program. These two courses are APAP 101 and LPAP 102. Each of these two courses is on skill

development, knowledge of rules and strategy, concepts of conditioning, and participation in one or two physical activities. Additionally, students can take other LPAP courses for credit to satisfy requirements from non-engineering departments. These LPAP one-credit courses may be chosen from a very long list including courses on Middle Eastern Dance, Tennis, Badminton, Golf, Flag Foot, Softball, Soccer, Volleyball, Basketball, Ballroom Dance, Latin Dance, Country Western Dance, Swing Dance, Modern Dance, Ballet, Jazz Dance, Lifeguarding, Martial Arts, Pilates, Capoeira, Classical Indian Dance, Tai Chai, Walk Jog and Run, and Cardio Kickboxing.

It is interesting to note that even some two-year community colleges fall in this regard. Finger Lake Community College in the State of New York is an example. The AS Engineering Science degree requirements include the successful completion of four credit hours in PE. The PE department at this college offers a wide variety of one and two credit courses on various PE activities including the courses of PE 102-Basic Rhythms, PE 103-Judo, PE 105-Ice Skating, PE 106-Bowling, PE 107-Golf, PE 108-Badington, PE 110-Physicl Conditioning, PE 112-Yoga for Beginners, PE 113-Techniques for Angling, PE 114-Karate, PE 115-Tennis, PE 116-Raquetball, PE 117-Basic Weight Training, PE 118-Skiing/Snowboarding I, PE 119-Skiing/Snowboarding II, PE 121-Walk and Jog, PE 122-Concepts of Wellness, PE 123-Spinning, PE 140-Beginning Swimming, PE 141-Scuba, PE 142-Basic Sailing, PE 150-Beginning Camping, PE 151-Canoe and Kayak Padding Experiences, PE 162 T'ai Chai Chuan I, PE 163 T'ai Chai Chuan II, PE 164-Stress Reduction Through Exercise, PE 165-Oriental Healing Arts, PE 166-Biofield Therapy, PE 167-Aerobics, PE 171-Recreational Shooting, PE 172-Hunting Fundamentals, PE 181-Mime, PE 185-Fencing, PE 202-Creative Dance, and PE 203-Judo II.

This category includes a few universities, which are mainly technical and engineering institutes. For its relative importance, a separate section is allocated to this group later in this paper.

Category II

In this category, the engineering curriculum does not state specifically that students must complete a certain number of PE courses. However, the curriculum includes various types of electives, and the rules allow students to take PE courses to satisfy such requirements. The nature and number of these elective courses vary widely from an institute to another.

Tufts University falls in this category. The Departments of Computer Science in the College of Engineering includes two free electives in its curriculum. The Bachelor of Science in Electrical Engineering (BSEE), the Bachelor of Science in Civil Engineering (BSCE), and the Bachelor of Science in Environmental Engineering (BSEvE), programs also have two free electives in their curricula. The rules for all of the above departments and programs allow the student to take these two free electives in physical education. The Department of Chemical and Biological Engineering however includes only one free elective in the 2nd semester in the senior year. The department rules allow the student to take this free elective in physical education. It is interesting to note that the Bachelor of Science in Biomedical Engineering (BSBME) curriculum does not have a free elective like the above two groups of engineering programs.

The Physical Education Department at Tufts University offers fifty-five courses each year including PE 05 Sailing, PE Yoga & Yogalates, PE 23 Rock Climbing, PE 32 Squash I, PE 33

Tennis I, PE 34 Tennis II, PE 41 Golf, PE 43 Muscle Conditioning, PE 45 Pilates, PE 46 Weight Training, PE Step Aerobics. The Physical Education Department describes theses courses as skill oriented courses and it states that two of the above courses will make up one course credit. That is, two of these PE courses count as one free elective. These PE courses are graded on a pass/fail basis. The Physical Education Department however offers other types of courses. It describes such courses as theory classes. Unlike the above skill oriented courses, each of these theory course counts for a full credit. That is one of these courses can be used as a free elective. Examples of these courses include PE 110 Independent Study, PE 131 Emergency Care, PE 145 Advanced Principles of Exercise, and PE 150 Bodyworks. These theoretical classes are not pass/fail courses.

The Middle East Technical University in Ankara, Turkey falls in this category. The Departments of Petroleum and Natural Gases Engineering, Computer Engineering, Civil Engineering, Chemical Engineering, and Aerospace Engineering include two Non-technical elective courses and one free elective course in their curricula. All of these courses are regular three credit courses. On one hand, the two non-technical elective courses must be from an approved list. The list contains many courses from many non-engineering departments like the departments of Architecture, City and Regional Planning, Political Science and Public Administration, Turkish Language, International Relations, Economics, Music and Fine Arts. This list includes the Department of Physical Education and Sports. However, only one course is accepted from this department as a non-technical elective. The above engineering curricula accept the course of PES 415 History and Philosophy of P. E. S. This course is a theoretical course and it does not involve any actual physical activities. On the other hand, the required free elective course can be any university course including any course from the PES Department. Students have the option of taking a course which involves actual physical activities.

Category III

The engineering curricula at the institutes in this category do not state specifically that students must complete a certain number of PE courses. However, the curriculum includes free electives. Theoretically, the rules allow students to take PE courses to satisfy free elective requirements. However, PE courses are not available for students at such institutes.

The University of Cyprus falls in this category. The Departments of Architecture, Civil and Environmental Engineering, Electrical and Computer Engineering, and Mechanical and Manufacturing Engineering at this institute include three free electives. Each course weighs five ECTS according to their system. Five ECTS are equivalent to three credit units according to the system of many other institutes. The engineering student can take these three free electives from any Faculty at this university. Unfortunately, the university does not have a PE department and consequently no courses with physical activity aspects are available to the engineering students.

Category IV

In this category, the engineering curriculum does not accept PE courses to fulfill degree requirements. In almost all cases, the engineering curriculum has various types of electives, but PE courses cannot be used for this purpose.

The University of Portland falls in this category. The curriculum for all engineering branches (electrical and mechanical for example) at this university requires a course in Literature, a course in Fine Arts, a course in History, a course in Social Science (Political Science, Psychology, Sociology), two courses in Philosophy, two courses in Theology, and a course in Theological Perspective. However, it neither requires nor accepts PE courses.

The University of Michigan is in this category. The engineering departments at this institute do not require PE courses in their curricula. They however require several non-engineering electives. A list of departments and divisions from which such courses can be chosen contains close to thirty entities. This list nonetheless does not include the Department of Kinesiology or the division of Physical Education. Further, this list includes Dance courses as long as they are non-performance courses.

Most of the engineering and engineering technology programs at Indian University Purdue University Indianapolis (IUPUI) fall in this category. The curriculum in mechanical engineering technology for example does not include free electives like some other engineering and engineering technology departments at IUPUI. It includes several Humanities and Social Science electives. The list from which such courses can be chosen includes Anthropology, Art, Economics, English, Folklore, Foreign Language, Geography, Music, History, Philosophy, Political Science, Psychology, Religious Studies, and Sociology. The construction technology curriculum is very similar to the mechanical engineering technology program except the list of the Humanities and Social Science electives is shorter. It includes Anthropology, Economics, Geography, Political Science, Psychology, and Sociology. Neither programs include courses from the Department of Physical and Tourism Management as a Humanities and Social Science elective.

It is interesting to note that some other engineering and engineering technology programs at IUPUI like computer engineering, electrical engineering, and computer and information technology have free electives in their curricula. These courses can be any courses at IUPUI including those courses offered by the Department of Physical and Tourism Management. However the Department of Physical and Tourism Management focuses its course offerings on its students.

Wake Tech Community College in Raleigh, North Carolina is in this category. The curricula of the Computer Engineering Technology, Civil Engineering Technology, Electronics Engineering Technology, and Industrial Pharmaceutical Technology two-year programs require only one three-credit elective course. It should be in Humanities or Fine Arts. PE courses are not offered in this college and are not required by its engineering technology programs.

The Swimming Test

The chairman of the Board of Editors at the popular Encyclopedia Britannica, at one point, Mortimer Alder, who was a famous philosopher and who also wrote more than thirty books, finished all academic requirements to earn an undergraduate degree in three years from Columbia University in New York City in 1923 with one exception [13]. He failed to pass a

mandatory swimming test [13]. Columbia University refused to bestow a degree on this distinguished scholar for exactly sixty years in spite of the fact that he was at the top of his graduating class [13]. Columbia University finally relinquished its longstanding stance and lifted the swimming test constraints and awarded a degree to him [14] in 1983 upon his request in which he informed the university that he was able to swim [13]. Current regulations at Columbia University state that a student who fails the swimming test must take a swimming course.

Columbia is not the only institute to mandate the passing of a swimming test. Many elite universities have this requirement before graduation. This includes the MIT, Notre Dame, University of Chicago, Swarthmore College, and Washington and Lee University. This list also includes King Fahd University of Petroleum and Minerals in Saudi Arabia.

The test itself is short and simple in its structure. It is however different from an institute to another. For instance at the MIT, a student passes if he/she can swim a total of 100 yards. The first 75 yards must be on front while the last 25 yards are optional. Similarly at Notre dame, the test is compromised of back and front strokes and it is a 100 meters test. At Columbia University however, a student passes if he/she can swim a total of three laps (25 yards per lap) using any technique or combinations of techniques. The swimming test at King Fahd University of Petroleum and Minerals involves being able to stay afloat for one full minute in addition to swimming across the pool.

Requiring the passing of a swim test is intriguing. It is very difficult to pinpoint the rationale behind this requirement. Rumors are abundant in this regard [15]. Many myths circulate around this issue. At Harvard University, which does not have engineering programs, it is alleged that this test is mandatory because Harry Widener who has a library in his name at Harvard drowned in the Titanic in 1912. His mother was a major donor to Harvard and this is one way of honoring her son [13]. Similar stories exist for other institutes like Swarthmore College and the University of Chicago [14]. In Saudi Arabia, the only university which requires a swim test is in Dharan, a coastal town on the Persian Gulf. This was the reason behind it for one of the authors of this paper when he attended this institute.

The logical explanation for this seems to stem from the fact that drowning is a leading cause of death especially among young people. For instance, it is the fifth leading cause of death in the USA in early 1990's [16]. It is also possible that it stems from the fact that many young soldiers were drowning in World War II and the US Navy was pressuring institutes of higher education to instill swimming skills in college students [17].

Some institutes require only the passing of the swim test like Columbia and the MIT, but others require taking a swimming course in addition to passing the test itself like King Fahd University of Petroleum and Mineral. However, all of them require a swimming course if the test is not passed. At Notre Dame, the group of students who fail the test consists of 200 students annually[17].

Penn State University

One author is an assistant professor of engineering at Penn State University. It is therefore pertinent to give some details regarding this topic at this institute.

Penn State University graduates many engineers annually. In 2004-2005, Penn State University graduated 1,396 engineers surpassing familiar engineering powerhouses like Georgia Tech, Purdue University, North Carolina State University, University of Illinois at Urbana-Champaign, University of Michigan, Virginia Tech, Texas A&M University, Ohio State University, and the University of California San Diego which made up the top ten list in the US in that year [18]. Further, Penn State was at the third place in the number of female engineering graduates behind Georgia Tech and the University of Michigan in the year 2004-2005. It graduated a total of 266 female engineers in that year [18].

All engineering departments at Penn State require their students to take a total of three credits in Health and Physical Activities [19]. Physical Activities courses are 1.5 credits which means, a student must take two courses to fulfill this requirement. According to the above classification, Penn State can fall in Category I. However, since students can take Health courses instead of Physical Activities, Penn State can be classified as a category IV institute. Further, the Physical Activities courses at Penn State contain a theoretical component in which students collect data and write up reports on the physical activities of the course. That is, they are not pure physical activity courses like the courses offered by the institutes listed in Category I above. The engineering curricula at Penn State University do not include a mandatory swim test.

The Kinesiology Department at Penn State offers a wide variety of 1.5 credit courses suitable for Physical Activities course. This list ranges from KINES 001 Introduction to Outdoor Pursuits to KINES 093 Masters Activity (Sport). Courses in between concentrate on a specific physical activity like walking, basketball, soccer, swimming, and rugby. Not all courses involve sports. KINES 019 Jazz Dance is an example.

Universities in the Kingdom of Jordan

The two authors are from the Kingdom Jordan. The lead author teaches at an institute in Jordan. It is appropriate then to include a specific section about the topic of this paper in this country.

Based on our search, none of the engineering departments at the Jordanian university mandates PE courses. That is, Category I does currently not exist in Jordan.

Many engineering programs at several Jordanian institutes accept PE courses as electives. That is, Category II exists in Jordan. Table 2 shows some of these colleges and universities along with the available PE courses.

Based on our search, none of the engineering departments at the Jordanian university falls in Category III.

Many other institutes in Jordan do not accept PE courses from their engineering students. Table 3 shows those institutes in Category IV

The swim test does not exist in any engineering curriculum in Jordan.

Table 2. Engineering Departments in the Kingdom of Jordan which Fall in Category II

Institute	Location	Type	PE Courses
University of Jordan	Amman	Public	Principles of Physical Education
Yarmouk University	Irbid	Public	Sports in Our Lives, and Physical Fitness for All
Mutah University	Karak	Public	Principles in Physical Education
Hashemite University	Zarka	Public	Sports and Health
Ahliyyah Amman University	Amman	Private	Sports and Health

Table 3. Engineering Departments in the Kingdom of Jordan which Do Not Accept PE Courses

Institute	Location	Type
University of Philadelphia	Amman *(aka Philadelphia)*	Private
German Jordanian University	Maadaba	Private
Princess Sumya University for Technology	Amman	Private
Tafila Technical University	Tafila	Public
Applied Sciences University	Amman	Public
Al Isra Private University	Amman	Private
University of Sciences and Technology	Irbid	Public
Al-Balqa' Applied University	Salt	Public

Disabled Students and PE Requirements

As mentioned above Finger Lake community College falls in Category I. Students in the AS Engineering Science program must complete four PE credits (one to three courses). It is interesting to note that no one is exempted from this requirement including disabled students. However, the PE department offers a special PE course for this purpose. A student can take the PE 160-Selected Physical Activity if he/she is not able to take regular PE courses for health or physical reasons. This course is tailored for this student in coordination with his/her physician.

Similar accommodations are provided for disabled students at other institutes. For instance, the course KINES 092 Adaptive Physical Education at Penn State University, which is a fitness activity class for students with medical disabilities, can be used to fulfill the Health and Physical Activities requirements in the engineering curricula.

PE Courses at some Pure Technical Institutes

The South Dakota School of Mines and Technology is mainly an engineering institute. It has only two colleges: The College of Engineering and the supporting College of Science and Letters. The College of Engineering has eight engineering departments.

The curricula of all of these engineering programs require each student to take one full year of PE. The PE 100 Activity Courses are one-credit courses. Each course contains activities stressing physical fitness and lifetime wellness to meet student needs and interests. The same activity course cannot be counted again toward graduation credit.

Additionally, some of the engineering curricula like that of the electrical engineering requires two credits of free electives. Two PE courses other than PE 100 can be used for this purpose. The PE department at this institute offers a variety of such PE courses besides PE 100. It offers the following one-credit courses: PE 101L Foundations of Officership Lab, PE 102 Basic Leadership Lab, PE 103 Nutrition for Everyday Living, PE 105 Wellness and Physical Fitness, PE 113 Varsity Sports I, PE 118 Beginning and Intermediate Swimming (Men and Women), and PE 160 Modified Physical Education Activity.

King Fahd University of Petroleum and Minerals in Saudi Arabia is also a technical university similar to the above South Dakota School of Mines and Technology. This institute has some non-technical division like Physical Education, and Arabic and Islamic Studies, but they are merely supporting divisions without formal degrees.

All engineering departments at King Fahd University of Petroleum and Minerals in Saudi Arabia mandate a total of four PE courses in their curricula. The preparatory physical education PE 01, and PE 02, and the physical education PE 101, and PE 102 courses are regular one-credit courses. The grades of these courses are included in the calculation of the Quality Point Average (QPA) for the students. A student must repeat the course if he gets an F grade. Each course has different sections. Each section is on one specific sports activity like soccer, badminton, and swimming. Further, as stated above, the student must take a swimming course. He must also pass a mandatory swimming test before graduation.

Comparing the above Four Categories Statistically and from an Educational Point of View

On one hand, and as stated above, the engineering curriculum at many institutes includes compulsory PE courses. On the other hand, many other engineering curricula do not include such courses. Many engineering departments will accept PE courses as electives. It is extremely difficult to conclude which is the most dominant category for several reasons. The main reason is the size of our sample. This sample of about one hundred engineering programs is very small compared to the sheer large number of engineering departments in the US and overseas. A much bigger sample is needed to make firm conclusions.

Nonetheless, based on our survey, category IV, which includes engineering curricula with no mandatory or optional PE courses, seems to be the norm. The other categories which have some PE involvement seem to be the exception. This is unfortunate given the established importance of physical activities to our engineering students.

Prevailing practice does not necessarily mean it is the best practice. The fact that many engineering curricula contain mandatory PE courses is an index for the importance of PE courses

in the engineering curricula. PE courses as stated above tend to enhance the engineering education itself.

Recommendations

For the benefit of our engineering students, the authors commend those engineering curricula with mandatory PE course. It is the hope that optional PE courses become mandatory courses in those programs which fall in this classification. It is recommended that engineering programs without physical activities components look into the educational benefits of including PE courses in the curricula similar to many prominent national and international institutes.

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