Int. J. Engng Ed. Vol. 19, No. 6, pp. 855–861, 2003
Printed in Great Britain.

0949-149X/91 $3.00+0.00

Cultural Studies in the Engineering Curriculum*

KIN WAI MICHAEL SIU
Massachusetts Institute of Technology/The Hong Kong Polytechnic University, Room 10-485M, 77 Massachusetts Avenue, Cambridge, MA 02139, USA. E-mail: m.siu@polyu.edu.hk

Several studies concerning industrial design, technology and engineering learning have been conducted on students in Hong Kong. The findings indicate that the students are weak in problem finding (that is, the identification of needs or problems). The absence of cultural studies was found to be one of the main factors limiting the development of the level of insight and understanding needed to identify problems. All of this further limits the ability of students to exercise critical judgement in other learning activities. By reviewing the findings of the case studies in Hong Kong, this paper tries to point out that cultural studies should serve as one of the key foundations for engineering students to make critical judgements in their future educational endeavours and careers. This paper then discusses the importance of incorporating cultural studies in the engineering curriculum in a more organised and regular way instead of only as optional activities, and identifies key activities, contents and elements of cultural studies in the curriculum. In the last section, discussing Kissock's ten-stage decision-making model, this paper suggests how a more flexible and dynamic teaching and learning arrangement can be developed for cultural studies in the curriculum.

INTRODUCTION

IN RECENT YEARS, more and more researchers and educators are concerned about and are discussing the importance of cultural understanding in engineering (including technology) professions [1–7]. They believe that this understanding helps students make critical judgements and helps them apply their knowledge to serve social needs. These kinds of concerns and discussions in turn give rise to considerations of what and how cultural elements can be incorporated in the engineering curriculum [8, 9].

Take Hong Kong as an example. The *Hong Kong Policy Addresses* clearly state that education at different levels should strive to develop individual students' understanding of cultural elements in global and local contexts. This understanding can allow students to gain experience from the past and to become aware of the social values of present-day society and of the role they can play in its improvement [10, 11]. Since the late 1990s, the need for students to have cultural understanding and experience has been increasingly raised in discussions of the engineering curriculum in Hong Kong. For instance, social and cultural studies have been considered as core subjects for some new engineering programmes in The Hong Kong Polytechnic University. Cultural elements are also incorporated in some part-time training programmes organised by the Vocational Training Council.

In general, cultural studies in the engineering curriculum requires students to think critically of the relationship between engineering practices and global, regional and local cultures, and then about how to apply this knowledge. In more detail, cultural studies is a subject about understanding the relationship between design objects/systems and human traditions, customs and daily preferences and routines. It aims to allows students to explore the importance of and opportunities in considering cultural and social factors in engineering design, implementation and evaluation. Through different activities such as investigation, seminars, discussions and projects, students are able to explore and identify why and how these cultural as well as social factors should be considered in engineering practices, particularly in the local context, and then apply their learning experience to meet the needs of the ever-changing society.

However, when we review the current engineering curricula (not only in Hong Kong but also those in many other places around the world), we cannot deny that relatively little attention is still paid to cultural studies. It is regarded more in the light of something that may or may not be needed, rather than as a key element in engineering teaching and learning activities.

ABSENCE OF CULTURAL STUDIES

Several studies concerning students' ability in problem finding and the situation of cultural studies were conducted for technology and engineering students in Hong Kong [12–17]. (Problem

* Accepted 28 March 2003.

finding is also called need or problem identification. It is generally defined and understood as the first stage of the design process: that is, like the project title/topic identification. The importance of problem finding is indisputable, although people still put less attention to it when compared with problem solving. In fact, as early as 1938, in *The Evolution of Physics*, Einstein asserted that, 'The formulation of a problem is often more essential than its solution . . . To raise new questions, new possibilities, to regard old problems from a new angle, requires imagination and marks real advance in science' [18]. In *Productive Thinking*, Wertheimer also points out that, 'The function of thinking is not just solving an actual problem but discovering, envisaging, going into deeper questions . . . Envisaging, putting the productive question is often a more important, greater achievement than the solution of a set question' [19].) The studies were based on questionnaires, and followed by in-depth interviews with some students.

The number of students involved in the studies was 574, and the number of teachers involved was twenty-five (including secondary school teachers and university professors). According to the findings, two major issues were brought up:

1. Many technology and engineering students are weak in problem finding (for example, in identifying project titles or topics).
2. Less attention is paid to problem finding when compared with other design and engineering activities, such as analysis, synthesis, development and evaluation.

The findings indicate that the narrow scope of theoretical study and research is one of the major reason why:

- Students find it difficult to identify—*recognise*, *discover* and *invent*—problems to solve.
- In particular, engineering teachers and students have always put very little time into the investigation and exploration of *cultural and social issues*.
- This, in turn, affects the ability of students to *think critically*.

INCORPORATING CULTURAL STUDIES IN THE ENGINEERING CURRICULUM

In present-day society, which is highly competitive and knowledge-based, engineering students need to have the ability to think critically at a high level, and to make good judgements [20]. In fact, cultural studies provides engineering students with the opportunity to *interact* with their society. Thus, students can find out what questions have been raised relating to living environments and both local and global cultures by three key type activities:

- theoretical study
- exploration
- application.

These key types of activities can be incorporated in different stages and areas of the engineering curriculum, in particular in the project process:

- needs identification
- ideas development
- decision-making
- evaluation.

Theoretical study

The contents and elements of theoretical study can include cultural and social theories (such as modernist and postmodernist thinking), the histories and cultures of particular nations and groups, engineering and (industrial and product) design history, special (cultural and social) needs of particular user-groups, cultural and social responsibilities, etc. This kind of cultural theoretical understanding helps students think critically about how the engineering knowledge they have obtained can be applied. Moreover, students can have more freedom and flexibility to make judgements. For example, in their projects, students may make the decision to strictly control and limit choices in the transportation system in order to have efficient human circulation. Or they may prefer to establish a transportation network that provides more variety to allow different people to make choices, although the overall speed of circulation may slow down. In short, different from conventional engineering practice, students are seldom required to give model answers or predetermined solutions; rather, they are asked to come up with critical interpretations and decisions according to their in-depth understanding of different cultural and social needs and preferences.

Due to time constraints and the nature of the engineering curriculum, engineering students do not need to spend too much time exploring endless philosophical arguments in depth, as social studies students do. The crucial thing is that engineering students should understand the fundamental arguments of different perspectives in cultural and social theories, how they have affected the daily lives of human beings and the quality of designs, be able to critique such arguments and perspectives, and then apply their understanding and experience to their studies and projects.

Exploration

Apart from laboratory investigations under controlled environments, the major activities of exploration in cultural studies include field studies (such as participant observations and interviews), cultural visits and exchanges, and projects (in particular, community projects). In other words, engineering students should not only hide inside the laboratories, studios, workshops and places of industrial placement. Field studies allow students to interact with the real world in which they are

living, provide opportunities for them to investigate and try their hand at solving existing social problems and difficulties, preparing them to face the future responsibilities of their profession [21].

For example, in an engineering programme with a cultural studies subject which the author coordinated, each engineering student was required to design an object that related to the daily lives of Hong Kong people. Besides a literature review and background study, the students needed to carry out field observations of how Hong Kong people interact with design objects regarding Hong Kong people's particular traditions, customs, needs and preferences. For example, if a student wanted to design a litter container, he/she should consider not only the engineering elements such as the structure, materials, ergonomics and production process but also required the traditions and ways of thinking of Hong Kong people regarding cultural issues involved in the notions of 'public' and 'responsibility,' etc. He/she also needed to explore the daily routines of Hong Kong people through field studies. If a student wanted to design an electronic bus-fare automatic collecting device, not only engineering elements such as the mechanism and electronic data transmission should be considered but also the speed of urban life, the concept of honesty, the educational level in Hong Kong, etc.

Apart from visiting other places as tourists only seeking tourist spots, cultural visits and exchanges allow students to explore the authentic histories, backgrounds, cultures, needs and preferences of other particular groups and ethics. According to the experience of the industrial design students in The Hong Kong Polytechnic University making cultural visits to different countries, this kind of visit broadens their perspectives and gives them more insights, in turn allowing them to generate and evaluate ideas more critically. The students further pointed out that these visits better prepared them to work in and for other places, a common trend nowadays. (For example, more than 90 per cent of new manufacturing engineering graduates in Hong Kong need to work in the Chinese mainland.)

Application

Engineering is a discipline that emphasises applications. However, the conventional curriculum focused on teaching students to 'know how' but put relatively less attention on to 'know why'. Cultural studies can compensate for this limitation and strengthen the imaginative, initiative and critical abilities of students. In the cultural studies subject taught at The Hong Kong Polytechnic University mentioned above, students were required to tackle a social and cultural problem using their engineering knowledge. According to the subject evaluation, sometimes students might not be successful in finding answers or proposing a good solution to a cultural problem or issue, but the important thing is that they were introduced to the processes of questioning and examining.

Therefore, the contents of cultural studies in the engineering curriculum should, first of all, not aim to verify a 'predetermined' answer or an 'imposed' social value. Rather, cultural studies should be viewed as a kind of student practice, in which the students are exposed to the 'experience of critique'. Through such critiques, students get the benefit of understanding not only themselves and their own cultures, but also how to accept and appreciate other peoples and cultures, and in turn produce more solutions (both products and systems) with a higher degree of *userfitness*.

Second, the detailed contents of cultural studies activities should not be determined or fixed only by the teachers, although they can set up some key areas for study, such as design for particular groups, design for people with particular needs, ecology and environmental issues related to societies with particular social, economical and environmental settings, social responsibility in design and engineering, etc. The experience of students should be treated as the 'legal' content of the curriculum. They should have the chance to explore different areas, which stimulate different questions for discussion.

We should stress that discussions and explorations often do not come out as concrete solutions. However, through different empirical research methods and discussions, students can widen their outlook and deepen their understanding [22]. This is particularly true in the areas related to local culture and identity, which students think they know but actually do not. For example, before carrying out field observations, some students in the engineering programme mentioned above who were interested in designing objects for the elderly, had a misconception that the elderly were always relatively passive in reacting to a design object that had been provided—seldom changing the defined function. However, through observations, the students found out that this might not be totally true (at least in Hong Kong) and that, in fact, some old people always liked to create their own ways of using things. The students then changed the initial defined functions of some design objects, such as street furniture.

Third, through 'dialogic interaction' with teachers and colleagues, students should have the opportunity and should be encouraged to decide what should be learned (and experienced). The most important point is that their ideas and expectations should be highly respected.

Fourth, problem-solving projects should receive greater emphasis in cultural studies since projects allow students to 'testify' and 'falsify' their theoretical understanding. In different stages of the project process, such as identifying needs, selecting the title/topic, analysing, generating ideas, coming up with solutions and conducting evaluations, students can make critical judgements according to their knowledge and experience in cultural

studies. This is very important in engineering education as students can learn that decisions are rooted in the needs of society as uncovered by themselves instead of only based on 'what other people tell them to do'.

Among different types of projects, community projects should receive greater encouragement. This is because this is the type of project that provides students with the best opportunities to come into contact with the real world and understand society's real needs, allowing them to make practical evaluations of their work.

Fifth, cultural studies utilising critical thinking activities should not only be for a particular level or a particular group of engineering students. Engineering students at different levels, with different interests, should have the opportunity and responsibility to understand their cultures. Through different kinds of activities in cultural studies, students can learn effectively, despite individual differences. This is because cultural studies consist of processes of personal discovery and critiques. Followed by a fundamental theoretical understanding, students at different levels should be encouraged to identify problems and make judgements (that is, propose solutions) by themselves through different kinds of investigative activities (working alone or in groups). They do not need to compare or compete with each other. Their learning should be according to their individual interests and abilities.

Sixth, cultural studies should not be separated from other contents and elements—subjects—of the engineering curriculum. According to the evaluation of the engineering program mentioned above, *incorporating* cultural elements in other subjects and program activities is the best way to (a) allow students to put their theoretical learning into practice, and (b) motivate engineering students to learn cultural and social elements, as this incorporation allows students to recognise the importance of cultural studies. Moreover, it allows other teachers not directly involved in the teaching and learning of cultural studies to have more opportunities to understand and cooperate in the implementation of cultural studies in the curriculum.

Last, cultural studies should not be considered only as optional activities in the engineering curriculum. Instead, cultural studies should be incorporated in the engineering curriculum in a more organised and regular way. Moreover, culture is different in different societies; thus it is impossible to transfer cultural studies from the curriculum of one society to another. For example, Hong Kong is an urban city with dynamic interactions among people. Allowing students to make field studies of urban life and how it relates to design is a major

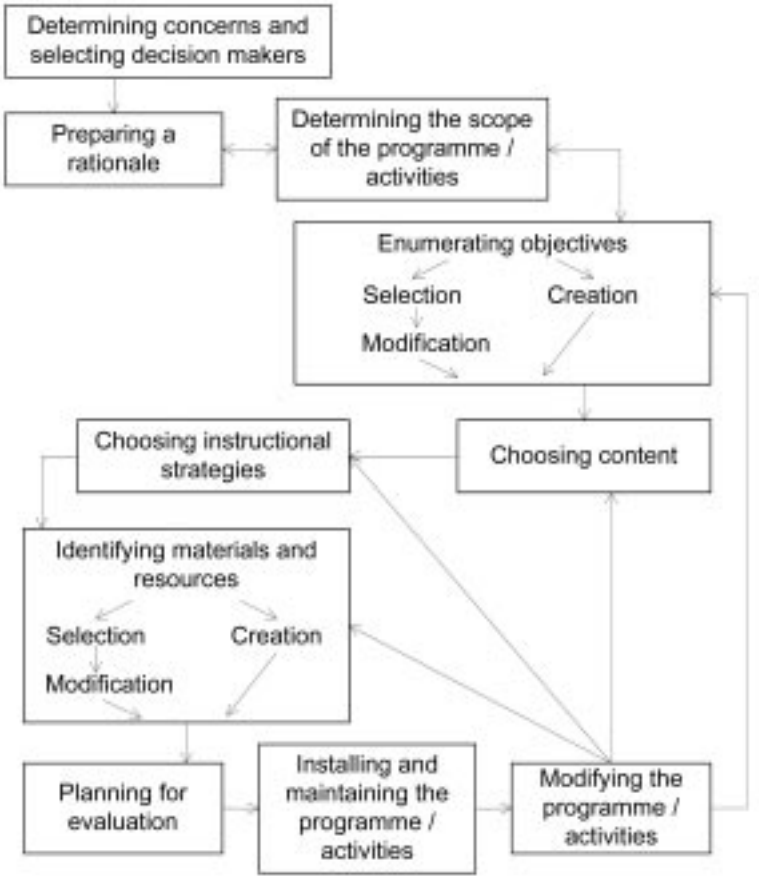

Fig. 1. Kissock's ten-stage decision-making model (Kissock, 1981).

learning element in cultural studies. However, this element may not be suitable for other regions where religion or social justice may be the important areas for students to explore. Nevertheless, it is possible to generalise about the decision-making process used in creating the cultural studies curriculum.

KISSOCK'S MODEL AND ITS POTENTIAL FOR CULTURAL STUDIES IN THE ENGINEERING CURRICULUM

Regarding developing cultural studies in the curriculum, Kissock's ten-stage decision-making model can give us some hints (see Fig. 1) [23]. However, his model initially applied to social studies, and therefore may have some limitations for use in cultural studies. Moreover, the initial stages in the development of the programme/activities in Kissock's model are heavily based on the determination of the developers/decision-makers (for example, teachers and supervisors), and lack space for the contributions and feedback of students. Another limitation of Kissock's model is that he has not provided channels for suggestions to be made to decision-makers modifying the programme/activities. Kissock only allows changes to start from the fourth stage, 'Enumerating Objectives.' As mentioned by Storey, 'cultural studies should be an unfolding discourse, responding to changing historical and political conditions and always marked by debate, disagreement and intervention' [24]. Therefore, the responses should not only be on the objectives and content, but on their rationale and on who determines the objectives and content. Of course, practically, it seems impossible to change all of the decision-makers at the same time. However, at least it is possible to have an opportunity to change.

In addition, Kissock lists 'Planning for Evaluation' as one of the sequential stages inside the model. However, designing strategies and preparing instruments for assessing students and programmes/activity performances should be carried out as part of the whole model of programme/activities development. Therefore, by modifying Kissock's model to suit the nature of cultural studies, a new model is proposed for the engineering curriculum (see Fig. 2).

The main rationale for the modification is to make the model more suitable for cultural studies and to provide a more flexible and dynamic structure for the programme/activities. While the stage 'Evaluating the Programme/Activities' is crucial for the active improvement of the programme/activities, 'Planning for Evaluation' is practised throughout each of the stages in the development of the programme/activities. In

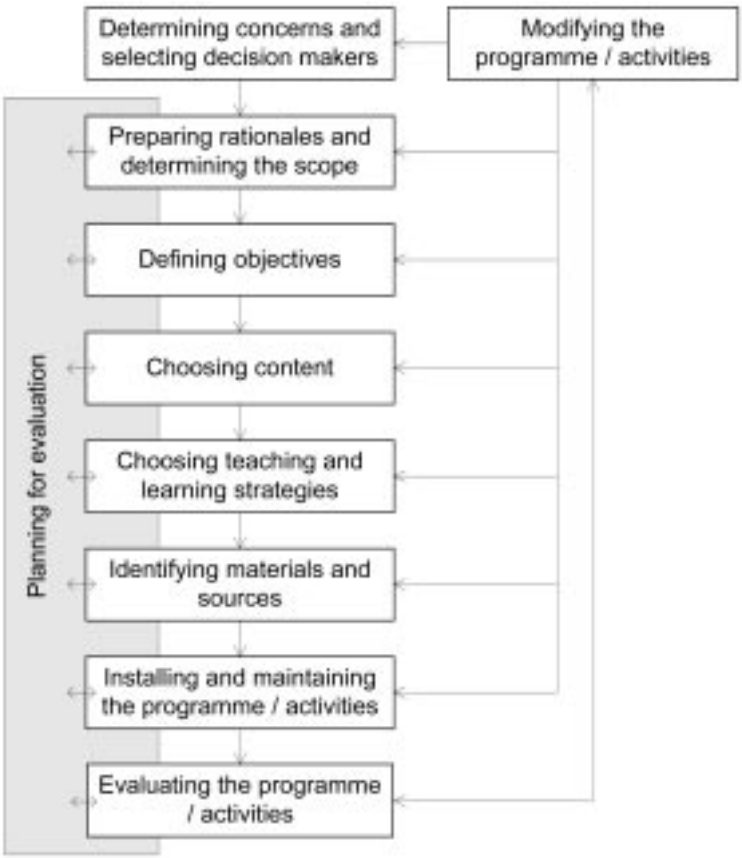

Fig. 2. The modified decision model for the development of a cultural studies programme/activities.

brief, only by having continuous interactive adjustments can we ensure that the programme/activities of cultural studies will fit a changing world.

CONCLUSION

The advantage of cultural studies in the engineering curriculum is to provide more opportunities and a wider scope for students to see, appreciate, and think about their local culture and other cultures, and in turn to apply this knowledge to their engineering studies and future careers. Cultural studies also encourage students to make judgements and to practise through self-discovery. This kind of experience is not only helpful in the learning of a particular engineering subject or discipline, but also in coping with daily life.

To obtain the greatest benefit from cultural studies, students should not work to obtain a fixed value or result, and should not make judgements according to the criteria set by teachers. Cultural studies in engineering consist of a process of critique that is based on practical discovery and analysis on the part of the students. To offer more space to students to explore, a greater 'looseness of fit' in the curriculum content of cultural studies should be practised. Thus, in providing cultural studies, the curriculum should allow flexibility for further modification and development. Instead of imposing a 'common rationale' and taking all students as 'average learners,' in terms of rationale, objectives, contents, activities and assessment, the curriculum should be dynamic and reviewed to suit diverse individual needs, goals, values, and a changing society.

The development of the contents and elements of cultural studies should not be determined only by curriculum developers and teachers, and without any flexibility for alternation during the implementation of the curriculum. Instead, the contents and elements should be reviewed and revised constantly, based on frequent interactions with and feedback from students as well as industry. Moreover, cultural studies should be incorporated in the engineering curriculum at all levels, and in a more organised and regular way. Furthermore, providing cultural studies in the engineering programme is not the work of one (compulsory or elective) subject, or a particular engineering discipline/major. It should be incorporated in all subjects although the degree of content may vary. It is also not the work of one group of teachers. It should be collaborative. Curriculum developers and teachers should sit together to discuss how cultural studies in different design disciplines/majors can be linked together. Only through having a good plan and co-ordination among different subjects, and by providing concrete support to facilitate the students' experiences, can cultural studies benefit the learning and future careers of the students to meet the changing needs of society.

Acknowledgements—This study was presented in part at the Tsinghua 2001 China International Industrial Design Forum and Industrial Design Education Symposium. The author would like to acknowledge the research grant from The Hong Kong Polytechnic University to support this study, and the support of the Fulbright Scholar Program in the preparation of this paper.

REFERENCES

1. W. E. Bijker, *Of bicycles, Bakelites, and Bulbs: Toward a theory of sociotechnical change*, The MIT Press, Cambridge, Mass. (1995).
2. P. W. Jordan, and W. S. Green, *Human Factors in Product Design: Current practice and future trends*, Taylor and Francis, London (1999).
3. D. A. MacKenzie, and J. Wajcman (eds.), *The Social Shaping of Technology*, Open University Press, London (1999).
4. J. Nielsen, *Usability Engineering*, Academic Press, London (1994).
5. D. A. Norman, *The Design of Everyday Things*, The MIT Press, London (1998).
6. E. Weibe, E. Bijker, and J. Law (eds.), *Shaping Technology/Building Society: Studies in Sociotechnical Change*, The MIT Press, Cambridge, Mass. (1994).
7. N. Whiteley, *Design for Society*, Reaktion Books, London (1995).
8. Technical expertise and public decisions, *Proc. 1996 International Symp. Technology and Society*, (electronic edition) Princeton, N.J. (1996).
9. K. W. M. Siu, Review the past to plan the future. In Y. C. J. Kwok (ed.), *(Re)-discovering Design: A critical consideration of the Hong Kong culture of design*, A Better Tomorrow Workshop, Hong Kong (1997) pp. 25–45.
10. *The 1997 Policy Address*, Printing Department, Hong Kong Special Administrative Region Government, Hong Kong (1997).
11. *The 1998 Policy Address*, Printing Department, Hong Kong Special Administrative Region Government, Hong Kong (1998).
12. K. W. M. Siu, *A study of pupils' rationale for the selection of topics in the project section of the HKCEE Design and Technology* (thesis, HKU Library Collection), The University of Hong Kong, Hong Kong (1994).
13. K. W. M. Siu, Criticism and theory studies in Design and Technology teacher education programs, *Curriculum Forum*, **7**(1), 1997, pp. 49–58.
14. K. W. M. Siu, The evaluation of higher education in a compressed spatial and temporal world, *Education Today*, **48**(1), 1998, pp. 9–13.
15. K. W. M. Siu, Improving design & technology education in Hong Kong, *J. Art and Design Education*, **18**(3), 1999, pp. 345–350.

16. K. W. M. Siu, Initiating problem directions by respecting cultures and everyday practices: A case study of the design project experience of engineering students, in D. W. K. Chan, and W. Y. Wu (eds.), *Thinking Qualities Initiative Conf. Proc., 2000 & 2001*, Centre for Educational Development, Hong Kong Baptist University, and Hong Kong Society for the Advancement of Learning and Teaching of Thinking, Hong Kong, pp. 215–222.
17. K. W. M. Siu, A case study of the difficulties and possibilities for students to initiate their project titles, in K. Volk, W. So, and G. Thomas (eds.), *Science and Technology Education Conf. 2000 Proc.*, Education Department, Hong Kong, pp. 112–120.
18. Einstein, *The Evolution of Physics*. Simon & Schuster, New York, (1938) p. 92.
19. M. Wertheimer, *Productive Thinking*, Travistock, London, (1959) p. 123.
20. K. W. M. Siu, Criticism: A relatively neglected area in engineering teacher training programmes, *Engineering Science and Education Journal*, **8(**5) 1999 pp. 206–208.
21. K. W. M. Siu, Reconstructing the learning environment for the new needs in engineering training, *Engineering Science and Education Journal*, **10**(3), 2001 pp. 120–124.
22. See [13], [16] and [17].
23. Kissock, *Curriculum Planning for Social Studies Teaching*, John Wiley & Sons, New York (1981).
24. J. Storey, *Cultural Studies & the Study of Popular Culture: Theories and Methods*, Edinburgh University Press, Edinburgh (1996).

Kin Wai Michael Siu is a professor in the School of Design at The Hong Kong Polytechnic University. He is a chartered designer and chartered engineer. He is a fellow of the Chartered Society of Designers, The Royal Society for the Encouragement of Arts, Manufactures and Commerce, and the College of Preceptors. He has been a visiting professor and scholar at universities in China, South Korea and the United Kingdom. He has been involved in more than twenty funded projects related to design research and engineering education. He is a Fulbright Scholar and is currently carrying out a funded research project at the Massachusetts Institute of Technology.