THE TECHNOLOGY REQUIREMENT SHOULD BE ELIMINATED

motion by Howard J. Curzer
(This is not a report by the academic programs committee.)

REASONS

(1) Most comparable universities have General Education Requirements which are significantly lighter than ours. There is a good reason for their lighter requirement level. Requirements are intrinsically burdensome for many students, especially those students in highly structured programs. Our students need more flexibility. Without the PE requirement, our general education requirements come to 53 hours. Consider a student whose major and minor requirements are 33 and 18 hours respectively. This student's requirements total 104 hours. Thus, of the 125 hours needed for graduation, this student has only 21 hours of electives. (Of course, major and minor requirements may overlap with the general education requirements. On the other hand, many programs require more than 33 hours for a major. And some colleges require more than the 53 general education hours. The College of Arts and Sciences, for example, requires 60 hours.) How can we expect our students to get a reasonable amount of breadth and depth out of their college education with only 21 hours or less of electives? Eliminating the PE Requirement is a step in the right direction, but it is not sufficient. Our General Education Requirements should be further reduced. I shall argue that the Technology Requirement is the requirement which should be eliminated.

(2) Technology Requirements are rare among universities. Of the 22 universities surveyed, only 1 had a Technology Requirement. Moreover, the state coordinating board's suggested General Education Requirements do not include a Technology Requirement.

(3) Choosing General Education Requirements is a matter of priorities. Many fine things are taught at Tech, but not all of them should be required of every student. I believe that Tech should require only those courses which are *absolutely central* to a college education. I do not believe that Technology courses are part of the bare minimum which *every* college student needs.

It may make sense for students *in certain programs or colleges* to take technology courses. Naturally these programs or colleges may continue to require their students to take technology courses. So eliminating the Technology Requirement would not prevent programs or colleges from ensuring that their students get the courses they need.

(4) The Technology Requirement as it presently stands is incoherent. The courses which satisfy the Technology Requirement fall into three categories:

(a) Courses which deal with the relationship of technology and society. (e.g. GEOG 3353 Man, Resources, and Environment; POLS 4343 Science, Technology, and Public Policy)

(b) Courses which teach a technical skill. (e.g. AGSM 3303 Small Gasoline Engines and Tractor Maintenance; CS 1405 Introduction to Computer Science)

(c) Courses which have little or nothing to do with technology. (e.g. ANSC 2303 Care and Management of Companion Animals; HORT 2311 Vegetable Crops)

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If the purpose of the Technology Requirement is to enlighten students about the relationship of technology and society, then courses of type (b) should not satisfy the Technology Requirement. On the other hand, if the purpose is to provide students with some technical skill, then courses of type (a) should not satisfy the Technology Requirement. No matter how the Technology Requirement is construed, courses of type (c) should not satisfy the Technology Requirement. I shall rebut the rationales for including courses of type (a) and (b) within the Technology Requirement separately.

(5) The main argument for including courses of type (a) within the Technology Requirement is this: Since technology and society are intimately connected, an adequate understanding of society presupposes some understanding of the relationship between society and technology.

I agree that an adequate understanding of society presupposes some understanding of the relationship between society and technology. But an adequate understanding society presupposes some understanding of many, many things, some of which are more central than technology. For example, I submit that sex and gender are more fundamental to society than technology. If you doubt this, consider the many major ways in which our arts, institutions, day-to-day life, etc. are built around sex and gender. Thus, sex and gender have a better claim to a requirement than technology. Another purely hypothetical example is other cultures. Students have to deal with people from other cultures as well as with technologies. And isn't it more important to help students understand people rather than things? So a Multicultural Requirement makes more sense than the type (a) component of the Technology Requirement.

Moreover, we already have a requirement specifically designed to enhance the understanding of societies, the Individual and Group Behavior Requirement. So the real question is this: Does the student gain an adequate understanding of society by satisfying the Individual and Group Behavior Requirement? If the answer is "no", then instead of focusing on just one aspect of societies (an aspect which is not the most central aspect) we should simply increase the Individual and Group Behavior Requirement from 3 to 6 hours. On the other hand, if the answer is "yes", then we should simply eliminate courses of type (a) within the Technology Requirement. I think the answer is "yes".

(6) The main argument for including courses of type (b) within the Technology Requirement is that students need to know something about technology to live in the modern world. In particular, students need to be at home with technology rather than perceiving technology as an alien, unintelligible aspect of their lives.

I agree that students need to know something about technology. But our students do not come to us fresh from hunter-gatherer societies. They already know quite a bit about technology. They know how to drive cars, use TV's, make phone calls, and so on. So there is no need to expose them to yet another piece of technology as if they have no idea what technology is. (Of course, they do not typically know how to build or repair cars, TV's, telephones, etc.. But the courses of type (b) do not teach students how to build or repair things, but rather they teach students how to operate things.) Students are very far from perceiving technology as an alien, unintelligible aspect of their lives.

(7) Advocates of including type (b) courses within the Technology Requirement might maintain that these courses aim to provide proficiency rather than mere familiarity with technological thought. And our students need proficiency not only to join industries which compete in the global,

modern marketplace, but also simply to get their VCRs off of "blink time" (12:00, blink, 12:00, blink, 12:00, blink, 12:00 blink).

The problem with this argument is that it misunderstands the problem. People, both at work and at home, do have trouble reading instruction manuals and implementing the instructions. But that is not because they lack proficiency in some mysterious way of thinking called technological thought. Instead, they lack the reasoning skills necessary for working through the manuals. After all, the same people who have trouble with technology-related instructions have equal trouble with instructions that are *not* technology-related. If we want to address the problem illustrated by blink time (and by many letters to the editor), we should replace the Technology Requirement with a Logic Requirement.

Insofar as there is something apart from critical thinking called "technological thought", it is adequately taught in the courses which satisfy our Laboratory Science Requirement.

(8) Advocates of including courses of type (b) within the Technology Requirement might maintain that these courses provide certain basic skills which the college student must have in order to cope with their classes. Just as we require students to be able to read, write, and do math, so we should also require them to be computer literate, etc..

The problem with this argument is that the skills taught by the courses of type (b) are clearly not basic skills. For example, they include cooking, home gardening, electronic music, care and feeding of pets, and tractor maintenance. While these are undoubtably useful skills, they are not on a par with reading, writing, and math. They are not the basic skills one needs in order to flourish in college.

The only courses of type (b) which have a plausible claim to teaching basic skills are the courses which teach computer literacy. If computer literacy were a basic skill, then it might make sense to replace the Technology Requirement with a Computer Literacy requirement. But when computer literacy is compared with the ability to read, write, and do math, it becomes clear that computer literacy is not in the same league. It is simply not a basic skill which all college student must have in order to cope with their classes.

(9) The final version of the general education curriculum as well as the faculty senate and academic council recommendations specify that courses satisfying the Technology Requirement should be, "designed to prepare students to make intelligent choices with regard to scientific and technological issues affecting society." Courses of type (b) do not meet this criteria.

The overall goal of General Education Requirements is to broaden students, but courses of type (b) work in the opposite direction. They force students to focus on narrow, purely mechanical skills. General Education Requirements should open the student up to whole new horizons of thought. They ought to be "gee whiz" courses (courses where the students come away saying, "gee whiz, I never thought of that"), rather than technique courses. But courses which focus on narrow, purely mechanical skills cannot open students up to whole new horizons of thought. Since the Technology Requirement provides neither a basic skill nor a new horizon, let us abolish it and give the student another 3 hours of elective so that perhaps they can find a "gee whiz" course on their own.

IMPACT OF ELIMINATING THE TECHNOLOGY REQUIREMENT

The Technology Requirement may be satisfied by taking one course from a list of 65 courses. These courses are distributed among the colleges in the following way: AG 23, ARCH 2, A&S 15, BA 1, ED 1, EN 18, HS 5.

The impact of eliminating the Technology Requirement is difficult to determine. However, the fact that the courses satisfying the Technology Requirement are spread out over so many departments suggests that the elimination of the Technology Requirement would not be a devastating or even a heavy blow to any single department. Moreover, demand for these courses will not vanish if the Technology Requirement is eliminated. Many students will continue to take these courses as electives or as part of their major or minor. For example, ISOS 3344 Introduction to Production and Operations Management is presently taken only by BA students and would continue to be required by the business school even if the Technology Requirement is eliminated. So the elimination of the Technology Requirement would have no impact on BA.

SURVEY RESULTS

UNIVERSITY	TEXAS TECH	U OF TEXAS	U OF HOUSTON	TEXAS A&M	U OF KENTUCKY	U OF ARIZONA	KENT STATE	U OF ILLINOIS
TECHNOLOGY	3	0	0	0	0	0	0	0
TOTAL	53	42	50	57	51	50	39	30

UNIVERSITY	STANFORD	NORTH CAROLINA	OHIO STATE	MICHIGAN STATE	U OF CONN	OKLAHOMA STATE	U OF ARKANSAS	LOUISIANA STATE
TECHNOLOGY	3	0	0	0	0	0	0	0
TOTAL	45	59	45	45	45	42	35	39

UNIVERSITY	U OF FLORIDA	NORTH DAKOTA	U OF WISCONSIN	BOISE STATE	PENN STATE	U OF OKLAHOMA	NORTH TEXAS	COORDINATING BOARD
TECHNOLOGY	0	0	0	0	0	0	0	0
TOTAL	39	39	3	51	46	41	36	

COURSES WHICH SATISFY THE TECHNOLOGY REQUIREMENT

College of Agriculture
AGED 4302 Transfer of Agricultural Technology
AGRO 1321 Agronomic Plant Science
AGRO 2321 Crop Growth and Culture
AGRO 2432 Principles and Practices in Soils
AGSM 1301 Principles of Agricultural Modernization
AGSM 2302 Agricultural Surveying and Land Conservation
AGSM 3303 Small Gasoline Engines and Tractor Maintenance
AGSM 4302 Agricultural Buildings and Environmental Control
ANSC 1301 General Animal Science
ANSC 2303 Care and Management of Companion Animal
ANSC 2401 Anatomy and Physiology of Domestic Animals
ANSC 3301 Principles of Nutrition
ANSC 3402 Animal Genetics
FDT 2300 Principles of Food Technology
FDT 2302 Elementary Analysis of Foods
FDT 3301 Food Microbiology
FDT 3303 Food Sanitation
HORT 2311 Vegetable Crops
HORT 2312 Propagation Methods
LARC 3304 Landscape Construction
R&WM 2301 Introductory Wildlife
R&WM 2302 The Ecology and Conservation of Natural Resources
R&WM 2303 Introduction to Fisheries

College of Architecture
ARCH 2351 Building Systems
ARCH 2352 Building Systems 11

College of Arts and Sciences
ATMO 2301 Weather, Climate and Human Activities
ATMO 3301 General Meteorology
BIOL 2313 Ecology and Environmental Problems
CHEM 1303 Applied Chemistry
CHEM 3305 Organic Chemistry
GEOG 3353 Man, Resources, and Environment
GEOG 4401 Geomorphology in Environmental Management
GEOL 2303 Geology for Engineers
GEOL 3323 Geological Processes and Human Activities
G PH 2300 Introduction to Geophysics
MBIO 4307 Industrial Microbiology
MUCP 3001 Projects in Electronic and Experimental Music
PHIL 3330 Philosophy of Science
PHYS 1305 Engineering Physics Analysis I
POLS 4343 Science, Technology, and Public Policy

College of Business Administration
ISOS 3344 Introduction to Production and Operations Management

College of Education
EDIT 2318 Computing and Information Technology

College of Engineering

C E   1130 Civil Engineering Seminar I
C E   1205 Engineering Analysis I
CH E 1305 Engineering Analysis I
C S   1405 Introduction to Computer Science
C S   3462 Introduction to Artificial Intelligence
CTEC 1312 Construction Methods
CTEC 2301 Surveying and Surveys
E E   1305 Introduction to Engineering and Computer Programming
GTEC 1312 Alternating and Direct Current Technology
GTEC 2301 Living with Technology
I E   1305 Engineering Analysis I
I E   2301 Engineering Design in Production Operations
I E   3351 Manufacturing Engineering I
I E   4363 Work and Product Safety Engineering
M E   1305 Engineering Analysis I
M E   3321 Engineering Thermodynamics I
MTEC 1312 Mechanical Technology
PETR 1305 Engineering Analysis I

College of Human Sciences

C&T   3301 Textile Fabrics: Properties and Performance
C&T   4331 Contemporary Textiles for Nonapparel Use
F&N   2310 Principles of Food Preparation
ID   4383 Computer Aided Design for Interiors
RHIM 3303 Computers in the Hospitality Industry

Argument Against Elimination of the Technology Requirement

by Mica Endsley

A motion has been made to eliminate the Technology requirement from the General Education requirements on the grounds that: (1) there are currently too many General Education requirements, thus limiting flexibility in students' programs, (2) it isn't necessary, and (3) the courses currently listed as satisfying this requirement do not provide adequate benefit to the student.

(1) The argument that academic programs are currently saddled with too many General Education requirements, thus limiting the ability of programs to provide students with sufficient depth and breadth in their subject area, is a good one. If this is the objective, then all General Education requirements except the basics (the three Rs) and those mandated by the state should be eliminated. If the objective, however, is to provide students with a broad education that prepares them to function in society, then the General Education requirements should be maintained.

The purpose of the General Education requirements is not to provide students with expertise or skills in all areas, but to ensure that students receive exposure to a wide variety of areas. The Technology requirement is not in place to benefit students with technical majors. It is designed to benefit students in the humanities and other areas which are non-technical. Similarly, the Humanities and Fine Arts requirement is designed to benefit students who otherwise may not get adequate exposure to these areas, not those already studying in the humanities.

It is unreasonable to expect that any student will gain sufficient knowledge in a three hour technology course to become technically proficient. Similarly, a student will not become a skilled artist after a three hour course in the Visual and Performing Arts area, or a philosopher or psychologist after a three-hour course in the humanities. The goal of these requirements was never to accomplish proficiency, but rather to provide students with some minimal exposure to other subjects in order that they may (1) be aware of other areas of study, and (2) gain an understanding of the basic approaches, issues and terminology of other areas.

This is a period of time in which there is great concern about providing cultural awareness in order to improve communications across various segments of society. There is just as great a need to improve communications between various professions both on this campus, in business and other organizations, and in society at large. It is highly useful for an engineer to be able to understand the accountant's ledger sheet or various approaches to business management, as it greatly facilitates communication and effective decision making in business life. Similarly that manager needs to be able to understand the language and problems of technology in order to be able to communicate effectively with the engineer. This broad level of understanding is the real objective of the General Education requirement. To assume that this can be accomplished by forcing technical majors to learn about the humanities, but to not require non-technical majors to acquire a minimum of knowledge regarding technology does those students a great disservice.

(2) A strong argument can be made for the need for technical knowledge in today's society. The rapid increase in technological development and influx of technology on almost every aspect of human life cannot be disputed. According to the motion to eliminate the Technology requirement, however, as student's already know how to drive cars and use TV's, they are sufficiently exposed to technology in every day life. This is akin to saying that students do not need courses in the humanities as they are already human and have plenty of experience in interacting with humans, and they don't need courses in the arts as they already see plenty of movies and TV shows and listen to plenty of rock music.

Just as courses in these areas actually seek to instill a higher level of understanding of their subject areas, courses in the technical area seek to instill a higher level of understanding of technology. Courses in the technology area are not supposed to be simple "how to" courses, but courses which provide a deeper level of understanding regarding technology. While there may be some transfer of direct skills that occurs (e.g. how to operate a computer), the main objective is to provide students with some basic level of understanding regarding how such systems operate.

This type of knowledge usually applies to not only a given system, but also to a wide range of systems that they will interact with now and in the future. A student who takes a course on the internal combustion engine has knowledge about how a wide variety of mechanical systems function. A student who understands the basics of how a computer functions will be prepared to interact with a wide variety of systems based on this technology, and will be a more knowledgeable consumer and decision maker in the future. A person who considers technology some mysterious "black box" is never able to progress beyond following simple instructions to operate that system. They are unable to understand the actual capabilities and limitations of the system. They are unable to diagnose unusual behavior or improvise new methods. They are hostage to technical specifications and hype in making informed choices regarding purchase or implementation of technologies.

While the argument can be made that courses in math, science and logic undoubtedly useful for providing "thinking skills" that will be helpful in dealing with technology (all of which are covered in other General Education requirements), these courses are probably not sufficient for providing detailed technical knowledge.

In addition, courses which address the relationship between technology and social issues are also of value. Educated people need to be able to address questions such as how should technology function, what are the significant issues involved in deciding how to employ technology for a given function, and what will a piece of technology do or not do in meeting organizational objectives? These issues are inherent in design and purchasing decisions that will confront a wide segment of the population either as consumers or in business and which rely on a realistic understanding of technology.

The problem with a lack of understanding of technology in our society is a real one, and one which is not solved by exposure to consumer electronics. For instance, "Computer anxiety" is a fairly widespread phenomenon that negatively effects people's ability to learn to interact with these systems (Harrington, McElroy, & Morrow, 1990; Marcoulides, 1988), and which has been shown to be negatively correlated with computer experience (Dyck & Al-Awar Smither, 1992). Providing students with exposure to technology that provides a real understanding of how the technology works provides a platform that goes a long way towards opening doors to them in the future as they learn to interact with various specific systems.

People involved in almost every enterprise in life will be confronted with new technologies at least periodically throughout their life. Positive adjustment to these technologies has been found to be highly related to attitudes towards technology in general (Endsley, 1985). Negative adjustment to technological change has been manifested (1) in terms of increased stress and emotional and behavioral reactions that are harmful to the individual and (2) in terms of destruction, sabotage, strikes, turnover and lower commitment and job satisfaction, all of which are harmful to organizations and society. As the development of an understanding of technology can directly impact attitudes regarding technology, the ability to learn to use new technologies, and successful implementation of technology, it behooves us to provide this knowledge to students if they are to perform in a technological society. The ability of the U.S. to remain competitive in the world market place is highly dependent on a workforce with technical knowledge (which many other nations appear to be doing a better job of currently). A generation of Luddites will not be beneficial in this matter.

(3) The final major argument in favor of eliminating the Technology requirement, revolves around the degree to which individual courses do or do not meet the objectives. The first issue to be realized is that the requirement is actually for "Technology and Applied Science". Many of the courses discussed actually fall into the later category (e.g. Care and Management of Companion Animals). No discussion was made of the need or lack of need for applied science courses in the original motion, however, I dare say sufficient evidence could be generated for the utility of such courses on the same grounds as those laid out here regarding technology.

In addition, the content of many of these courses has been greatly oversimplified. CS 1405 — Introduction to Computer Science — does not endeavor to teach students basic skills such as how to turn on a computer and how to run Lotus 1-2-3. It teaches fundamental knowledge regarding the functioning, structure and processes of computer systems and languages that is applicable to many systems in addition to those used as platforms for course instruction. AGSM 3303 — Small Gasoline Engines and Tractor Maintenance —

does not merely teach students the simple mechanics of how to repair a tractor, but also fundamental knowledge regarding the internal combustion engine that applies to a large number of mechanical systems.

There are notably a wide variety of courses and subjects which are currently listed as satisfying the Technology and Applied Science requirement. I suspect that this is largely to provide as much latitude as possible in meeting the needs of different students and programs. We are currently allowing that students gain exposure to some technology, as opposed to requiring that all have the same technical knowledge. This provides as much flexibility as possible within the broader objectives.

With these issues in mind, the degree to which the current selection of courses meet the objective of the Technology and Applied Science requirement may still be questioned. If this is the case, however, it implies that the rules by which courses are selected for meeting the requirements should be made more stringent or the requirements increased, not that the requirement should be eliminated. Regardless, a review of the courses listed as satisfying the Technology and Applied Science requirement by the appropriate academic committee, as well as those in other areas of the General Education requirements, would be in order to meet this concern.

In summary, there is great need for educated people to function in conjunction with technology in this society that is forecasted to continue to increase. This knowledge cannot be gained purely by osmosis or casual interaction. The desire for students to have breadth in their education is one which applies to all students, and is not unidirectional. It is as important for students in the arts to have an understanding of technology as for students in engineering to have an understanding of the humanities. If there is truly a desire to decrease the General Education requirements in favor of greater flexibility for academic programs, it should be done across the board and not in a manner which reflects a single academic viewpoint. If a broad education is still a desirable outcome of higher education, the Technology and Applied Science requirement should be maintained.

References

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February 25, 1994

Dr. Jerry Hunt
Chair, General Education Committee
Texas Tech University
MS 2101

Dear Jerry:

The College of Engineering has reviewed Dr. Curzer's Senate motion that the technology requirement be eliminated from our general education requirements and wishes to share some of its thoughts with your committee.

The arguments below are based upon the assumption that the purpose of having general education requirements is to ensure that all Texas Tech graduates receive an education that prepares them for lifelong learning.

On behalf of my colleagues in the College, I encourage the General Education Committee to not support Dr. Curzer's motion for the following reasons:

1. Technology plays a central role in everyone's life. If one accepts the premise that the majority of our leaders will come from the college-educated population, then it would seem appropriate that those leaders understand the development, implementation, utilization, and management of technology.

2. Many of the courses that are listed as satisfying the technology requirement are not courses designed to fulfill the general education requirement but rather are courses that simply have a technological component sufficient to meet the definition of a "technologically-based" course. As a faculty, we have the responsibility to develop general education courses (new and existing) that will specifically serve the needs of our students in understanding the technology arena.

3. If we, as a faculty, are serious about trying to provide our students an education that will prepare them for lifelong learning, then we believe that we should examine all general education requirements to determine whether or not they provide a fundamental education to our students. Many of the current general education requirements appear to not serve our students well. Many of our graduates and students see our general education requirements as self-serving for the faculty and our

academic structure, while minimally serving their educational needs. An examination of _all_ of the general education requirements is timely.

4. The fact that technology influences our societal structure, its fabric, ethics, and lifestyles would be difficult to refute. If one accepts this premise, one can make the argument that a major need on the part of the society is to understand its technologies and develop their full potential for the benefit of all.
    Virtually every major technological development in history from the Roman aqueducts, to the steam engine, to the automobile, to the transistor, to nuclear technology, and to computers has had a major and often unseen societal impact. Perhaps sex and gender are more fundamental than technology, as argued by Dr. Curzer. However, it is equally obvious that the automobile changed the relationship between the genders (as did readily available water, power, and information). Consequently, one of the issues related to technology is forecasting the impact of new technologies and thus enabling the control of its development.

    Courses that teach the fundamentals related to technology (as opposed to courses that discuss the relationship between society and technology) are central to the general education of our students. While the relationship between Technology and Society is of concern, courses which address this relationship are not sufficient for ensuring that students obtain adequate understanding of technology itself.

5. The arguments presented defending the proposal to eliminate technology provide evidence that we should encourage the development and expansion of the technology requirement in our curriculum. The failure of most undergraduates to understand the difference between fundamental understanding and skills is evident in the presented arguments. For example, CS 1405 teaches the fundamentals of computer science, including algorithm structure, the strategy for the design of algorithms, and the implementation of algorithms to new problems. This is analogous to a history course which examines and analyzes man's political behavior and the basis for that behavior so that the analytical skills and knowledge gained can be applied to new situations.

    It is a common misconception on the part of people not familiar with technology to see technology courses as "skill" courses because they have not studied the language (mathematics) and facts (science) that are prerequisite knowledge to analysis in technology. The courses cited, with the possible exception of AGSM 3301, teach fundamentals which can be applied, developed and used to support the analysis and development of new and non-existent technology and are **not skills courses**.

6. We submit that one of the major issues for the University is, "How are we, as faculty, to educate ourselves, as well as our students, to understand the society we live in?" and, thus, be able to develop general education requirements that meet the needs of the society we serve. A lack of the understanding of technology and its impact upon society may be a problem which is under-appreciated by those whose own educational background was devoid of the opportunity to study the fundamentals central to understanding technology. To produce a group of individuals who do not understand technology seems to us to be the ultimate insult to our society when those graduates will have to control, develop, implement and live with technology.

7. Three hours out of the 53 hours required under general education certainly does not begin to reflect the importance of understanding technology to our graduates. It seems to us that a more appropriate and balanced general education requirement would allocate 10 to 20 percent of the credit hours to the understanding of technology.

In closing, we strongly support the position of our Student Senate, which recently voted unanimously in favor of keeping technology as part of the general education requirement. For the reasons cited above, we believe it imperative that the development of an understanding of technology remain as an important part of our General Education Requirements. Please contact me should you have any questions or wish to discuss this matter with me.

Sincerely,

Mason H. Somerville, Ph.D., P.E.
Dean of Engineering

MHS/jhk

cc: President Lawless
        Provost Haragan
        Engineering Chairs
        Engineering Associate Deans
        Dr. Sue Couch
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        Mr. Jay House