

STS for Engineers: Integrating Engineering, Humanities and Social Sciences

Joseph R. Herkert
North Carolina State University

This paper discusses the use of science, technology and society (STS) courses as a means of integrating perspectives drawn from engineering, humanities and social sciences, with particular focus on the STS general education requirement (GER), the STS Minor Program, and the Benjamin Franklin Scholars dual-degree program in engineering and humanities/social sciences at North Carolina State University.

Why STS for Engineers?

MIT's first Dean for Undergraduate Education, the late Margaret MacVicar, once noted [1] that the challenge for educators with respect to integration of engineering, humanities and social sciences is to bring about: "...a true educational partnership among the technical, arts, social and humanistic disciplines so that on some level students see the interrelationships between science and technology on the one hand, and societal, political, and ethical forces on the other."

One approach to exploring such interrelationships is through the STS courses and programs that have sprung up over the past quarter century. Indeed, the critical reflection on the interactions among engineering, humanities and social sciences typically found in successful STS courses and curricula has caused a number of educators to call for major changes in the engineering curriculum in order to accommodate STS concepts and issues [2]. At NC State, however, we have found it possible to expose engineering students to STS courses and programs even in the absence of major changes in the engineering curriculum.

An STS General Education Requirement

All students entering NC State since Fall 1994, including engineering students, are required to take at least one STS course. The goals of the STS requirement are threefold:

- (1) developing an understanding of the influence of science and technology on civilizations,
- (2) developing the ability to respond critically to technological issues in civic affairs, and
- (3) understanding the interactions among science, technology and values.

Engineering students, and other students with majors in science and technology, are required to fulfill this requirement with a course developed from "a humanities and social science perspective" or with an interdisciplinary course designed to incorporate perspectives drawn from science, technology, humanities and social sciences. Conversely, students with majors in the humanities and social sciences are required to take an interdisciplinary STS course, or one which draws heavily on science and technology perspectives. The STS requirement is thus an explicit statement that all students, including engineering students, should partake in study that in some fashion integrates perspectives drawn from science, technology, humanities and social sciences.

The STS requirement for engineering students is incorporated in the required Humanities and Social Sciences courses. Students may select a course from an approved list of approximately thirty courses, about half of which are multidisciplinary studies courses (MDS) on such topics as: Environmental Ethics; Science & Civilization; Contemporary Science, Technology, and Human Values; Humans & The Environment; Ethics In Engineering; Technological Catastrophes [3]; Alternative Futures; and Bio-Medical Ethics. Offerings on the list based in the traditional departments include a number of courses on the history of science and technology; Technology, Society and Culture (sociology and anthropology); Environmental Economics; Philosophy of Science; and Science, Technology and Public Policy (political science).

An STS Minor

A minor in STS serves to meet the need of students who desire more comprehensive study of the relationships between science, technology and society. In addition, minor programs provide “institutional legitimacy” to STS efforts, as well as a means of drawing together faculty with STS interests and of advertising to students the availability of STS courses.

The STS Minor at NC State consists of five courses including Issues in Science, Technology, and Society, an independent study technology assessment project. Of the remaining four courses, at least one must be taken in each of three content area. The Group I courses provide a historical perspective on science and technology while the Group II courses focus on science, technology and values. The third group consists of courses with social science perspectives and courses focusing on specific problems and issues posed by science and technology. As in the case of the STS GER requirement, the courses in the minor program can be drawn from Multidisciplinary Studies and/or the traditional disciplines. In addition, as a pre- or co-requisite, students must take at least one advanced course in science and technology and either a statistics course or the first semester of calculus. The minor requirements thus insure that each student has some exposure to the methodology of science and technology in addition to the five required minor courses which emphasize the historical, ethical and sociopolitical contexts of science and technology.

The Benjamin Franklin Scholars Dual-Degree Program

Some of the best students at NC State enroll in the Franklin Scholars Program, a dual-degree program specifically designed to integrate engineering, humanities, and social sciences throughout the five-year course of study [4]. Franklin Scholars earn a BS degree in an engineering field or computer science, and a BA or BS degree from the College of Humanities and Social Sciences (CHASS). The CHASS degree can be in a traditional discipline, such as English or Philosophy, or an individually designed degree in Multidisciplinary Studies.

While not an STS program per se, the Franklin Scholars Program incorporates STS concepts in two ways. All Scholars, regardless of their engineering and CHASS majors, are required to take a core sequence consisting of three STS courses: Technology and Values (first year), Ethical Dimensions of Progress (second or third year), and the Franklin Capstone (fourth or fifth year), a team-oriented project course in technology assessment and public policy. With the exception of a member of the engineering faculty who participates in the capstone course, all of the required

courses are taught by members of the Division of Multidisciplinary Studies, a component of CHASS, who specialize in teaching STS courses (two philosophers, a political scientist and an engineer).

In addition, many of the Scholars who choose to pursue their second degree in Multidisciplinary Studies design major concentrations in STS areas. The concentration consists of 9-10 courses focusing on a coherent, multidisciplinary theme which the student is required to justify in an essay that is evaluated by a committee comprised of faculty from across the university. Concentrations have been approved for Franklin Scholars in such areas as: Ethics and Technical Management; Environmental Ethics, Policy and Science; Technology, the Environment and Public Policy; Science, Technology and Society; Issues in Medicine and Bio-technology; and Technology and Communication in a Cross-cultural Context.

Plans are currently underway to develop an STS track for the degree in Multidisciplinary Studies. It is anticipated that this new track will be utilized by a number of the Franklin Scholars as well as by Scholars in NC State's other dual degree programs involving CHASS and the Colleges of Textiles, Agriculture & Life Sciences, and Forestry, and the School of Design.

Conclusions

As the experience at NC State has shown, existing and new STS courses and programs are an excellent vehicle for integrating perspectives drawn from engineering, humanities and social sciences for the benefit of engineering students as well as students majoring in the natural sciences, social sciences or humanities. Such integration can be effectively achieved at the level of a single required course in STS or through more ambitious programs such as a minor in STS or a second, multidisciplinary major in STS.

References

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- [4] R. L. Porter and J. R. Herkert, "Engineering and Humanities: Bridging the Gap." In *Proceedings of the 1996 Frontiers in Education Conference*. Salt Lake City, Utah: Institute of Electrical and Electronics Engineers and American Society for Engineering Education (available on the World Wide Web at URL <http://www.caeme.elen.utah.edu/fie/procdngs/se8c4/paper5/96407.htm>).

JOSEPH R. HERKERT is Assistant Professor of Multidisciplinary Studies at North Carolina State University, Raleigh, NC 27695-7107 where he teaches in the Science, Technology and Society Program and the Benjamin Franklin Scholars Program, a dual-degree program in engineering and humanities/social sciences. Dr. Herkert is immediate Past-President of the IEEE Society on Social Implications of Technology. (Email: j.herkert@ieee.org)