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Problem Finding: A Critical and Fundamental Element in Design

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Problem Finding: A Critical and Fundamental Element in Design

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For my supervisors and committed educators

Louise Poulson and John Eggleston

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Abstract

Recent researchers have pointed out that designers should not only be able to solve problems, but also to find and identify them. Also, many design curriculum publications and syllabi have unequivocally indicated that design students should be able to identify and state clearly the needs and opportunities for design activities through investigation of the contexts of home, school, recreation, community, business and industry. However, pilot studies conducted in Hong Kong indicate that education policymakers, curriculum planners and teachers pay relatively less attention to this specific ability. Therefore, there are limited opportunities and little flexibility for students to find problems (that is, to identify needs and opportunities for design). This lack is particularly apparent in public examinations, and even in university studies.

The key aims of this study are to explore the importance of "problem finding" in the design process, and to discuss how our current design curricula should be improved to nurture all-round design students. The study first reviews the significance of the skills and experience of problem finding in design practice. It then examines the importance of problem finding in design process. Taking selected Hong Kong secondary schools and university design school as materials for a case study and reviewing the development of design curricula in the secondary and tertiary levels, the thesis identifies the deficiencies in the current design curricula.

The research activities for this thesis include literature reviews, documented reviews of the primary, secondary and tertiary design curricula or similar and related

curricula, interviews with curriculum planners and developers, examination officers, school principals, teachers in secondary schools, professors in tertiary institutions, students, and questionnaires completed by students. Through empirical studies in two secondary schools and a design school in a university, this study asks whether and how problem-finding knowledge and experience affect design students. The thesis offers in-depth exploration and discussion on three aspects of the question: (a) students' learning process, (b) students' performance in design, and (c) students' perception of the importance of problem finding.

List of Abbreviations

A&D	Art and Design
AltS	Alternative Syllabus
AS (Level)	Advanced Supplementary (Level)
CDC	Curriculum Development Council
CDT	Craft, Design and Technology
CE	Certificate Education
CityU	City University of Hong Kong
CUHK	The Chinese University of Hong Kong
DSS	Direct Subsidy Scheme
DES	Department of Education and Science
DfEE	Department for Education & Employment
D&T	Design and Technology
EC	Education Commission
ED	Education Department
EMB	Education and Manpower Bureau
HK	Hong Kong
HKADTE	Hong Kong Association for Design and Technology Education
HKCEE	Hong Kong Certificate Education Examination
HKDI	Hong Kong Design Institute
HKEA	Hong Kong Examinations Authority
HKEAA	Hong Kong Examinations and Assessment Authority
HKIEd	The Hong Kong Institute of Education
HKU	The University of Hong Kong

IVE	(Hong Kong) Institute of Vocational Education
ITC	Innovation and Technology Commission
PolyU	The Hong Kong Polytechnic University
PRC	People's Republic of China
QCA	Qualifications and Curriculum Authority
RGC	Research Grants Council
SBA	School-Based Assessment
SBM	School-Based Management
TE	Technology Education
TI	Technical Institutes
UGC	University Grants Committee
VTC	(Hong Kong) Vocational Training Council

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Author's Publications Referenced in this Study

(A) Book chapters

Siu, K. W. M. (2002). Meeting the new needs: Curriculum development and assessment of technology subjects. *25th anniversary commemorative album of the Hong Kong Examinations and Assessment Authority* (pp. 48-54). Hong Kong: Hong Kong Examinations and Assessment Authority.

(B) Refereed journal papers

Siu, K. W. M. (2003). Nurturing all-round engineering and product designers. *International Journal of Technology and Design Education, 13*(3), 243-254.

Siu, K. W. M. (2001). What should be solved? *The Korean Journal of Thinking and Problem Solving, 11*(2), 9-22.

Siu, K. W. M. (1999). Criticism: A relatively neglected area in engineering teacher training programmes. *Engineering Science and Education Journal, 8*(5), 206-208.

(C) Refereed Conference Proceedings

Siu, K. W. M. (2003). Creating potential problems: Knowledge, experience and critical thinking. In Hiroyuki Aoki et al. (Eds.), *Journal of the Asian Design International Conference (Vol. 1)* [CD-publication]. Ibaraki: Asian Society for the Science of Design.

Siu, K. W. M. (2002). More than seeking model answers to predetermined problems: Enhancing students' problem-finding capabilities in design subjects. In A. Davies (Ed.), *Enhancing curriculum: Exploring effective curriculum practices in art,* *design and communication in higher education* (pp. 343-359). London: Centre for Learning and Teaching in Art & Design.

Siu, K. W. M. (2002). Nurturing all-round problem solvers: Enabling students to recognise, discover, and invent problems. In H. Middleton, M. Pavlova & D. Roebuck (Eds.), *Learning in technology education: Challenges for the 21st century (Volume 2)* (pp. 211-221). Brisbane: Centre for Technology Education Research, Griffith University.

Siu, K. W. M. (2002). The quality of need identification in design. In H. Pham & M. W. Lu (Eds.), *Proceedings of the Eighth ISSAT International Conference on Reliability and Quality in Design 2002* (pp. 211-215). New Brunswick, NJ: International Society of Science and Applied Technologies.

Siu, K. W. M. (2002). 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 & W. Y. Wu (Eds.), *Thinking Qualities Initiative Conference Proceedings 2000 & 2001* (pp. 215-222). Hong Kong: Centre for Educational Development, Hong Kong Baptist University, and Hong Kong Society for the Advancement of Learning and Teaching of Thinking.

Siu, K. W. M. (2001). Training for critical self-awareness: Developing students' ability in needs identification. *Ninth International Conference on Thinking Proceedings* (CD publication). Auckland: Auckland College of Education.

Siu, K. W. M. (2000). A case study of the difficulties and possibilities for students to initiate their project titles. In K. Volk, W. So, & G. Thomas (Eds.), *Science and Technology Education Conference 2000 Proceedings* (pp. 112-120). Hong Kong: Education Department.

Chapter 1 Introduction

1.1 Brief Review of the Need for Problem Finding

Common Neglect of Problem Finding

Problem finding is a critical stage in the entire thinking and design process. Problem finding (sometimes called problem identification, need identification, need finding, design opportunity identification), is obviously a fundamental issue, without which there would be no problem to be solved (Dudek & Côté, 1994; Jay & Perkins, 1997; Houtz, 1994; Robertson, 2004; Runco, 1994, 2003, 2007; Starko, 2000; Treffinger, Isaksen & Stead-Dorval, 2006).

In recent years, researchers, thinkers and design professionals have considered the quality of thinking. However, while people continuously try to find ways to be more creative in problem solving and have published volumes of studies on the subject, problem *finding* as an area in the thinking or design process has been considered relatively little (Hicks, 2004; Marshall, 1995; Runco, 1994, 2003, 2007; Robertson, 2004; Rowe, 1999; Wilson, 2000). Moreover, very few theoretical or empirical studies have focused on problem finding. About 70 studies have been related to design curriculum and education, such as the published research studies, in Hong Kong (including funded projects and research students' theses in eight tertiary institutions) from 1990 to 2006. More than 50 of the studies are related to design process. Nearly all of them focus on problem-solving skills and training. Only five of them consider some areas related to problem finding. Three of them were done by the author of this thesis.[1] One possible reason for this situation may be that, compared with problem solving, problem finding seems less relevant to the final outcome of the thinking or design process (Hicks, 2004; Runco, 2003; Siu, 2003; Treffinger, Isaksen & Stead-Dorval, 2006).

Importance and Significance of Problem Finding

As early in 1929, the well-known scholar John Dewey (1929), widely considered the father of progressive education, identified the act of discovering the problem as the first step in knowing, and the first step in creative activity and problem solving.

In his classic *The Evolution of Physics*, the great scientist and inventor, Albert Einstein (1938), asserted that "the formulation of a problem is often more essential than its solution, which may be merely a matter of mathematical or experimental skill". He further identified that to raise new questions, to discover new possibilities or to regard old problems from a new angle requires the imagination that marks real advance in science.

In *Productive Thinking*, Max Wertheimer (1959) identified that the function of thinking is not only the solving of actual problems, but also the discovering of new ones. He further pointed out that envisaging and formulating the productive question is often a more important and greater achievement than finding the solution to a set

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[1] Besides publications available in libraries and on-line resources, theses collected in eight major tertiary institutions were reviewed. The institutions included The University of Hong Kong, The Chinese University of Hong Kong, Hong Kong Baptist University, The Hong Kong Polytechnic University, and The Hong Kong Institution of Education.

question.

In *Originality*, Norman Mackworth (1965) also pointed out that an activity like problem finding would seem to be close to the heart of originality in creative thinking. Similar to Einstein and Wertheimer, Mackworth emphasised that problem finding is much more important than problem solving. In particular, most of the time problem finding is related to "initial discovery" (see also Csikszentmihalyi & Getzels, 1970; Runco, 2003; Schoennauer, 1981; Siu, 2002c).

In addition, in *Creativity's Compass*, Jay and Perkins (1997) stated that the act of finding and formulating a problem is a key aspect of creative thought and performance in many fields. They declared that problem finding is an act that is distinct from and perhaps more important than problem solving.

In short, few would dispute that a person who is good at generating creative solutions to defined problems is a creative thinker. However, if neither this person nor any other can find a problem for this "creative" person to solve, his or her creative as well as critical thinking talents would never be expressed (Runco, 2007; Robertson, 2004). In other words, without people who discover problems, there would be no creative solutions. Also, a good thinker can be a person who is able to solve problems creatively, but equally he or she is one who can critically find problems using his or her initiative (Chand & Runco, 1992; Dillon, 1982; Runco, 2003, 2007; Siu, 1994, 2001a, 2001b; Starko, 2000; Treffinger, 1995; Treffinger, Isaksen & Stead-Dorval, 2006).

1.2 Background of Design Education in Hong Kong

Needs for Creativity and Innovation Elements in Education

Hong Kong lacks natural resources, and its development relies heavily on industrial production and economic activity. As a result, Hong Kong society reacts in a sensitive and dynamic manner to social, political, economic and technological changes in other countries and regions. For example, since the 1960s, Hong Kong has changed its focus from an entrepôt trading post to a manufacturing oriented economy, then to a combination of manufacturing and service industries, and finally to become the international financial centre it is today (*The 2001 Policy Address*, 2001; Chan & So, 2002; *Hong Kong Annual Report*, 1986, 1990, 1996; Hong Kong Trade Development Council, 2000; Mo, 2006; Turner, 1989).

Due to the decline of the manufacturing industry, the government expects Hong Kong to develop its industry with more emphasis on creative thinking and high-tech innovation (*Consultation Paper*, 2004; Innovation Technology Centre, 2004). Thus, the terms "creativity and innovation" have become key factors (as well as a fashionable term) affecting not only Hong Kong's industrial development, but also its education policies and directions, as well as the whole development of the city in recent years. As clearly indicated in the Policy Addresses of the Former Chief Executive of the Hong Kong Special Administration Region, Tung Chee Hwa, regarding his expectations of education: "creativity and innovation" are one of the major driving forces of economic growth (*The 1998 Policy Address*, 1998; *The 2001 Policy Address*, 2001).

When talking about creativity and innovation elements in education, what first comes to mind is to design programmes and related subjects, and indeed this is what has happened, particularly in the past 15 year, during which people have considered the trends and quality of design education in Hong Kong much more than they ever did before. For example, starting in the mid 1990s, the Curriculum Development Council (CDC) and the Education Department (ED) faced increasing criticism of the slow pace of reform in secondary level design curricula.[2] Since the early 2000s, the boards of directors of tertiary institutes and the University Grants Committee (UGC) have also received pressure from the public, in particular from the design and manufacturing industry, suggesting that design curricula need to be critically reviewed and then changed to meet rapid social and industrial changes (The Hong Kong Polytechnic University, 2003; Lau et al., 2005; Siu, 2005).

Many people have considered and recognised the significance of design education, particularly the programmes and courses that offer more creativity and innovation elements. For example, since the late 1990s, hundreds of design-related short courses have been offered both to students as extra-curricula activities and to working people as further study. Moreover, apart from a large number of design-related courses offered by private design schools, tens of new UGC funded, subsidised and self-financed full-time and part-time programmes with the titles that include the term "design" have been initiated in tertiary institutes.[3, 4]

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[2] From 1996 to 2001, the author was the Executive Committee Member and the Chairperson (1998-2000) of the Hong Kong Association for Design and Technology Education (HKADTE). During this period of time, the Council as well as teachers of Design and Technology (D&T) exerted great pressure on the Curriculum Development Council (CDC) to reform the curriculum. In 1994, the CDC started to put the curriculum reform of D&T into formal agenda.

[3] Students of these programmes and courses can gain different recognised qualifications, including

Design Education at Post-primary Levels

In Hong Kong, all levels of education have claimed to have a certain degree or nature of design-related elements in their curricula. Nearly all subjects at all levels claim to include particular levels, degrees and natures of "creativity and innovation" elements, as well as problem-solving knowledge and skills in their curricula and activities. Nevertheless, according to the official terms used in the education departments and councils, design education in Hong Kong can be considered to be formally offered only at secondary and tertiary levels; that is, the post-primary levels (Siu, 2002a).

Some people may identify art and design subjects offered in primary education and early childhood education curricula. Strictly speaking, these subjects and activities can be considered as "creativity and innovation-related subjects". Most of the time, these subjects are related to traditional fine art and craft matters. This situation can easily be understood by the two common Chinese titles of the art and craft related

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certificate, professional certificate, diploma, higher diploma, associate degree, and degree or master degree qualifications.

[4] The current two major tertiary institutes in Hong Kong offering design programmes are the Hong Kong Polytechnic University (PolyU) and the Hong Kong Design Institute (HKDI). The PolyU has a long history in organising technical and new programmes related to design studies. It offers programmes from diploma to doctorial levels (for details, see http://www.sd.polyu.edu.hk). The HKDI was established in 2007 and it was transformed from the Hong Kong Institute of Vocational Education (IVE). The HKDI offers design curricula, from entry level at foundation, to higher diploma, and onto degree level in collaboration with overseas university partners (for details, see http://www.vtc.edu.hk).

subjects in primary schools, kindergartens and nurseries: "美術"and "藝術". The direct English translations of these two subject titles are "Fine Art" or "Art".

To have the topic more structured, and to generate a more focused discussion, this thesis is confined to and focused on design education provided in Hong Kong secondary schools and tertiary institutes. As stated, this definition of design education is officially and commonly accepted by the government and the education system in Hong Kong (Curriculum Development Council, 2000, 2005; Fung, 1997b; Martin et al., 2003; Siu, 1994, 1999a, 2002a, 2002b). However, this definition of the thesis does not limit the consideration of design elements in other levels of study. Information related to primary and early childhood education is not totally neglected in this thesis and discussion: it is used as reference for discussion in the following chapters as necessary.

Early Development of Design Related Subjects

The history of formal design-related subjects taught in educational sectors and schools in Hong Kong can be traced back to the 1920s. At that time, "design" was not a common or popular term (subject or area) as it is in the curriculum today. Instead, people liked to consider the subjects such as craft, design, and technical elements as "technical subjects" (Aberdeen Technical School, 1985; Siu, 1994, 2002b; Turner, 1989).[5]

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[5] It is also the reason, up to the late 1970s, design related subjects were only offered in the technical schools or institutes (工業中學, 工業學院, 工專). In Chinese, "工" always associates with the meaning of work, craft, and technical technique.

Apart from the traditional Chinese-style apprentice training, formal design-related subjects (that is, craft subjects) were offered in the 1930s. The first industrial school, the Aberdeen Industrial School, established in 1935, is a good example that illustrates the early design and technical education development of Hong Kong (more correctly: craft, apprentice and technical training). At that time, the school (the only one existing at that time) offered apprentice courses lasting 3 or 6 years in mechanics, cabinet making, tailoring, and shoe making to students who had completed their elementary studies. Besides providing industrial training, the school was also designated as a reform institution by the government.

In 1952, the Aberdeen Industrial School was renamed as the Aberdeen Trade School. This change marked a milestone in skill training in Hong Kong, in that industrial schools would no longer strive for practical correctional training. The subjects offered at the trade school included handwork, with the following subject elements: bookbinding, carpentry, metalwork, pottery, leatherwork, paperwork and carving (Aberdeen Technical School, 1985). Referring to the title of the subject and its elements, it is easy to see that the emphasis of the subject matter and learning activities is on handcrafts and skills rather than creative thinking or problem-solving knowledge and skills.

Design Related Subjects at Secondary Level

In 1955, formal public examinations for technical subjects started to be implemented in Hong Kong. The examinations established a critical milestone for the subjects, in that they were considered as part of secondary education; that is, post-primary education. In 1957, the Aberdeen Trade School took the first step towards becoming a technical school, that is, further changing its name to "Aberdeen Technical School".

From 1955 to 1964, more technical schools (equivalent to the current secondary level) were established. Students in these technical schools could take the craft subject handicrafts stream, in which they could select two out of six choices, including pottery, toy making, leatherwork, book-binding, weaving, and embroidery. Students could also take one of the following technical subjects: (a) woodwork or metalwork, (b) geometrical and mechanical drawing, or (c) dressmaking.

In 1960 and 1961, there were five "modern schools" established to provide training in craft and technical subjects. They claimed to provide pre-vocational training at the secondary level. They also offered craft and technical subjects similar to those offered at the technical schools. After 1963, these modern schools were also renamed technical schools. At their peak, there were 27 technical schools in Hong Kong. From 1965 to the late 1970s, woodwork, metalwork, practical electricity, and technical drawing became individual subjects and were offered in technical schools. This is also the longest period in which the syllabi of the technical subjects (or so-called design related subjects) did not undergo great changes.

In fact, the name "technical school" is still used now, though most of them changed their names to "secondary school" in 1997. One of the major reasons for the change is that many schools also offer science and arts subjects, so that "secondary school" more accurately reflects their nature. Another reason is that in the past, technical schools were always considered "second class" schools at the secondary level. Due to the nature and names of technical subjects offered in the schools, many people considered that the academic standards as well as the standards of students of technical schools were not so good as other secondary schools.[6]

As implied by the names of the technical schools and the subjects they offered, the core education aims of the subjects were to provide skill training. The so-called "problem-solving skills" were just skills necessary to finish assigned technical tasks or technical routines. That is, students (sometimes called apprentices) were mainly required to acquire skills and practical experience in preparation for earning a living (Siu, 1997a, 1997c). Even until the mid 1970s, students in technical schools and some pre-vocational schools also attended classes in skill training that included a great deal of routine and repetitive drills. The students' performance was mainly assessed on their familiarity with certain skills, and their accuracy in required work (that is, with predetermined solutions and outcomes). For example, a student learning metalwork might be required to spend tens of hours using hand files to produce a piece of metal plate in perfect dimensions according to a working drawing provided by the instructor. In short, students were seldom offered problems to be solved on their own initiative.

With respect to curricula, the subject matter of most of these craft and technical subjects were mainly adopted from the UK's early curricula, and had not been revised for many years. For example, the curricula in woodwork and metalwork that were used for several decades in Hong Kong did not undergo any great changes until

[6] The Chinese name of technical secondary school is "工業中學". The Chinese word "工" is related to "technical" and "(cheap) labour". However, there is a popular saying in Chinese (Cantonese): "工字不出頭". It means that "technical" and "labour work" will not have an excellent future (that is, to be the persons in the higher class of the society). While the living standard in the 1980s started to get better, many people therefore did not want their children to study in these technical schools.

the mid 1970s, when many workshop facilities were imported from the UK, including machines, hand tools and furniture that fit the UK curricula and teaching and learning materials.

As stated above, public examinations in woodwork, metalwork and practical electricity started in 1955. The examinations for each subject consisted of three papers: drawing, theory and practice.[7] The contents were skill and practice oriented. The nature of these examinations in fact affected the contents and development of the curricula of the design-related subjects for many years, even to today (Fung, 1997b; Martin et al, 2003; Siu, 1994).[8]

Before the 1980s, teaching and learning activities in many of the schools offering technical subjects such as woodwork and metalwork focused on the technical aspects. Due to a revision of the curriculum and the examination syllabi, as well as to new teacher-training methods, more attention has been put on the design and thinking elements (Curriculum Development Council, 2000, 2005; Leung, 1998; Siu, 1997b, 2000a, 2002a). Activities are more flexible and more variety is provided for the students.

To promote problem-solving skills in students, a new subject, Design and Technology (D&T), initiated in the United Kingdom, was introduced in Hong Kong in 1975 and implemented concurrently with conventional technical subjects for

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[7] "Practice" was an important part of examinations of some technical subjects. The students needed to finish an assigned technical task within a period of time, e.g., 3 hours. The major and only assessment criterion was the workmanship of the students.

[8] The influence of assessment will be discussed in detail in the following chapters.

secondary level students (aged between 11 and 17 years).[9] According to the original plan, the conventional technical subjects characterised mainly by skill drilling and technical knowledge would be gradually replaced by D&T. In 1975, D&T was offered to Secondary Four students who had taken woodwork and metalwork, and as a new subject to Secondary One students. The subject has been offered until the present, although the syllabus has been revised several times (Curriculum Development Council, 1983, 1991, 2000, 2005; Siu, 2002a, 2002b).

The core aims of D&T in Hong Kong are claimed to foster and develop the creative, intellectual and technical abilities of students through the use of materials and the application of technological knowledge (Hong Kong Examinations and Assessment Authority, 2002a, 2002b; Leung, 1998; Siu, 2001b). In detail, D&T is expected to enable students to achieve design and technological literacy through the development of:

- Design and technological knowledge and understanding,
- Communicating and problem-solving capabilities,
- Design and technological capability, and
- An understanding and awareness of the relationship between design/technology and society (Curriculum Development Council, 2000).

As clearly indicated in the syllabus of the subject, the design process (that is, mainly problem solving and "realisation") is considered central to such development (Hong Kong Examinations and Assessment Authority, 2002a, 2002b, 2005; Leung, 1998).

[9] Up to the present moment, there is no formal D&T subject for primary level students.

D&T has not been a compulsory subject in Hong Kong, though many local educators and D&T teachers have claimed that the problem-solving skills in the subject should be learned by all students (Siu, 1999a, 2001b; Volk, Yip & Lo, 2003). Schools can determine their curriculum under the School-Based Management (SBM) arrangement, in which the Education and Manpower Bureau (EMB) delegates authority to schools. Thus, as indicated by an interviewed officer of the Hong Kong Examinations and Assessment Authority (HKEAA), "recommended subject" would be a better description for D&T. Today, about half of secondary schools offer D&T in Secondary One to Three, and about 40 schools offer the subject at the senior level.

Advanced Supplementary (AS) Level D&T has been available in Hong Kong for Secondary Six and Seven students in four pre-vocational and technical schools since the late 1990s. To provide a different D&T curriculum to suit the needs of different types of schools, the D&T (Alternative Syllabus "AltS") is offered in some schools. This curriculum is more technology-oriented, in that more advanced facilities are required, and schools have the freedom to opt for it if they can provide the resources and facilities (Hong Kong Examinations and Assessment Authority, 2005, 2006; Siu, 2002a).

In sum, at the secondary level, design-related subjects have been changed several times from traditional craft and technical subjects in the 1920s to D&T in the late 1970s. It is a fact that D&T has been able to fulfil most of its original objectives, though it still has some limitations that will be discussed in the following chapters. Nevertheless, D&T offers a new direction and environment where students can have more opportunities to practice their problem-solving skills. Unlike before, when students were required to follow an engineering drawing to produce a "perfect" output, the current D&T curricula at different levels allow more space for students to explore, think and apply their theoretical knowledge. In other words, the curricula focus relatively more on the thinking and design process, though the final outcome is still emphasised in assessment. For the past ten years, under the Education Reform, the curricula and examination syllabi D&T has been revised (Curriculum Development Council, 2003; Martin et al., 2003). At the present moment, the syllabi of D&T and other design and technology related subjects are still under review and are planned to be further modified. As pointed out by the interviewed officers in the CDC and the HKEAA, there is still a long way to go.

Design Programmes at Tertiary Level

Until the early 1990s, universities in Hong Kong were still considered as places for small numbers of elite students. If other students wanted to further their studies after secondary school, they had to go to government-funded or subsidised institutes, private institutes and colleges, or study abroad.

At that time, there was a critical increase of places for studying tertiary education, and higher education developed in three major directions or streams:

(i) Government-funded universities and colleges with conventional programmes and courses such as science, law, engineering, architecture and arts;

(ii) Government-partially-subsidised or private institutes and colleges with a limited number of programmes and courses in business, social studies, humanity studies and cultural and art studies, etc.;[10] and

(iii) Government-funded or subsidised polytechnics and technical institutes with vocational and technical subjects such as sand casting, production engineering, printing, bookkeeping, and textile and clothing which focus on training for technician and skill labours working in the industry.[11]

Although most curriculum planners, coordinators and teachers[12] in these three major directions or streams declared that thinking skills were important in their programmes, "creativity and innovation" in fact were not so commonly emphasised in the curricula. Moreover, the meaning of problem-solving capability in general was understood as mastering knowledge of particular subjects and then solving assigned questions and problems related to the subjects (Martin et al., 2003b, Siu, 2000b).

Apart from the technical and design-related subjects offered in the technical institutes mentioned above, the history of "design" programmes can be traced back

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[10] In general, the scale of these institutes and colleges were small, and some of their qualifications were not formally recognised by the government. If the graduates wanted to get recognised qualification in some subjects, they might need to take some recognised professional/public examinations.

[11] Most of the technical/professional qualifications of these programmes and courses were recognised by the government and/or some professional bodies. Sometimes, the recognition of some programmes in professional and technical training was higher than university programmes. In the 1970s and 1980s, the qualification of Accounting offered by the Hong Kong Polytechnic was much higher than those offered in two main universities.

[12] Unless specified, "teacher(s)" in the coming sections and chapters has a broader meaning include instructor(s), lecturer(s) and professor(s) in higher education sectors.

to the early 1960s. The first formal government-recognised diploma design programme was offered in 1964 by the Hong Kong Technical College.[13] Before the mid 1990s, design programmes were only offered in non-university institutes, such as the Hong Kong Polytechnic,[14] technical institutes,[15] and subsidised and private design schools.[16] The first design degree programme offered in a design school of a "university" was in 1994, though design degree programmes had been offered in the Hong Kong Polytechnic much earlier, in 1984 (The Hong Kong Polytechnic University, 2003; *University Prospectus*, 2000-2005).[17]

Before the mid 1980s, design programmes were mainly skill based, even though the words "problem solving" could be found in many programme documents. At that time, techniques such as graphical illustration gained recognition and both local and

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[13] The Hong Kong Technical College (1947-1972) was the former name of the Hong Kong Polytechnic. Before that, the college was called the Government Trade School (1937-1947). The Government Trade School was the first government funded, post-secondary technical school in Hong Kong. It ran classes in wireless telegraphy, building and engineering for about 70 students in its first year of operation. In 1994, the Hong Kong Polytechnic was granted its official university title as "The Hong Kong Polytechnic University" (for details, see www.polyu.edu.hk).

[14] The design department of the Hong Kong Polytechnic was formally established in 1967. The first higher diploma design programme was offered in the Hong Kong Polytechnic in the same year. Before that, skill based training related to design/technical subjects were offered in the Hong Kong Technical College and the Government Trade School (two former names of the Hong Kong Polytechnic). And, some form of diploma in commercial design existed in the polytechnic in 1964.

[15] As stated in the note above, the VTC has been the major council to organise non-degree design programmes in technical institutes.

[16] Sometimes, subsidising of the programmes was based on consideration of individual programmes. Except The Hong Kong Polytechnic University, all of the technical institutes and colleges do not have the authorised status to carry out the self-accreditation of their design related programmes.

[17] The first two degree programmes (graphics and industrial design degrees) and the first two honours degrees (fashion and industrial design degrees) offered in the Hong Kong Polytechnic were in 1984 and 1989 respectively.

international reputation. For example, the quality of a free-hand or spray-brush illustration could be as good or real as a photo, so that non-professional people were sometimes not easily able to distinguish the difference. However, the students' thinking skills, problem-solving capability and experience were continually criticised by the industry. In addition, many of the design students at that time did not possess academic qualifications. Companies therefore would hire many graduates only as technical design staff, even though some graduates preferred to operate their own design firms, particularly in graphic design areas.

As stated, many of the students studying design did not have a strong background in academic studies. The public considered these students unfit to enter universities or study academic subjects. For example, as indicated by two interviewed professors of The Hong Kong Polytechnic University (PolyU), many parents at that time did not like their children to choose design as a lifelong career, because they did not consider it a serious study. Some students, who were successful in their academic studies and had the talent to study design, were not able to enrol in design programmes because their parents, their peer groups and society at large discouraged them. Until the late 1980s, this situation affected the quality of the student intake for design programmes.

Starting in the 1980s, new design trends and technologies in western countries significantly affected the development of design education and brought critical change in public perception of design to Hong Kong (Siu, 1994, 2005). These changes affected not only the curricula, contents and instruction methods of design education, but also the quality of the students studying them. Fortunately, most of these influences were quite positive for the development of design education and industry practice in Hong Kong. For example, design became considered as a subject in which students can "invent" something new and "see and think" something in some new ways, instead of being thought of as a subject for skill training, as in the past. Design graduates' work also started to gain recognition by the industry, and their pay scales improved relative to the graduates of other disciplines. More parents then started to allow their children to study design and choose it as a career. Together with the attractive images and lifestyle of designers that appeared in mass media (for example, TV programmes) and the example of some successful local designers, more and more young persons wanted to get into the design field for a long-term career. Thus, since the early 1990s, thousand of people each year have applied to study design programmes, even though only several tens of places are offered in the university.[18, 19] Consequently, the quality of the students has improved in recent years.

Nevertheless, tertiary design education in Hong Kong has made some critical changes over the past three decades. One of the critical changes is that design technical skills have not been considered as the most and only objective in design. Instead, design theories and thinking have been more emphasised. Students are also encouraged to have more contact with society instead of hiding up themselves in design studios and labs. And, instead of focusing on one particular area or discipline,

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[18] Although there are some universities and institutes have claimed to offered design programmes and subjects in Hong Kong, only The Hong Kong Polytechnic University (PolyU) has a fully and directly government-funded school of design that offers different research and undergraduate design programmes. One of the major reasons is that the University Grant Committee (UGC) has a quite strict arrangement and monitoring on the funding for different particular degree programmes (that is, UGC funded programmes) offered in different universities.

[19] Since 2007, the Hong Kong Design Institute (HKDI) is another tertiary institute offering degree programmes, which is a joint programme in collaboration with the universities in other countries.

a multi-disciplinary approach is increasingly implemented and encouraged in the curricula. These changes in the schools and the programmes have started to attract local and international recognition. For example, the design school of the PolyU was ranked as one of the top 60 design schools in the world by *BusinessWeek* in 2006.[20] Design graduates from different disciplines in different institutes have also won international awards. In addition, despite the economic decline in recent years, design graduates still have a very high appointment rate and receive reasonable pay from local and international design companies.

However, this does not mean that the development and quality of tertiary design education in Hong Kong is perfect. Indeed, it is still receiving considerable criticism. Although creative thinking and problem-solving skills have been increasingly emphasised in design programmes in Hong Kong since 1980s (Siu, 1994, 2001a), there is criticism that the students' thinking skills are not meeting the continuously changing needs of both the industry and society at large. In particular, since 2000, design graduates have been criticised for their lack of initiative and weakness in need identification — problem finding.[21] Moreover, the Policy Addresses of the Chief Executive (1998, 2001) states that Hong Kong is expected to be a place that nurtures manpower for front-end creative and innovative industry, such as interactive multimedia and high-tech innovative design. All of these factors increase the pressure to reform design programmes still further, particularly in the area of critical thinking. It is also the reason why the PolyU has spent much effort and resources

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[20] See http://bwnt.businessweek.com/dschools/2006/index.asp?sortCol=num_students&sortOrder=ASC&pageNum=1&resultNum=100

[21] Regarding the changes of the industry requirements, and the major causes of the weakness in problem finding, see Appendix I.

over the past five years to reform and bring new directions to design education. Furthermore, technical institutes and colleges that originally offered skill-based non-degree design programmes have also realised that they need to change their programme structures to have more content and activities that nurture students' problem-solving capability. Therefore, most institutes do not emphasise "skills" any more, but focus more on preparing students to have creative, thinking minds. Some institutes also work with universities in foreign countries to offer higher levels of design studies. For example, in 2006, the VTC re-organised and established its new design institute, HKDI. The HKDI also works with a foreign university to organise top-up degree programmes in order to bring foreign experience to re-organising existing programmes and implementing new programmes. The Hong Kong Art School of the Hong Kong Arts Centre has also changed the original nature of its programmes from only focusing on creative fine art to including some design thinking and problem-solving elements.[22]

Nearly all agree that it is necessary to have further reform and change in design education; consequently, it is a critical time and opportunity for design educators and designers to ask two key questions:

What kind of things are the current design curricula still missing?

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[22] In May 2007, the author was nominated to the Hong Kong Council for Academic Accreditation as the Panel Member of the accreditation exercise for an applied art (design) programme proposed by the Hong Kong Arts Centre. The programme has achieved significant changes in the curriculum contents compared to its existing programmes. New design elements (that is, problem solving skills) have been included in the curriculum.

What areas of current design practice and education should be improved and enhanced?

1.3 New Needs in Design Practice and Education

Critical Changes and New Needs

Since early in the last century, particularly during the growth of modernism, scientific invention and technological development have become utopian goals, not only in schools but also in the wider world.[23] Industrialisation made the training of skilled labourers become one of the core aims of many schools, in particular those offering education to the lower-class sector of the population. Further, in countries or cities such as Hong Kong, which lack natural resources, training manpower to service the needs of the mass production industry seemed essential in education, and sometimes the only reason for its existence.

For about the first seven decades of last century, as reviewed in the previous paragraphs, educational goals in Hong Kong were simple and direct. Excepting conventional British-style university education for a small number of students, most other students and apprentices were in general trained in skills that met the needs of local industry.[24] Therefore, the subjects or areas for training were very specific and

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[23] Unless specified, "school(s)" in the coming sections and chapters has a broader meaning to include school(s), institute(s) and college(s).

[24] Early in the 1990s, Hong Kong saw a sudden growth of places offered in universities as well as increased grants and re-titling of several polytechnics and colleges as universities. Before that time,

limited. As pointed out by Turner (1989), at that moment, industry in Hong Kong was very "passive," its nature, development, existence and survival solely depended on "orders" and "requirements" such as the well-known plastic flower production for markets in the North America and Europe in the 1950s and 1960s. Similarly, areas and subjects of training were also very passive and dependent on the needs of local industry.

Changes in technology in Hong Kong (in terms of machines and knowledge) at that time were not as rapid or dramatic as today, although scientific inventions and technological developments quickly blossomed after the World War II (Mo, 2006; Siu, 2005; Turner, 1989). Thus, the curricula and subject materials of craft and technical subjects did not need to be constantly revised, and the facilities available in schools did not become outdated as quickly and easily as they do today. The area of coverage of the curricula was also not as wide as today. This is clear if one observes the limited number of subjects selected and taken by students at that time. Unlike today's students, who have many choices when selecting the subjects in which they are interested, students before the 1970s were required to concentrate on a few subjects and learn skills for a particular area or closely related areas (Martin et al., 2003; Siu, 2002b).

The nature of Hong Kong's industry changed slowly. Skilled labourers were needed (and were almost the only need) of the production and manufacturing industry. Due to repetitive mass production, the number of people working in supervisory roles was relatively smaller than today. In other words, there was no significant need for

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university education in Hong Kong was considered elite education for a small number of students.

people in decision-making and supervisory positions to initiate anything new. As pointed out in an interview with a manager of a textile and clothing production factory, in the 1960s and the 1970s, a supervisor (or, as he called it, a "line production foreman") could supervise more than 200 workers in a production line (Siu, 2005). Therefore, the need for people with decision-making capability was very limited. What a factory needed at that time was well trained or easily trained labourers. As also indicated by an owner of a small factory producing cheap flash lamps and accessories, in the 1970s being "creative" was not important. It did not help earn money. Instead, at that time, it was important for a good manager to know how to copy things on the market quickly, and for a good technician to be skilful in drafting production drawings quickly. Maintaining a strong and young labour working team (for example, one willing to work overnight and on holidays) was "the key to win in the market".

All of these factors resulted in more stable education policies and curricula for craft and technical subjects. Policymakers saw no need for rapid changes in the way they produced students whose skills fitted the needs of society. These stable policies and curricula also allowed schools to survive long enough to educate or train more students (that is, there was no need to use vast financial resources to update facilities when Hong Kong's economy was weak and education investment by the government was very limited). Furthermore, the government and the schools also received little pressure from the public (including parents, politicians and pressure groups) to revise curricula, learning and teaching activities. Because parents' lives were hard, they had little time to consider their children's education or to criticise education policy and curricula. There were almost no pressure groups to monitor the policies and implementations of education, particularly those related to skill training curriculum. Consequently, the government was free either to change or not change educational matters.[25]

However, starting in the late 1970s, there were critical changes in several aspects of Hong Kong that brought new needs in industry and education. The following sections will review the changes and needs in design industry and education over the past several decades. This includes both the nature of and requirements for jobs social matters, and educational objectives. The review presents and discusses the issues related to problem finding; however, this focus does not imply a neglect of other areas. Rather, some issues related to design practice and design education are also considered as references.

Job Natures and Requirements

Since the early 1980s, routine repetitive skills and cheap labour were expected from Hong Kong industry more than creative thinking in terms of problem-solving skills. A large number of small-to-medium sized design studios and companies, and some design-related manufacturing companies were established between the 1980s and the mid 1990s to provide local design services. During that time, designers and design engineers in Hong Kong were mainly required to use what they claimed were creative minds to generate ideas to *solve* problems that they had been given. Designers in the industrial and production engineering field were also mainly

[25] There were several student and social movements and actions in Hong Kong from 1950s to 1970s. Most of these movements and actions were focused on political and social issues. Some actions were related to the nature and direction of university education, but nearly no action related to craft and technical education.

required to solve problems based on their technological and engineering knowledge and experience.

There have been gradual changes in the job natures and requirements in the design industry in Hong Kong over the past two decades (*The 2001 Policy Address*, 2001; *Consultation Paper*, 2004; Siu, 2001a, 2001b; Turner, 1989). Today, besides generating solutions in response to clients' orders, designers are more often required to *initiate* directions for design, development and production. In fact, a large portion of these small design service companies has closed during the past ten years. One of the major reasons is that they received fewer orders. Unfortunately, they can no longer lead the market or self-initiate new directions for survival.

On the other hand, in some big companies, even some of the designers are not working at the supervisory level where they are required to take more initiative and use higher sensitivity to identify opportunities for improvement. As stated by the interviewed managers and design directors, some regional-sized product design companies in post-industrial societies such as Hong Kong's, are characterised by a high level of competitiveness and rapid change in the direction of development. In this context, employees are more often required to show initiative in the area of "What should be done?" rather than of "How should it be done?"

For example, about 20 years ago, a toy designer in Hong Kong might only need to produce creative ideas for designing a new toy according to the specifications and requirements provided by his or her working company or clients (Siu, 2003, 2005; Turner, 1989). Or, he or she might only need to be creative enough to know how to "smash and re-pack" the shell and cover of toys from foreign countries and then generate some *new* designs for putting the result into mass, low-cost production.[26] At that moment, the quality of work or the capability of designers to fulfil the assigned jobs mainly depended on their problem-solving skills and technical design techniques and experience.

However, since the late 1980s, nearly all of the factories in Hong Kong have been moved to the Chinese mainland. The concept of cheap labour production does not work in Hong Kong any more. For the past ten years, even original equipment manufacturers (OEM) have also not existed successfully. It is also the reason that many well-educated professionals such as product and industrial designers and engineers cannot find jobs in Hong Kong. For example, in 2006, more than 90% of mechanical engineering and design graduates had to work outside Hong Kong, mainly in China. To survive on the Chinese mainland with its huge manpower resources, Hong Kong graduates must rely on the strength of their problem-solving skills, initiative, talent, management knowledge and experience. In this context, good problem-solving skills are still applicable and significant, but not sufficient. As indicated by the Trade and Industry Department (2007), the Hong Kong design industry needs to "develop", "create" and "initiate" their niche areas in order to compete with the neighbourhood regions and have the same pace as the rest of the world. Companies, in particular small and medium enterprises (SME), need to initiate and develop new product lines and find new markets. Individual designers need to be capable of identifying design opportunities.

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[26] "Smash and re-pack" was a common term used in the Hong Kong product design field in the 1970s and 1980s. Designers most of the time were required to know how to copy (that is, the concepts and technological inventions) and then re-generate some new versions of products (that is, covers of the products) in a clever way suited to production by the local factories.

In sum, as we leave the age of production- and manufacturing-oriented design industry and design services that operated according to provide specifications, design firms and production companies in Hong Kong as well as many neighbourhood regions must identify the directions and opportunities that will allow the industry to survive. Designers are required to identify and bring new opportunities as assets to the companies where they work. As indicated by the interviewed managers and project managers of several design companies and production companies in Hong Kong, skills and experience in problem solving are not enough. Instead, the current expectation for designers includes whether they can identify new directions for development in the companies where they work. As stated by an interviewed CEO of a lighting factory in Guangzhou, PRC:

> "I am not worried too much about the quality of designs generated by the young designers today in my company. ... But I really lack good designers with capability to see what new directions and things we need to go further. Most of the time, we need to tell our clients what kinds of new lighting we can produce. ... Our clients only know lighting is a potential market. They have also prepared money to invest, but they do not have much idea about what lighting they need to develop. We need to tell them."

A manager of a local home appliance and gift product design firm with its design headquarters in Hong Kong and production partners in Chinese mainland, stated:

> "Why do I need to keep you [a Hong Kong designer with relatively higher salary] in my company? The only reason is that you can tell me some new things, new directions, new opportunities and undeveloped areas that I haven't thought before."

Social Matters

People in Hong Kong have a much higher standard of living than in the late 1960s, thanks to the success of the manufacturing industry, steady stable economical growth, a stable political environment, rapid establishment of infrastructure and improving welfare services (Faure & Lee, 2004; Lee, 2000; Ma, 2007; Perloff, 1985; Siu, 2005; Social Welfare Department, 2007; Territory Development Department, 1993; Town Planning Office, 1988).[27] Because of improved living standards, people's expectations about quality of life in general have also increased.

Starting in the late 1960s, rapid technological inventions have changed the daily lives of Hong Kong people (Turner, 1989). The changes exist not only in people's physical lives but also in their ways of seeing and judging. The huge number of inventions publicised by mass media has aroused people's awareness of the changing needs of the local society and outside world. The world situation has also had significant impact on the people who are more open to and have more contact with the outside world (Ho & Ash, 2006). People have started to understand that

[27] The "Ten-Year Public Housing Policy" has been considered as a critical policy and establishment of the Hong Kong Government. The policy also founded a more stable social environment for urban development in the 1980s and 1990s, in particular for the lower sector. At the present time (2007), about half of the population of Hong Kong are living in public housing estates.

they are entering a wisdom-driven era. Hence, many people — in particular those born after the early 1960s and who received a better education than their parents — are not satisfied to earn a living as cheap skilled labourers. They expect to be at a higher (that is, decision making) level in their work places; it is no longer a matter of survival or self-sufficiency. They also realise, to survive in such a rapidly changing and competitive city (as well as in most of the places in the world), they need to know how to take more initiative and become more self-motivated so that they can make the most of the changing world around them. (Siu, 2005).

On the other hand, due to the success of family planning promotion and changes to the concept of family,[28] most young couples' families have a small number of children. This situation has enhanced young parents' consideration and expectations about the quality of education as it affects the future careers of their children. Learning from their own experience, more parents reject the idea that their children should be skilled labourers working in factories to earn a living, as mentioned above. As a Chinese saying has it, people nowadays prefer themselves and their next generation to "use their brains rather than their hands to earn a living".

In the recent years, young people have changed with respect to their ideas for their education and careers. With fewer demands for money matters from their families, young people have more freedom and choice in selecting their studies and ways of

[28] The family planning campaign in the mid 1970s was very successful. Even many western countries came to Hong Kong in the 1980s to see how well it worked. Today, the birth rate in Hong Kong is negative. This situation has also a new social problem: the elderly population of Hong Kong is very high. In 2002 the United Nations predicted that unless there are other critical social and demographical changes, Hong Kong will be the city/region with the highest elderly population percentage in Asia in 2050 — even higher than Japan.

life. Instead of learning a skill to earn a living or to do routine work day by day, more young people prefer to study programmes and subjects which allow them to have more space to develop their thinking talents, express their feelings and ideas. That is, they want careers that involve a high degree of self-expression, and they seek goals involving higher self-satisfaction (Kwok & Siu, 2002). Consequently, design- or problem-solving oriented programmes and subjects with more space for initiation and creation are more attractive to young people (The Hong Kong Polytechnic University, 2003). Moreover, due to these changes in both education and generally held value judgements, more young people like to find their own ways of doing their jobs, instead of following orders or well-defined job requirements. Although there still is a debatable social and educational issue whether or not this kind of thinking on the part of the young is appropriate and should receive more support, it is indeed a very common trend in the value judgements of the younger generation.

Educational Objectives

As early in the 1980s, *Regulations and Syllabuses* clearly stated the aims and the objectives of Design and Technology, namely that the subject is intended "to foster and develop students' abilities in the utilisation of scientific and engineering knowledge through the technological process and in problem-solving activities" (Hong Kong Examinations Authority, 1987). The syllabi of technology subjects, as well as revised syllabi and documents for curriculum review, which were prepared by the Curriculum Development Council (CDC) (Curriculum Development Committee, 1983; Curriculum Development Council, 1991, 1999, 2000, 2003, 2005), all state that the aims of the course are:

> "To develop students' ability in solving problems ... to develop students' analytical and critical ability to carry out cognitive modelling to tackle problems ... to develop an understanding of the basic elements of design and technology." (See Curriculum Development Council, 1991, 2005)

Similarly, the National Curriculum in England and Wales also pointed out that identification of needs and opportunities must be a key area for technology students' learning (Department for Education & Employment. 1999; Department of Education and Science, 1989, 1995; *The National Curriculum for 11 to 16 Year Olds*, 2007). The attainment targets (ATs) were set for the design and technology subject (that is, Technology): (a) identifying needs and opportunities, (b) generating a design, (c) planning and making, and (d) evaluating. Another publication of the National Curriculum (Department of Education and Science, 1990) also gives more details on the first attainment target that:

> Students should be able to identify and state clearly needs and opportunities for design and technological activities through investigation of the contexts of home, school, recreation, community, business and industry. (p.3)

In fact, for the past nearly twenty years, the importance of "identifying needs and opportunities" (that is, problem finding) has still been continuously mentioned in revised curriculum documents, syllabi and consultation documents about design (and technology) subjects in Hong Kong as well as in other countries (Curriculum

Development Council, 2000, 2003, 2005).[29] The education documents related to tertiary design studies, such as syllabi of the degree programmes and Master of Design programmes of The Hong Kong Polytechnic University and the Higher Diploma and Diploma programmes of the Hong Kong Institute of Vocational Education, all recognise the importance of problem finding (for example, need and design opportunity identification).

Many educators also state that it is important for students to have freedom to select topics for project assignments in technical subjects (Nicholson, 1989). So, it is clear that design education activities should not only focus on educating students to generate, make and evaluate an artefact or system but also to *identify* needs and opportunities.

1.4 Key Issues Identified for Further Investigation

Responding to the two key questions identified in previous paragraphs (that is: "What kind of things the current design curricula are still missing?" and "What areas of the current design practice and education are necessary to be improved and enhanced?"), it can be noticed that problem finding is one of the significant areas in

[29] Since the mid 1990s, the author has been invited to contribute in the revision and drafting curricula for the new design and technology subjects. He is also involved in the revision of the degree and master degree design programmes. Frequently, he has raised the need of the problem-finding elements in the curricula. The committee members in these review boards and curriculum planning committees also agree with this proposal. Thus, "identifying needs and opportunities" is clearly listed in different curriculum documents, for example, examination syllabi of Design and Technology (see Hong Kong Examinations and Assessment Authority, 2006).

design practice and education that deserves attention.

The detailed issues for further investigation include:

1. Why do policymakers, curriculum planners and teachers in Hong Kong still pay relatively less attention to problem finding?

2. What are the possible advantages to putting problem finding in the curricula?

3. What limitations and difficulties will be faced when problem-finding elements are added to the curriculum?

4. What are possible ways to enhance design students' learning to find problems?

1.5 Aims and Objectives of the Study

Taking Hong Kong as a case study, this thesis explores the importance of problem finding in design processes, and identifies how our current design curricula should be improved to nurture all-round design students by enhancing their problem-finding knowledge and experience. Through these explorations and identifications, this thesis aims to offer knowledge to curriculum planners and developers, examination officers, programme and subject coordinators, teachers, and other educators and researchers which will improve the design curricula and examination syllabi and practices, and establish a foundation for further investigation on the topic.

In particular, through the investigation on the perspectives in (i) curriculum planning and development, (ii) assessment and examination, and (iii) schools at secondary and degree levels, the study identifies the advantages, limitations, difficulties and possibilities of enhancing problem-finding knowledge and experience for design students.

This study investigates the importance of problem finding with particular reference to the following objectives:

1. Reviewing the development of design curricula and identifying the deficiencies in the current design curricula at the secondary and tertiary levels, in particular in the aspects and elements related to design process (which is generally accepted as the core activity in design study and practice).

2. Exploring and identifying the significance of problem-finding knowledge, skills and experience in design practice.

3. Reviewing and discussing the different *definitions*, *situations* and *levels* of "problems".

4. Reviewing the different natures, formats and models of design processes, and identifying the importance of problem finding in design processes.

5. Reviewing and identifying the different definitions of "problem finding", and identifying the natures and relationships between problem finding and enquiry, and also their relationships with other elements in design processes.

6. Exploring the advantages, limitations, difficulties and possibilities in incorporating problem-finding elements in design curricula through different research methods such as in-depth interviews, questionnaires, and empirical studies at secondary and degree levels.

7. Generating information and insight for curriculum planners and developers, examination officers, programme and subject coordinators, teachers, and other educators and researchers that will enhance problem-finding knowledge and experience of students.

1.6 Scope of the Study

As advised by Poulson and Wallace (2004b), both value and practical factors should be balanced in defining the scope of research and conducting a study. Considering the value of the study: by reviewing the importance and significance of problem finding for designers and design students, the significance of the value of the study can be established. Considering the practical factors (for example, limitations, constraints, difficulties, existing educational structure, local development/history of design curricula, personal capability and possibility in the study) of a research student's thesis, this study confined its scope to a feasible scale and depth in research.

In the review presented in Chapter 1, the study focused on the secondary and tertiary levels of design curricula in Hong Kong, although other levels of curricula were also considered as reference where necessary.[30] Another reason for the scope of this definition is that the regular and formal curricula of significant design elements at these two levels of study are relatively more maturely developed and formally recognised by the Hong Kong government, including the Hong Kong Curriculum Development Council (HKCDC), the Hong Kong Examinations and Assessment Authority (HKEAA) and the Hong Kong University Grants Committee (HKUGC). The design-related subjects are also better defined at these two levels. Students taking the design subjects at these two levels are also more. For example, Design and Technology is recognised as a recommended subject for all secondary students. Design (with different programme titles) is a UGC funded discipline in Hong Kong and considered as a key type of programmes in some universities.[31]

In addition, the educational sectors (that is, schools in secondary level and universities in tertiary level) were easy to approach for collecting data. The author of this thesis has worked in these two levels of design education for more than twenty years. His knowledge, experience and connections with persons related to the research topic were advantageous to the study.

Moreover, as indicated in Chapter 1, referring to the current research deficiency in design practice and education in Hong Kong, in-depth research on the topic is important and necessary. Thus, the study did not aim at a large scale and wide study of curricula on the topic. Instead, it offers an in-depth study designed to generate insights that will be useful in further investigations and discussions. Therefore, two

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[30] The tertiary level was confined to be the degree/undergraduate level.

[31] For example, design programmes offered in The Hong Kong Polytechnic University and the City University of Hong Kong. For the details, see the review of the design curricula in Chapter 1.

secondary schools and a university were selected as case studies for in-depth research.[32]

The results from the case studies at the secondary and tertiary levels were considered as a whole in the analysis phase. However, this thesis does not provide a direct comparative study between two levels of design curricula. Instead, it presents some issues related to the problem-finding matters in design that are related, associated and corresponding at these two levels. Through this scope of coverage in investigation and analysis, this thesis presents a more comprehensive picture of the topic; and hopes to arouse more particular, further and/or more comprehensive and inter-level related research on the topic.

[32] Regarding the detailed methodology, see Chapter 2.

Chapter 2 Methodology

2.1 Research Structure and Framework

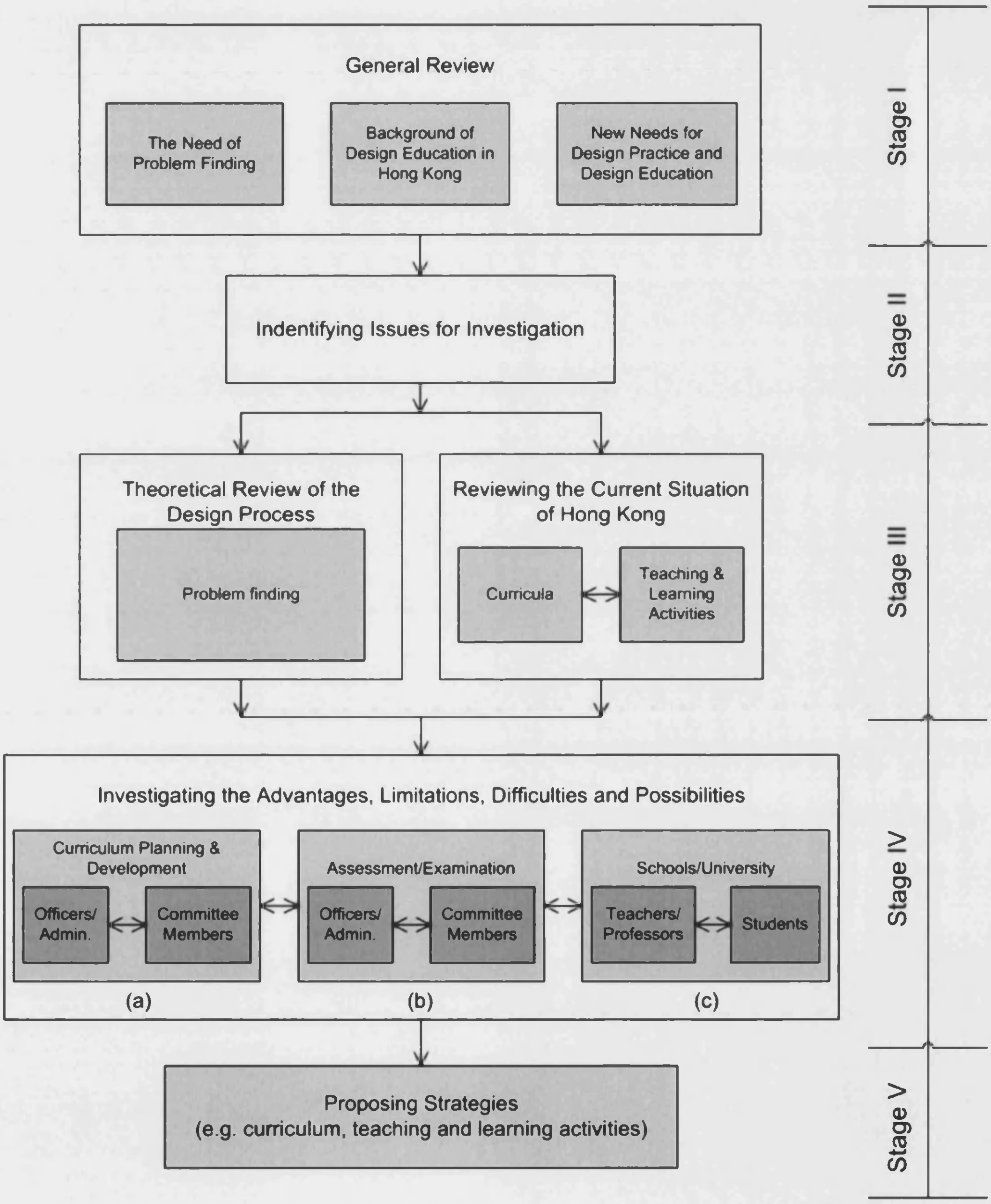

Figure 2.1. Research Framework

The entire study was divided into five major stages. These stages were not independently separated but were linked together. Each stage of research work was particularly planned to generate information relevant to the following stage(s) of research work.

2.2 Five Stages of the Study

Stage I

Stage I (also the logical beginning of the entire study) was a general review of three major areas:[33]

- The need for problem finding;
- The background of design education in Hong Kong;
- New needs for design practice and design education.

All these three reviews were expected to provide a good foundation (as well as reasons and justifications) and a clear direction for both the study and also the preparation of the thesis. This stage also served as a guide for the whole study, so that it would not be diverted and distracted far away from its original identified needs. It is also the reason for putting this review in Chapter 1; that is, before the chapter on research methodology. In sum, these reviews defined (or at least gave

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[33] For the details of the review, please refer to Chapter 1.

helped to define) the structure and framework of the research and the conclusions at the end of this thesis.

Regarding the review on the need for problem finding, the study attempted to identify the importance and significance of problem finding briefly by reviewing previous important and significant literature (that is, views and experience). In fact, the ideas and comments of some well-known and experienced researchers and scholars about thinking and problem solving in different disciplines were also important. This review offers their comments on the importance of problem finding (or related topics) according to their experience with different generations of students.

As the focus of the study was confined to Hong Kong, the background of design education and its development in Hong Kong was very important. This background provided information on both historical change and transformation of design education systems and also design curricula.

As explained in Chapter 1, the scope of this study was confined to the secondary and tertiary levels. Thus, the emphasis of the review on design education and development of curricula was on these two levels. However, as emphasised before, the defined scope of study did not affect the discussion of other levels in the review and later chapters. On the contrary, some of the curricula, subjects and/or activities that have design elements at other levels were referenced for a better discussion of the topic.

The review of the recent needs of design practice and education was important, since it provided a base and direction for the analysis and discussion related to current and future issues (Siu, 2000a). Although the focus of this study is more on education aspects and curricula, nonetheless education is for students' future career and development. Thus, besides considering the needs of design education and curriculum development, the review also took account of career matters (that is, design prospects for students in the future) as a discussion topic to see how significant problem finding is.

Stage II

After these three reviews, the issues for the investigation were identified. Chapter 1 states three key issues. This study aimed at more confined and precise issues so that the investigation and analysis and the recommendation proposed in the last chapter of this thesis (that is, conclusions) could be more focused and significant.[34]

The first issue focused on the reason for the lack or deficiency in design curricula of problem-finding knowledge, skills and experience.

The second and third issues focused on the limitations and difficulties in bringing problem-finding knowledge, skills and experience to students, and the possibility of facing or solving such limitations and difficulties.

By using these three issues, the detailed research methods could be identified and also justified.

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[34] See also the reason stated in Chapter 1 regarding the scope of the study.

Stage III

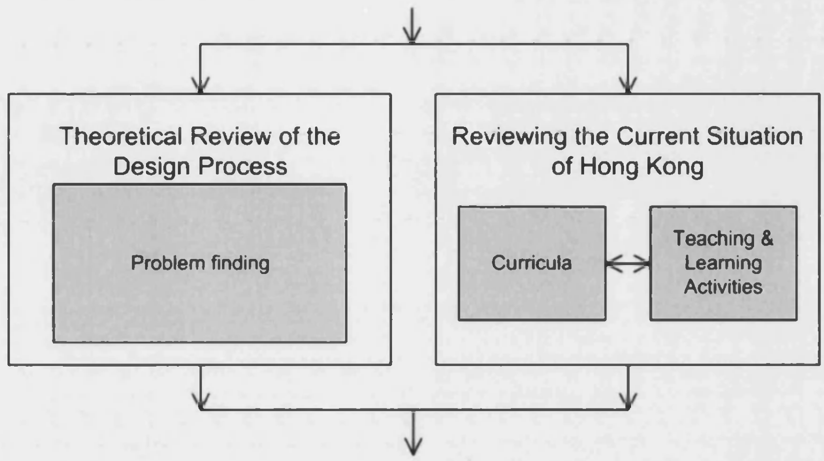

Figure 2.2. Stage III of the Research Framework: Reviews of the Design Process and Current Situation of Hong Kong

Whether or not problem finding is emphasised, in general, people seldom deny that it is a part of the design process (Department for Education & Employment, 1999; Department of Education and Science, 1995; Eggleston, 2001; Jay & Perkins, 1997; Hicks, 2004; Kimbell, 2005; Marshall, 1995; Rubinstein & Firstenberg, 1995; Runco, 1994, 2007; Siu, 1997, 2000b, 2001b, 2002d, 2003). Moreover, most people like to consider problem finding as the start of the design process.[35] Therefore, to see the relationship of problem finding to other parts, activities and/or stages of the design process, a review of the types of design processes generally learned and used in secondary schools and design schools in universities was conducted.

The review was not intended to describe and explain different types of design

[35] More discussion will be conducted in later chapters.

processes in detail. It was also not intended to comment on the pros and cons of different design processes. None of these were the goal of this study. Instead, the review aimed to see the significance of problem finding in general in the design process, in particular within those commonly taught and used in secondary and tertiary levels of design studies. During the discussion, the different but similar terms for problem finding (such as need identification) were considered and referenced in order to have a more in-depth understanding of the nature of problem finding.

After that, the current situation in Hong Kong regarding the curricula and teaching and learning activities were reviewed. Compared to the general review in Chapter 1 (that is, Stage I), this review was more in-depth and particular in nature. The activities included:

- Review of the recent documents;
- Interview with principals (secondary schools);
- Interview with D&T teachers (secondary school teachers);
- Interview with design teachers (professors and tutors from a selected university);
- Interview with curriculum development officers (that is, officers responsible for secondary level D&T);
- Interview with programme leader, coordinators of a design programme of a university;
- Observe the students general learning activities;
- Discuss with the students and review their work/assignments (including projects).[36]

[36] The author conducted these interviews and discussions in the context of information-collecting,

Within the review of documents in the secondary level design-related studies, the documents included curriculum syllabi, examination syllabi, examination papers and records of the secondary level of design subjects by the Hong Kong Curriculum Development Council and the Hong Kong Examinations and Assessment Authority.

Within the review of documents in the tertiary level design studies, the documents included programme- and assignment-related documents (such as project briefs and reports) of design programmes in the selected university.

All of the interviews were semi-structured; no detailed questions were fixed. This technique was selected because the characteristics of semi-structured interviews are that "questions are open-ended, assume a conversational manner … and follow a certain set of questions" (Yin, 1994, p. 85). In Berger's (1998) words, "[it] allows the respondents plenty of room to speculate, offer opinions, and so on" (p. 59; see also Wolcott, 2001).

This type of interviewing permitted the author to ask follow-up questions constructed in the process, depending on how the person interviewed gave a specific response to an initial question (Babbie, 2004; Cohen, Manion & Morrison, 2007; Wolcott, 2001; Yin 1994). Another advantage of the semi-structured form was that the order of the questions was not fixed, but might thus run according to the "natural

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setting on one side his experience as a teacher of design at secondary and tertiary levels. That experience, of course, was highly relevant to the overall purpose, analysis and conclusions of the thesis.

flow of ideas" of the interviewees (Denscombe, 2000; see also Flick, Kardorff & Steinke, 2004; Silverman, 1997, 2000). In sum, the nature of the interviews was important for this stage of study because it generated more in-depth points, from the experience of the interviewees (Cohen, Manion & Morrison, 2007).

The initial questions of the semi-structured interviews were set according to the issues related to problem finding. The topics of the initial questions included:

- Administration of the programmes and subjects;
- Syllabus and curriculum issues;
- Teaching and learning activities in the design subjects, such as key objectives, major activities in the subjects;
- Assignment and assessment issues (related to the reviewed and observed findings prompted by the author).

The observation at this stage was carried out during visits to the schools and the selected university (that is, the observations were arranged with two secondary schools and one design school in a university). Discussion in the form of casual talks with the students was carried out in order to understand the learning in the schools and the university. Although observation and discussion with the students was not structured in detail, it was important since it provided the author a basic understanding and overall picture of students' learning activities. The review of the students' work assignments did not look for data for quantitative analysis. Instead, the review searched for a better understanding of the nature of teaching and learning activities and subsequently to reference the results of interviews in this stage. That is, the collected data from the interviews and observations could form a kind of triangulation activity. In addition, the observation result could also be referenced to the review of the documents mentioned above for overall analysis later.

In sum, besides a general understanding, the focus of the research activities was on the possibility, nature and degree of problem-finding activities (including knowledge and practical experience) provided to or available for students.

Stage IV

The objective of the entire Stage IV was to an understanding of the advantages, limitations, difficulties and possibilities of incorporating problem-finding knowledge and experience in curricula. This understanding was founded on data collection from three perspectives (see Stage IV (a), (b) and (c)):

- Curriculum planning and development perspective:
  - Curriculum development officers (responsible for design and technology), and curriculum development committee members;
  - Programme planning, coordination and teaching staff of design programmes (including teachers and staff from other sectors such as universities and technical institutes);

- Assessment and examination perspective :[37]
  - Examination officers (responsible for design and technology), and examination committee members;

[37] In Hong Kong, in general, members of curriculum planning and assessments are formed by officers and invited external educators/teachers of the subjects.

- Programme planning, coordination and teaching staff of design programmes (including teachers and staff from other sectors such as universities and technical institutes);

- School perspective:
  - Principals;
  - Teachers/professors;[38]
  - Students.

(A) Stage IV (a) & (b) : Curriculum Planning, Development, and Assessment and Examination

Regarding the first two perspectives, interviews were the major data collection method. This was because the number of the approachable informants was small.[39] Hence, the interview was a more effective and convenient way to collect in-depth comments. Moreover, the informants — the interviewees — had different backgrounds and roles in their working and related sectors, and some of their roles and commitments in the committee(s) overlapped. Thus, other data collection such as questionnaires would have been complicated in design and administration, their data would have been more difficult to analyse, and the tools for in-depth investigation might not be easily established (Burgess & Bryman, 1999; Cohen, Manion & Morrison 2007; Silverman, 2000; Wolcott, 2001).

[38] For convenience, unless specified, the term "teacher" will be used in the following chapters to represent both teachers and/or professors.

[39] Design is still a small (non-major) subject in Hong Kong. The committees in curriculum planning and development and assessment are also very small. In this study, the number of approachable informants was also limited.

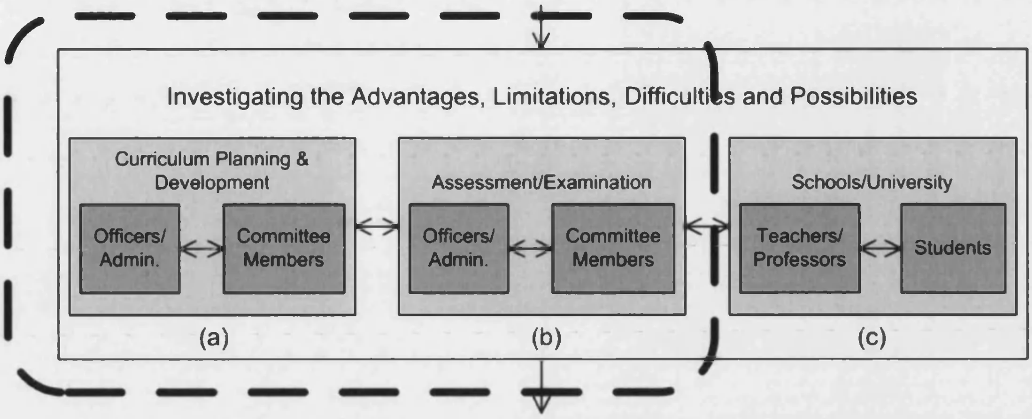

Figure 2.3. Stage IV (a) & (b) of the Research Framework: Curriculum Planning, Development, and Assessment and Examination

In the same way as the interviews described in previous section (Stage III), the interviews in this stage were semi-structured and no detailed questions were fixed. Initial questions set up open-ended responses. As stated by Babbie (2004), when the available or approachable informants are very limited,[40] the interview is a better tool than the questionnaire to collect data (see also Burgess & Bryman, 1999; Flick, Kardorff & Steinke, 2004; Punch, 1998; Wolcott, 2001). Therefore, it was better to have the interviews, which could collect data for in-depth understanding on the topic.

The initial topics for interviews and discussions included (a) advantages, (b) limitations, (c) difficulties and (d) possibilities of incorporating problem-finding knowledge and experience in curricula from the following views:

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[40] Including some persons having overlapping duties and committed services in two sectors.

- Curriculum planning and development;
- Assessment/examination.

While interviews were the main tool in this stage of study, the best way to present the collected data was by quoting some of the interviewees' opinions. Therefore, in the discussion in the following chapters, the collected data is presented directly. Along with the analysed results, this data is referenced to other data collected in other stages (for example, Stage IV (c)) for further discussion.

<u>(B) Stage IV (c): Schools/University</u>

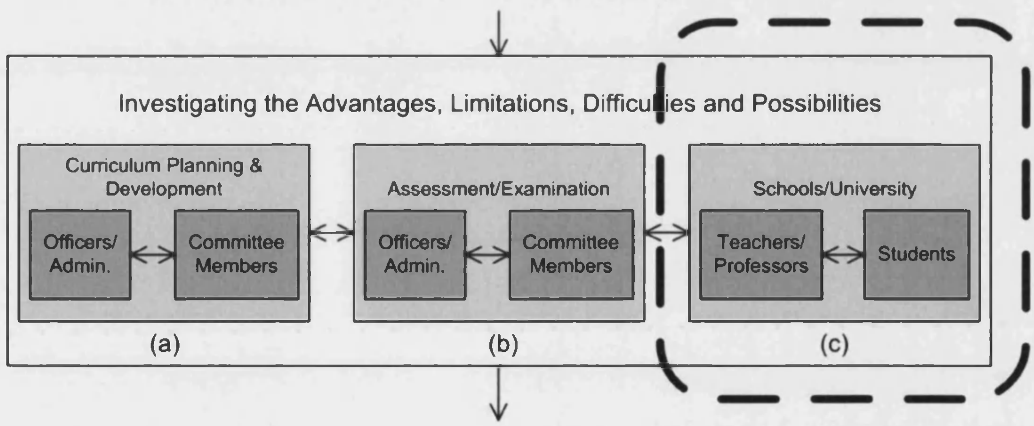

Figure 2.4. Stage IV (c) of the Research Framework: Schools/University

The major objectives of Stage IV (c) were to explore the advantages, limitations, difficulties and possibilities of incorporating problem-finding knowledge and experience in the curricula in Hong Kong. However, distinct from the first interviewees in Stage IV (a) and (b), the informants from the secondary schools and the university (that is, the third perspective) were more flexible and easier to approach. They were also the *core* informants for this study.

In Stage II, teachers were interviewed for information in Stage IV (c). A relatively larger number of teachers were approached and questioned for overall comments and opinions on the topic. It was better to carry out a more in-depth and focused study in Stage IV (c). In other words, at this stage instead of only interviews, a more structured case study was conducted in two secondary schools (School A and School B, (names remain confidential)),[41,42] and a design school of a university.[43]

Problem-finding elements were incorporated in D&T of the secondary schools. As the review in Chapter 1 reveals D&T is the recognised design subject at secondary level. It is also the most popular design subject studied by Hong Kong students.

Problem-finding elements were incorporated in two design subjects in degree Year 1

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[41] One of the secondary schools that participated in the study did not mind that their school name might in the thesis (for academic purpose only), but the school requested that the teachers' and students' names (or any identifying material) should not appear in the thesis. The other school principal and the subject teachers expected that the name of the school would not appear in the thesis. Similarly, no photos were allowed. Therefore, the schools are identified solely as School A and School B in the following chapters.

[42] In fact, in recent years it has not been easy to approach a secondary school in Hong Kong to carry out a study. One of the reasons is that the schools want to protect the privacy of students and teachers. The schools also face a high pressure from the parents to "protect" their children (sometimes without objective reasons). Moreover, lesson time for design subjects is always cut by the schools due to the intensive curricula and high expectation on other "academic" subjects, such as English and Mathematics. Therefore, many schoolteachers are not willing to participate in external research projects. They prefer to play safe and protect themselves from criticism. This issue will be considered further in the following chapters, as necessary.

[43] School of Design, The Hong Kong Polytechnic University. The professors (that is, the project supervisors) participated in the study expected not to have their names mentioned in this thesis.

and Year 2 of the design school.[44] The design subjects were compulsory design subjects of the same design programme.[45]

The major objective of the case study was *not* to compare the collected results between secondary and degree levels. Instead, the case study's key purpose was to see how problem-finding elements could be incorporated in the curricula of the schools with different levels, natures, settings, teaching and learning activities, educational goals, teachers' and students' backgrounds and experiences, etc. In other words, through an in-depth case study of design studies at these two levels of schools, the thesis expected to generate information to help explore whether there were some related, associated or even contradictory matters in incorporating problem-finding elements in the curricula of these two levels.

In detail, the research activities of the case study were:

- The students' backgrounds related to problem-finding knowledge and experience were reviewed. The students received questionnaires at the beginning of the study. The questions included nominal scale questions, ordinal scale questions and open-ended questions.[46] The nominal scale and ordinal questions were

[44] The details of the problem-finding elements incorporated in the subjects is discussed in the following paragraphs and chapters.

[45] The natures of these two subjects is explained in detail in the following paragraphs and chapters.

[46] An earlier version of the questionnaire for the whole study was generated at the beginning of the study (see Appendix II). However, after a trial run with some students, this version of the questionnaire was not used. Instead, it was divided into two new tools for this study: (i) questionnaires for two levels of students to understand their backgrounds (see Appendix III & IV); and (ii) initial questions for group discussion and in-depth interviews with the students (for a sample of initial questions and record of the interviews, see Appendix V).

mainly to collect some basic education background (related to the students' design study experience and problem-finding experience); while the open-ended questions were to collect students' comments and expressions when and after they participated in the case study.

- The teachers' teaching backgrounds and experience were reviewed. Since there were only two teachers involved in the secondary level of teaching and two teachers involved in the degree level teaching (in total, four teachers), semi-structured interview was selected as the tool to collect data.

Regarding the case study in the two secondary schools (School A and School B), after discussing with the teachers, the following arrangements were made for the case study:

- A class of secondary level junior form D&T students from School A and a class of secondary level senior form D&T students from School B were invited to participate in the case study. The junior form was Secondary 2 (S.2) and the senior form was Secondary 4 (S.4).

- There were three major reasons for selecting the students from two separate schools. The first reason was that it was very difficult to request schools to allow the author to conduct research in schools. School senior management nowadays is afraid of any negative comments, especially by parents and the reports of mass media, as well as any problems made by external parties. Thus, most of the schools prefer not to allow research studies that could affect their students' studies. After more than two years of searching, long discussions and sharing, the school principals of School A and School B allowed the author to conduct such a study in their schools, but under the condition that only one class of students could be approached for the study. The second reason was that it was better to see the results collected from two schools (so that for example, more teachers directly involved in the study could be approached). The last reason is that School A did not offer senior form D&T studies.

- One of the reasons for the selection of students was that these two levels of secondary students had different design knowledge and experience, including design project experience. Moreover, the study would not affect the schools' general management and the normal learning of the students, as required by the principals of the schools.[47] This was because the S.2 students had one year of study in School A. There was no school transition problems or issues for the students, and also none that could affect the school and classroom management.

- The S.5, S.6 and S.7 students needed to face public examinations (not only in the design subject, D&T, but also in their other subjects). For D&T, these levels of students had already received projects assigned by the HKEAA. As advised and requested by the school principals and teachers, the forms for this study conducted were not so convenient for the schools. The most critical point was that the study might affect the examination performance of the students (in particular, the project examination time was very tight). Moreover, the numbers of students in the S.6 and S.7 were very small in most of schools in Hong Kong. School B, had only four students in S.6 and three students in S.7 studying D&T.

[47] It was the strict requirement of the principals of the secondary schools. Under such requirement, the study was still satisfactorily arranged for the study objectives.

Therefore, students in the S.4 were the most appropriate senior form to be involved in the study.

- Additionally, the curricula S.2 and S.4 were more flexible, allowing the teachers to make changes. The students did not face the pressure of public examinations.[48]

- Furthermore, there were several S.4 girls studying D&T in School B. It was a good chance to see the responses from girls as compared to the responses of boys, though gender issues were not the key objective of this study.[49,50]

- All of the S.2 students involved in the study were boys (N_{S2} = 18 boys). Among S.4 students, there was a total of 12 students (N_{S4} = 12 boys). There were 3 girls in this group of students (therefore, N_{S4B} = 9 boys; N_{S4G} = 3 girls).[51]

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[48] Nevertheless, the influence of the public examination will be discussed in the later chapters. It is also a factor affecting the attitude, performance and perception of students regarding problem-finding knowledge and experience.

[49] As reviewed in Chapter 1, due to the school management convenience and still some biased thinking, D&T is still a subject mainly for boys. Girls are always assigned to study other cultural subjects, like Home Economics. It is not easy to find D&T female students to be studied in Hong Kong. And, in general, there are about 40 students in a class in Hong Kong's secondary schools. In junior forms, schools like have a 50-50 balance of boys and girls in a class. For some practical or special subjects, like D&T and Home Economics, fewer than 20 students are allowed in a classroom (that is, workshop) supervised or taught by a teacher. Thus, the schools like to divide a class of 40 students into two 20-student classes. Separating boys and girls into two classes is a common practice.

[50] The author of this thesis has raised this issue with the CDC and HKEAA for many years. However, the feedback on the gender issues related to D&T study has still not seriously reviewed and considered by the government and also the public (Siu, 2002b). The gender issue was not the major objective and scope of this study, though it is referred to in the later chapters as necessary.

[51] When girls have relatively smaller chance of taking D&T in junior forms, they are also unable to further their study of D&T in senior forms.

- The teachers recommended the classes in each level. There was no particular reason to select the classes that participated in the case study. The major and nearly only reason for selection was for the convenience of the timetable management and the availability of the teachers of the classes. As pointed out by the teachers in the two schools, their selections of the classes were quite random and they did not intend to show or hide anything from the study. The qualifications and capability of the classes at the same levels were nearly the same.

Regarding the case study in the design school, after discussing with the teachers (university professors), the following arrangements were made for the study:

- Two classes of students studying design subjects in a design programme were selected for this study. The nature of the programme was related to industrial and product design and engineering. Compared to other design programmes, this programme had a similar nature to the D&T at the secondary level, although the curricula, nature of activities and level of difficulties were different. Some students studying the programme had had good D&T experience before. This gave a good area and topic for the data analysis in the coming chapters of this thesis.

- The students were studying Year 1 and Year 2 of same programme, but they were studying in different modes. The Year 1 students were all full-time students; and the Year 2 students were all part-time students. Most of the students in the full-time programme had similar educational backgrounds. The students of the part-time programme had quite a large variation in educational and working backgrounds.

- There were 14 boys ($N_{D1B} = 14$) and 14 girls ($N_{D1G} = 10$) in the Year 1 class, while there were 12 boys ($N_{D2B} = 12$) and 6 girls ($N_{D2G} = 6$) in the Year 2 class.

- The selection of the degree students from different levels and different modes of study — full-time and part-time — allowed the author to make comparisons according to the level, study mode and gender of the students, though this was not the key objective of this study. Nevertheless, the arrangement was expected to maintain a more comprehensive investigation as well as analysis for this study.

In the case study, both classes and levels of secondary students and both classes and levels of degree students were required to take a design assignment — a project. The overall project requirements at these four different levels of study were nearly the same. The subjects were project based. Teachers gave design knowledge and technology knowledge and support according to the different levels of the students.

Regarding the project for each class and level, the students were required to find a problem — problem finding — by themselves. This is different from many existing project assignments in which the teachers provide project briefs and titles to the students. The students involved in the study had freedom to identify the needs (and design opportunities and then to finish the project within a period of time.[52]

[52] More details are presented in the coming chapters about the current practice of project arrangements in Hong Kong.

After discussion with the teachers, (as opposed to the students being entirely free "to do what they want" in the projects) the teachers set some simple guidelines, boundaries and requirements for the benefit of the students, to help them in problem finding. Within the allotted time, each student was required to find a problem, identify an issue, need or some other matter that related to daily life in the Hong Kong environment. Each student was required to identify and design a project title and brief. As a design student, each of them needed to carry out research and then use what they learned to produce a final solution, and have a presentation at the end of the project. As the teachers agreed, such project guidelines were loose and flexible enough for the students so that the guidelines would not inconvenience and offer barriers to the students in problem finding as well as in their entire projects.

Due to the normal timetable requirements of the secondary schools and the university, the project durations of the secondary students in both School A and School B were 7 weeks; and the project durations of the degree students in Year 1 and Year 2 were 14 weeks.[53]

Besides investigating the students' backgrounds at the beginning of the projects,[54] several research components were carried out during the project duration:

- Interviews with all of the teachers at the middle of the project period.

[53] For the details of the project arrangement, see the following paragraphs and chapters.

[54] See the description at the beginning of this section.

- Interviews in the form of causal discussion with the students at the middle of the project period. Due to the time constraints, only some students were randomly selected for interview.

- Interviews with all of the teachers at the end of the project period.

- Group discussions with all of the students at the end of the project period.

- Individual interviews with some of the randomly selected students were conducted at the final stage.[55] The interviews included some individual interviews and small groups discussions or interviews (that is, two to four interviewees). The secondary students came from two different schools. Therefore, it was difficult to arrange for the students to sit together to have the small group discussions. Thus, the small group discussions were conducted individually in two secondary schools. Unlike the secondary schools, the two years of degree students participated in the small group discussions together. One of the major reasons was that the degree students were in the same programme. Some of their experience might be related. It was hoped that the opinions and experience in a level of students might stimulate those in another level. Compared to the group discussions with all of the students, the individual interviews and small group discussions were more in-depth, in order to elicit more specific and individual comments on the problem-finding experience. As

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[55] Some of the initial questions for the discussion and in-depth interviews and small group discussions were adopted from an early version of a questionnaire for this study. (see Appendix II). The questionnaire finally was not used. For the final version of questions and the record of interview (that is, a sample), see Appendix V.

stated by some researchers, such as Babbie (2004), Cohen, Manion and Morrison (2007), Silverman (2000) and Wolcott (2001), this kind of specific data collection does not only seek the author's particular or specific data, but also allows the respondents or informants to be more free to express their own views (Siu, 2002c). The data could also be formed and considered as a kind of triangulation to other collected data.

Stage V

Stage V was the final stage of the study. Based on the findings from Stage I to VI, the final part of this thesis responded to the key question of the study: whether and how problem-finding knowledge and experience affect design students.

Through the analysis of the collected data, this study identified several key aspects for in-depth discussion and proposed strategies to help students to enhance their problem-finding knowledge and experience, and in turn to nurture their problem-finding capability. The areas for the analysis and discussion include curriculum, and teaching and learning activities.

As stated before, this stage of work (and the purpose of the final part of this thesis) is not intended to generate a golden rule or model solution for the identified issues of this study. Instead, it is expected to generate some insights for the further investigation and discussion, in order to bring advantage to design practice and design education in Hong Kong, as well as some insight and experience for other places.

Chapter 3 Problem Finding and Design Processes

3.1 Definitions of Problem Finding

The researchers and thinkers reviewed in Chapter 1 refer to different situations and disciplines in which "problem finding" can be recognised as an important element in creativity, innovation, science and technology breakthrough, and related thinking activities (see also Robertson, 2004; Runco, 2007; Starko, 2000; Treffinger, Isaksen & Stead-Dorval, 2006). Regarding the relatively more modern term, design, many people define problem finding as a kind of problem solving or a part of problem solving in design activity (Runco, 2003, 2007; Siu, 2001b, 2003), even though some people may not agree with this kind of thinking.

When the literature related to problem finding (or similar activities indicated by a variety of terms) was reviewed, the author discovered that the terms relating to problem finding vary, even though most of the time the meanings and objectives are quite similar. Simply speaking, "problem finding" means finding out or identifying a problem or a set of problems (Bunge, 1967; Chand & Runco, 1992; Runco, 1994, 2003; Starko, 2000).

Some people prefer to define problem finding as problem identification, while some may call it problem sensing, problem invention, problem creation, problem formulation, problem discovery, creative problem discovering, or problemising, etc. (Allender, 1969; Bunge, 1967; Dillon, 1982; Getzels, 1987; Runco, 1994, 2003; Siu, 2000; Wilson, 2000). In different generations, in different contexts and according to different objectives and professional practices, people classify problem finding by other names; and they link problem finding to and associate it with other similar terms, such as "need identification" in the design process (Curriculum Development Council, 2005; Eggleston, 2000; Rubinstein & Firstenberg, 1995; Runco, 2003; Siu, 2001b; Wilson, 2000). It is also a quite common practice in design education (for example in Hong Kong), in particular in the lower forms, for curriculum planners and teachers to classify problem finding as project brief or project title identification (Curriculum Development Council, 2005; Siu, 1997b; 2001b).

Nevertheless, problem finding can be understood in various ways. It entails sensitivity to needs or an awareness of possibilities in a given situation (Runco, 2003, 2007; Siu 2001b; Wilson, 2000). It may demand focusing on and clarifying a problem or analyzing data to determine a broad issue underlying several seemingly disparate situations (Getzels, 1964, 1982, 1987). It may also include an evaluative component, selecting which problems are worthy of pursuit and further development (Friedman & Shore, 2000; Starko, 2000).

3.2 Situations of Problems

Before going further into the discussion of problem finding and this study's findings and analysis, it is worthwhile to briefly review the "situations" of problems. In his numerous studies of creative thinking, problem finding and creative achievement, Getzels (1964, 1982, 1987) identified two main types of problem situations in terms of the degree to which the problem, method and solution are already known (see also the similar definition by Runco, 2003):

- *Presented* problem situation;
- *Discovered* problem situation.

For example, in a different way from industry, which most of the time it is required to discover new problems to gain profits, many school problems can be considered *presented* problems. This is because, in general, teachers already know the methods and solutions of the problems presented to the students. On the other hand, creative activity in art and science exemplify the *discovered* problem. That is, the central question becomes "How is a new problem discovered?" rather than the more usual question "How is an existing problem solved?"

3.3 Levels of Problems

By considering different degrees of the existence and nature of related activities, Dillon (1982) distinguishes problems into three levels:

- Existent
- Emergent
- Potential

An *existent* problem is evident: a problematic situation exists (Dillon, 1982; see also Runco, 2003; Siu, 2000a, 2000b, 2001a, 2003). The key appropriate activity is to recognise the situation and solve it. This level of problem needs little or no problem finding. The problem is obvious and demands a solution (see also Wilson, 2000). For example, there is little need to engage in problem finding when faced with a provided mathematics question. Although there may be some redefinition of the problem, the general problem is obvious and evident.

An *emergent* problem is implicit. This means that this kind of problem must be discovered before it can be solved. The appropriate activity is to probe the data for a hidden, unclear or incipient problem or solution.

Moreover, emergent problems are important for people dealing with complex situations and data. For example, a technician must discover what the problem is when he or she examines an out-of-order machine before setting out to solve it. Also, as Treffinger (1995) states, in dealing with an emergent problem, a problem finder is necessary to explore, search and examine all of the data in a given "mess", to identify problems to address. Emergent problems differ from existent problems in that problem finding is necessary before the problem solving can take place (see also Runco, 2003, 2007; Siu, 2001b; Starko, 2000).

A *potential* problem does not yet exist as a problem. Its elements exist and may strike the problem discoverer (instead of being called the problem finder) as an unformed problem, interesting situation, or idea worth elaborating upon. As stated by Starko (2000), perhaps potential problems are most clearly seen in the invention process. In short, by examining the elements, the problem discoverer can create (or invent) a problem where no problem previously existed. As with an emergent problem, problem finding is necessary for potential problems (Friedman & Shore, 2000; Runco, 1994; Siu, 2003; Starko, 2000).

3.4 Problem Finding in Design Processes [56]

There are many types, structures and settings and even names for design processes identified according to different needs, purposes, situations or environments, etc. (Aspelund, 2006; Curriculum Development Council, 1983, 2000; Department of Education and Science, 1990; Peto, 1999; Runco, 2003, 2007; Treffinger, Isaksen & Stead-Dorval, 2006; Wilson 2000). Simply speaking and using the early and direct definition of Bullock (1986), design must be seen as a process (see also Aspelund, 2006; Siu, 2000b, 2000c; Wilson, 2000).

Most of the time, the design process is similar to or nearly equivalent to problem solving, or to the problem-solving process (Runco, 2003). For example, as the review in Chapter 1 stated, at the earliest stage of D&T implemented in the UK and later in Hong Kong, "design" is considered as a kind of "problem-solving" activity. Thus, a popularly accepted D&T textbook in the 1970s (imported from the UK to Hong Kong) introduced design as a kind of problem-solving process. The book gave an interesting description, suggesting that design — problem solving — is similar to eating a banana; that is, a person who has not seen and does not know what a banana is, needs to find way(s) to eat one. The whole discovery process — in this case the eating process — is considered as a fundamental design process. Thus, students studying D&T at that period of time liked to make a joke if they were asked: "What is design?" or "What is the meaning of design?" They would like to say: "Design is

[56] As identified in previous chapters, the objectives of this study were not to go into depth about the definition of "design process". The discussion in this section is just to identify the role and position of problem finding in design process in general.

eating a banana!" In fact, still today, many teachers who received D&T education in the 1970s still like to use this "eating banana" example to tell their students about the basic concept of design process.

Design is full of discovery and problem-solving elements, though the activities involved may be different in different contexts and needs (Eggleston, 2001; Runco, 2003). This situation also explains why "problem" is considered as a core matter or element in the design process, and also in design as a discipline (Runco, 2007; Siu, 2001b; Wilson, 2000).

Most of the time, problem finding is considered the first stage of, or is put at the front stage of the entire design process, whether or not it is one of the commonly accepted and implemented linear design process models used in schools and the design industry, the wall-fall model commonly used in engineering, information technology and software development projects, as well as some complicated hybrid models, or the action model popularly used in research and design practice in recent years. (Runco, 2003; see also Papamichael, 2003; Siu, 1994, 2001b). As discussed above, the reason for this recognition, perception and practice is simple and obvious; the design process most of the time is considered as a kind of problem-solving activity; that is, it is considered as a tool or a process in solving a problem. As the discussion in the first few paragraphs of Chapter 1 considered, without a found problem, there is no need to do problem solving. The first thing to do in the design process is to find a problem (Runco, 1994, 2003). The idea is reflected in a Cantonese saying: "No problem! No need to be worried and no need to solve anything!"

In recent years, more researchers place focus on problem finding and need identification in the design process. It is also the major topic in many design-related subject curricula (for example, Curriculum Development Council, 2005). Although there has been very little research related to this topic, "need" is more or less considered as the beginning of the design process (Curriculum Development Council, 2003, 2005; Department of Education and Science, 1995). As stated above, no matter whether people consider the importance or the need for problem finding, they would like to put "need" as an element at the beginning of a design process (Runco, 2003; Siu, 1994). Of course, there is still a need for people to distinguish between "problem" and "need" in the design process. Nevertheless, the abstract perception (and mixed understanding) of these two terms illustrate that they are important at the start of the thinking process or design process (Siu, 1994).

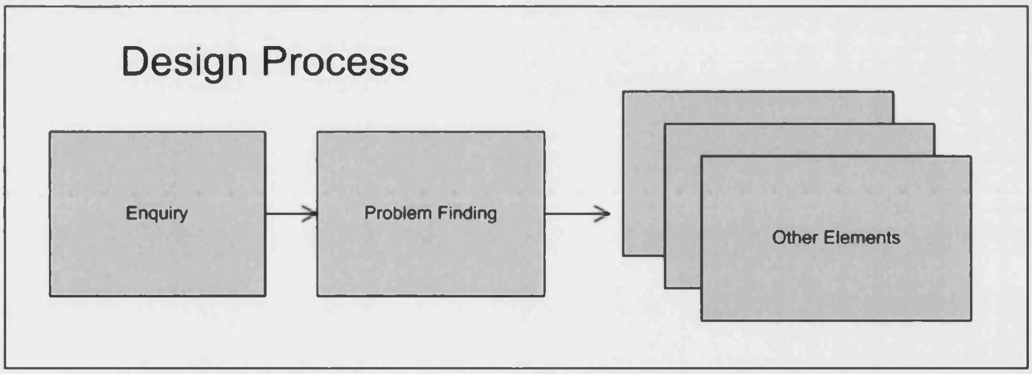

Figure 3.1. Relationship between Enquiry and Problem Finding: Enquiry before Problem Finding?

The question is whether "finding" implies enquiry (that is, research, investigation, exploration, survey, searching, query, questioning, doubt, etc), and then whether enquiry must be considered as an earlier stage than problem finding in a design process. If not, what is the relationship between (preliminary) enquiry and problem finding?

To respond to the questions above, Getzels (1964, 1982, 1987) pointed out that it totally depends on the two "situations of problems": *presented* problem situations; and *discovered* problem situations. As the discussion above illustrates, different situations of problems dictate different natures of activities involved in "problem finding". Instead of separating "enquiry" from "problem finding" itself, Getzels preferred to put enquiry as a part of problem finding. He considered the nature and characteristics of problem finding itself *first,* rather than its relationship to other elements in the whole thinking process (Getzels, 1987; see also Siu, 2001b). In other words, the role, nature and characteristics of enquiry and its relationship to other elements or stages in the whole thinking process depend on whether a problem is *presented* or *discovered.*

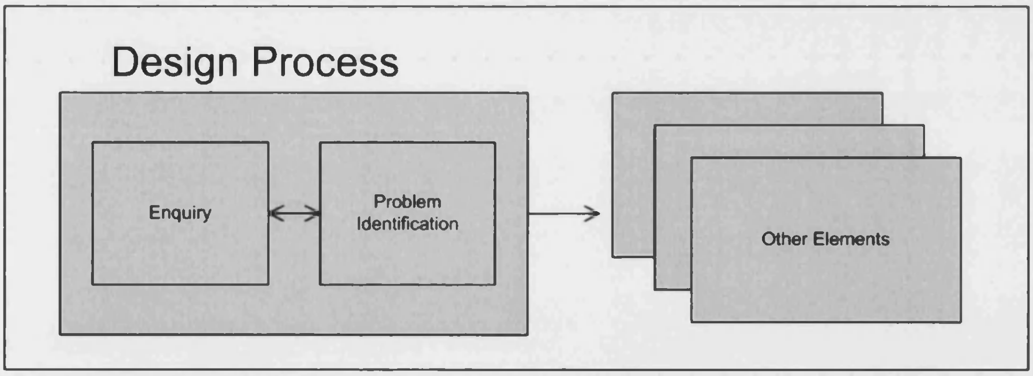

Figure 3.2. Relationship between Enquiry and Problem Identification

Similar to the thinking of Getzels, Dillon (1982) puts emphasis on the levels of problems: that is, *existent*, *emergent*, and *potential* problems. As discussed above, an existent problem is evident: a problematic situation exists. An emergent problem is implicit. This means that this kind of problem must be discovered before it can be solved. A potential problem does not yet exist as a problem.

Therefore, the role, nature and characteristics of enquiry also rely on the "problem" itself. Although Dillon did not have any direct communication or academic exchange with Getzels, and Dillon's publications did not mention the relationship between enquiry and problem finding, his publications about problem and levels of problems explicitly indicated that enquiry (that is, different natures of enquiry) is an important element in problem finding.

In fact, the views of Getzels and Dillon give a good foundation to respond to some of the recent enquiries about the different common names related to problem finding, such as problem identification, need identification, and even project title identification. If we adopt (as this thesis does) Getzels and Dillon's perspective, or at least use it as a reference, problem finding should be considered in a wider scope. Problem finding consists of two major elements: enquiry and problem identification (see also Runco, 1994). As stated above, it is not necessary to compulsively fix the sequence of these two elements permanently (Siu, 1997c, 2001b).

Nevertheless, as stated by one of the authors of a comprehensive study on project title identification in Hong Kong in the early 1990s, it appears that an inflexibility in defining the relationship between enquiry and problem identification may limit the potential of problem finding and also limit the chance for investigation and further exploration and discussion (Siu, 1994). Therefore, this thesis prefers to take a more flexible role and not go straight into discussion and definition on this issue. This thesis considers enquiry is an important element incorporated in problem finding. There is no limit or restriction to observing the sequence of enquiry and problem identification. In fact, it may be better to consider them as kind of *action* process.

While the internal elements (that is, enquiry, problem identification and some other sub-elements) of problem finding can be considered as a kind of continuous action process, another question could be raised: "What is the relationship between or among problem finding and other stages or elements in a design process?"

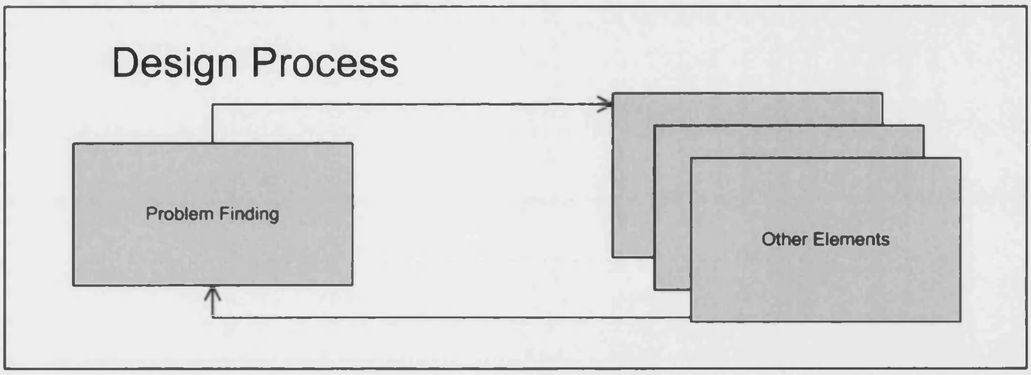

Figure 3.3. Action Perspective of Problem Finding in a Design Process

In fact, in recent years, it is widely accepted that the stages of a design process should be more considered as an action cycle (Runco, 2003). This means that, even a linear model of design process is adopted; the stages in a design process also form as loops or cycles. The major advantage of this action approach is that it can push the proposed solution to a better and better quality (Hicks, 2004; Siu, 2005). This situation is particularly significant since the variables considered in any design problem always change; as is captured in a Chinese saying in Hong Kong design practice: "There is no perfect solution, but there is always a better solution"(Siu, 2005).

For example, in a design process, idea development and evaluation are always considered in an action relationship, and there is no perfect idea for a problem. The termination of a design process is only according to defined requirements and timelines. In the same way, problem finding can be considered as "continuous communication" and "interaction" among other stages or elements in a design process. In fact, lacking this understanding and recognition of the role and importance of problem finding is the major reason that many people put problem finding as a minor or "may or may not be needed" stage in a design process (Siu, 1994, 2000a). Many people would also consider problem finding as a very short period at the beginning of a project, and consequently not would not emphasise it.[57]

[57] More discussion on this issue will be presented in the coming paragraphs and chapters, in particular related to the discussion of the case study in the secondary schools and the design school.

Chapter 4 Current Situation of Hong Kong: Curricula, Teaching and Learning Activities

4.1 Problem Finding Elements in Secondary Level Curricula

Design and Technology Curricula in Hong Kong

As stated in previous chapters, Design and Technology (D&T), along with some conventional technical and design related subjects, is the core design subject formally recognised by the CDC and HKEAA and offered to secondary students in Hong Kong. It is also the subject that has the most comprehensive official and research documents available for reference and study. As stated in the review of design education in Hong Kong presented in Chapter 1, nearly all of the conventional design-related and technical subjects in the secondary level have been faded out over the past fifteen years.[58] Therefore, as identified in the methodology of this study in Chapter 2, D&T is considered the core subject at the secondary level for review and discussion in the coming paragraphs and chapters.[59]

Lacking Problem Finding Elements

The D&T curriculum documents and the examination syllabi of Hong Kong were

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[58] Although the CDC plans to implement more design-related subjects at the secondary level, there have been no significant subjects successfully implemented in a long-term way for the past 10 years. For the details, see the review in Chapter 1.

[59] The curriculum documents and syllabi of other subjects will be referenced to where necessary.

reviewed (Curriculum Development Committee, 1983, 1991, 1998, 2000, 2003, 2005; Hong Kong Examinations and Assessment Authority, 2002a, 2002b, 2002c, 2005, 2006; see also Siu, 1994, 2002b). According to both these documents and publications and other relevant literature, it is obvious that "problem finding" has not been considered as a *necessary* knowledge, skill, experience and capability for students. In the official curriculum and examination documents there is not one paragraph that mentions problem finding.

If one searches for all terms related to problem finding, "need identification" and "project title" are mentioned in some of the curriculum and examination documents. These terms mostly appear in the contents of the documents related to project requirements. For example, need identification is mentioned in several of HKEAA's syllabi in the context of project examinations. However, need identification is not identified or considered as an examination requirement, or an assessment criterion. Instead, the students taking the public examinations are only required to understand and have explored the project titles provided (Siu, 1994).[60]

On the other hand, although need identification is mentioned in the curriculum, the weight of the emphasis is very insignificant. In addition to design and technological skills, the elements of the design process and the contents of the curriculum are focused on investigation (after defining a project title), design idea development, solution proposal, implementation and final evaluation — but there is very little about need identification, and nothing about problem-finding elements (Siu, 1994, Siu, 2001b).

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[60] There is more discussion in later paragraphs related to the biased examination requirements.

In fact, this situation has existed for a very long time — starting from the mid 1970s when D&T was introduced to Hong Kong from the UK (Siu, 1994, 2001b). As stated in Chapter 1, the original syllabus of D&T in Hong Kong was modified from the UK's syllabus at that moment. However, while reviewing the recent UK's National Curriculum documents, it is not difficult to find out that the National Curriculum recommended "identifying needs" and "investigating contexts which are related to the design-brief" (Department for Education & Employment, 1999; Department of Education and Science, 1990, 1995; *The National Curriculum for 11 to 16 Year Olds*, 2007; Qualifications and Curriculum Authority, 2007). Even as early in the study of Level 4 (ages 8 to 10; same as the primary level of Hong Kong), the National Curriculum has also suggested that students identify needs and opportunities for design and technology activities, and "make judgements" about what is worth doing. The Department of Education and Science (DES) (1995) and Department for Education & Employment (DfEE) (1999) also clearly indicated that it is necessary for students to identify needs for design, to analyse information and to draw conclusions about the needs (Department for Children, Schools and Families, 2007). In addition, students are required to provide a detailed evaluation of the needs for design in the light of a range of considerations. In short, one of the original objectives of D&T was to help students to make judgements and identify or define an area for design and technology activities. However, the D&T curriculum in Hong Kong lacks both such objectives and concrete elements.

Because of little — nearly no — emphasis on problem finding and need identification in the curriculum, the text books and similar reference materials also put very little effort (as measured by number of pages or the volume of contents) on providing materials related to this design capability. In the review of several commonly used reference materials in Hong Kong in the 2000s, only one book mentioned "identifying needs and project title".

As agreed by the interviewed D&T teachers, this deficiency in problem finding and need identification in the curricula, syllabi and reference materials was one of the reasons for making these educators focus less attention and effort into providing problem-finding knowledge and experience to the students. As one of the interviewed teachers points out:

> "The existing D&T curriculum materials provide a *picture* [the teacher's emphasis] to us that need identification is not important in the curriculum. Then, I can say that no teacher would put effort on it."

In fact, the author was the curriculum development committee member for more than 10 years. For the planning of the new D&T curriculum and new design subjects (for example, for Alternative Syllabus (AltS) Level), the author raised the concern about the problem finding and need identification matters many times during the meetings. However, in the end there was no further action or improvement in incorporating problem-finding elements in the revised and new curricula — not even in the curriculum consultation documents.

Biased Examination Requirements

The school principals and D&T teachers interviewed for this thesis, instead of blaming the deficiency of the curriculum, saw the examination (the public examination) as the more significant factor, which de-motivated teachers from putting problem-finding elements in the D&T lessons. The biased setting, assessment requirement and weighting made the teachers reluctant to put effort into nurturing students in the process of problem finding.

Since 1979, a "project" has totally replaced the practical examination, which was three hours of practical testing in the traditional subjects such as woodwork and metalwork. A project carried out in school for one academic year becomes the major examination document in the HKCEE, and later in the AltS Levels examination in Hong Kong. The project examination has a very heavy weighting in these examinations.

In these project examinations, the HKEAA provides three to five project titles, called topics by the HKEAA, for students to select every year. Taking HKCEE level as an example, the project title list is sent to the schools in July so that students taking the examination can receive the set of titles before the summer holiday of the S.4 year. According to the HKEAA, students are encouraged to do their investigation of the project titles in the summer holiday. Students are not permitted to start their workshop realisation until September, and each of the students is required to finish all of the work and submit the final product with a design folio (that is, record and report) so that schools can submit them to the HKEAA in March. Therefore the summer holiday after students receive the project title list is the period for them to investigate the titles and then make a *decision* or *selection.*

However, this arrangement is different from many public examinations in design subjects in other countries, including the examinations of the London University

Examination Board in the UK. Most of these foreign examination boards provide considerable freedom for the students to "identify" their project titles, instead of "selecting" a title from a list. Even the non-Hong Kong students living in Hong Kong taking the UK's examinations (such as GCSE), are free to identify issues and define project titles by themselves. In sum, in the UK public examination syllabi, no topic or area is restricted. Teachers are required to supervise and guide students as they identify their own needs according to their learning background, abilities and interests. However, in the HKCEE syllabus, there is only a title list set by the HKEAA, and students are *compulsorily* required to select one title from it.

The HKEAA recommends teachers give suggestions and help to their students to do research and select a title of their own choice (see also the project lists of the HKEAA). The main difference between examination requirements in Hong Kong and in the UK is that Hong Kong students do not have the full freedom to identify needs and project titles by themselves (even at the S.5 level, when students have been taking D&T for about 4 years). In fact, the no-choice situation has disappeared from the UK examinations for a very long time. As stated by Nicholson (1989) early in 1980s, this kind of restriction and constraint in the syllabus of an examination or the assignment may limit the learning of students and cause imbalance in the students' learning outcomes.

As stated before, the HKEAA plans the project requirements ideally and the Authority expects the students to do some research in the summer holiday. However, according to the author's several studies on the students' rationale for the selection of project titles in the D&T public examination since 1992, the students' performance illustrates that such examination settings and requirements have failed to motivate them to take the project title identification seriously (Siu, 1994, 2002b). Instead, the arrangement and requirement *de-motivated* students from putting effort into research and thinking about their project titles. As the study conducted in 1992 and 1999 demonstrated, (results published in 1994 and 2002), students selected their project titles in the HKCEE public examinations because they perceived them to be (in order)

- Easier,
- Similar to a title done before,
- More likely to earn more from the title,
- Reflective of the students' own needs,
- Meaningful (only in the study in 1999),
- More interesting.

The first reason was chosen by a preponderance of students. For example, there were 78% and 71% of students taking the examination in 1992 and 1999 respectively because they perceived it "easier" to select their public examination project titles (see Siu, 1994, 2002b).

The examination committee members and examination question setters interviewed for this thesis agreed with these observations. However, they also indicated that, because of administrative convenience, up to the present moment, the HKEAA does not have any plan to change the examination settings and requirements. The author also worked as the external Chief Examiner of D&T design papers and committee member for several years, and the concern of the "need identification" and "project title identification" issues were raised several times. However, up to the present moment, the situation has not improved significantly.

As the interviewed D&T teachers and the curriculum development committee members indicated, and according to the observations of the students' performance in classrooms and workshops, [61] without any change in the examination requirements, the teachers as well as the students would not pay attention to or focus effort on the need and title identification — that is, problem finding. A curriculum development committee member added:

> "The Hong Kong education system up to now is examination driven. Without a good change in the examination requirements, there is nearly no hope of asking the teachers not to ask their students to 'play safe' in the examination."

Several students taking HKCEE projects in a secondary school also agreed that getting a high grade was their major goal and consideration in the project examination. When a set of project titles was provided to them, there was no need for them to spend any effort to find out a problem to solve. Instead, what they needed to do was just to see which title was the easiest for getting a pass or a higher grade.

The interviewed teachers recognised and agreed with the students' views. As one of the teachers stated:

[61] Two classes of students taking the HKCEE examinations were observed. Students were interviewed in a format of casual talks to see how they selected their project titles.

> "I know what you mean. As a teacher working in the D&T field for so many years, I also know the importance of need identification. It has been mentioned in some foreign countries' textbooks. However, students and teachers necessarily facing the public examination is another issue. We have pressure from the school, parents, and students also … the students and me aim at a better grade. In particular D&T this kind of so-called non-core subject and necessary to use so big workshop in the school, we need to have a good public examination result. If not, no student will take it as the higher form subject in next year, and the principal may give pressure to us [D&T teachers] to close the subject. Therefore, not only students, D&T teachers also have pressure to face the public examination."

Another D&T teacher expressed:

> "Unless it is a *requirement* [the teacher's emphasis] of the examination syllabus that the students must identify project titles by themselves in S.5 [public] examination, there will not have any change. If not, few teachers will teach this kind of knowledge and skills [that is, problem-finding knowledge and skills] to the students in their low form. … And, not so many students will be interested in it."

4.2 Problem Finding Elements in Degree Level Curricula

Design Curricula in Hong Kong

Most of the time, programmes in professional subjects such as engineering and medical science are required to acquire professional accreditation from professional bodies and organisations, which mandate the programmes needed to fulfil many specific subject content requirements. The international standards and requirements of these professional programmes also can affect or hinder the programme curricula from taking notice of local, cultural and social issues. In addition, professional training, industrial attachment and placement contents and elements are relatively more regulated than other, non-professional disciplines (Siu, 2001c).

Design has always claimed to be a professional discipline. However, due to its special nature and discipline requirements, most design curricula are more flexible than the programmes of other professional disciplines. In other words, in design programmes the programme leaders, subject coordinators and teachers have greater flexibility in defining their curricula (Siu, 2000a, 2001c, 2005).

Compared to other professional disciplines, design in Hong Kong is one with a high degree of flexibility in curriculum planning. Subject contents in general are flexibly planned and implemented by both the subject coordinators and teachers. Consequently, design curricula are more flexible and easily fitted to local, cultural and social contexts. Most of the time, subject teachers have a very high degree of autonomy in defining the detail of their subject syllabi.

The teachers of design subjects at degree level have more flexibility than design teachers at secondary level (that is, D&T). At the degree level, the teachers can make decisions on subject matter and classroom activities, although they all still need to fulfil the well-defined subject objectives (Siu, 2005; see also *University Prospectus*, 2000-2005). As pointed out by an interviewed programme coordinator in the design school of The Hong Kong Polytechnic University (PolyU):

> "Design lecturers are very free inside a classroom. Their teaching most of the time is based on some quite loosely defined subject syllabi. In particular in the 1980s and 1990s, there was no strict control on the programme curriculum details. We had a kind of saying at that moment: 'When the door of a classroom is closed, the teacher is the king inside the classroom.' ... But it may not be a bad thing. The interesting thing is that, at that moment, teachers were free and students were free without any strict control, but the quality of the students was very good — it seems better than the students today."[62]

Some Changes in Design Programmes [63]

In recent years, design subjects offered in design schools in Hong Kong have changed. Taking the design school of the PolyU as an example, the curricula of

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[62] A more detailed discussion on the performance of today's students compared to the students in the past will be presented in the later sections.

[63] As stated in the review in Chapter 1 and the methodology in Chapter 2, the design school in The Hong Kong Polytechnic University is the representative design school in Hong Kong. Thus, the discussion of the design curriculum matters most of the time is directly referred to the design school's curricula. If necessary, the curricula of other institutions are referenced.

different design programmes have had significant changes since the early 2000s.[64] Some of the changes are due to the new educational needs in the design discipline spurred by the high demand and pressure from industry, and some by education reform in the Hong Kong higher education system.

On the other hand, to encourage and facilitate inter-departmental collaboration and increase the flexibility in overall programme management of the university, some design subjects are offered to students other than those studying design programmes or without a design background. Some subjects are offered to engineering students as compulsory and/or elective subjects. That is, some design subjects are offered as "servicing subjects" to the engineering departments in their programmes.

Design schools also offer some programmes that are different from the conventional (original) design programmes. That is, some of the programmes are aimed at students with an engineering background, and some of the programmes are administrated and offered together with other departments, such as engineering and business departments.

All of these changes in educational needs, programme structures and administration generate a ripple effect in design curricula. The natures, settings and requirements of the curricula of these new programmes are different from the way they were before. One of the key changes in the design subjects is that the subject structures and

[64] The programme documents as well as the prospectuses of the design programmes of the School of Design, The Hong Kong Polytechnic University, were reviewed. Collection of these documents can be referred to the School's General Office, and the Pao Yue-kong Library of the university (see http://library.polyu.edu.hk/screens/opacmenu.html)

details of the syllabi are more structured with respect to subject content, learning outcomes and classroom and assessment activities, which are all defined better than before.

Problem Finding Elements in the Curricula (Original Design Programmes)

As stated by the interviewed teachers of the design subjects in the design programmes offered in design schools, design curricula in degree study are greatly different from the curricula in secondary schools. Most of the degree design students are familiar with problem finding. Starting from Year 1, students are required to identify problems, needs and project titles according to different subject and project requirements. There are five major types of project title identification setting:

(a) Teachers (that is, project supervisors) provide a fixed title so that the students have no choice (and no need) to select a project title. They are only required to tackle the project and finish it according to assigned tasks and requirements.

(b) Teachers provide a set of titles, and the students are required to select a title from the list and then to tackle the project. There are two major ways of selecting project titles:

(i) Students are free to select one of the titles from the list, and overlapping (repeat) selection is allowed.

(ii) Students are free to select one of the titles from the list, but overlapping selection is not allowed. This means that once a title is selected, students need to select titles from the remaining titles.

(c) Teachers provide a common or several common project briefs (that is, problem situations or problems) and the students are required to identify a need and project title by using the provided situation and problem and then finish the project.

(d) Teachers do not provide any detailed information, but only offer a statement of a particular social issue, one or some requirements, a particular environment; or they provide a context for the students. Each student is required to identify the problem, need and project title and then finish the project.

(e) Teachers do not provide any title or problem related materials or information to the students. Each student is free to make a choice on his or her project title. This situation most of the time appears in the final design project of a programme. Each student is required to find a problem by himself/herself and then finish the project.

As indicated by the interviewed teachers, in the recent years, Types (a) and (b) projects have become less common in degree level learning, since most of the design programmes are expected to provide more freedom to the students in the project exercise. It seems that Type (e) projects provide the greatest freedom to the students. However, as pointed out by the interviewed design students, this type of project has quite a lot of constraints. In general this type of project only appears as the students' final design project. Hence, Types (c) and (d) are the most common two types of projects that teachers to students with different requirements.

The degree design students in Hong Kong acquire considerable problem-finding experience. However, as pointed out by the interviewed design students (including Years 1, 2 and 3 students),[65] most of them still feel uncomfortable — and unconfident — in problem finding. Even the Year 3 — final year — students who already have some experience in problem finding in their final project (the interviews conducted just after the first semester) still pointed out that the process was difficult for most of them.[66]

Problem Finding Elements in the Curricula (New Design Programme and Subjects)

As mentioned above, design programmes and subjects have changed in both the curricula and the students' backgrounds. The nature and contents of some so-called design subjects offered by the engineering departments are quite different from the design subjects offered in the design school, particularly in those programmes particularly planned and/or offered to the engineering departments and their students. The interviewed programme leader, coordinators and teachers agreed that the contents and activities of these design subjects were significantly different from the subjects offered in the design programmes in the design school. And, in the light of

[65] Up to date, excepting some professional degrees, degree programmes in Hong Kong are 3-year programmes. All the design programmes in Hong Kong are 3-year programmes. Due to the education reform in tertiary education, the Hong Kong government plans to change most of the degree programmes to 4-year programmes starting in 2012.

[66] More discussion on this issue can be found in the discussion of the case study.

reviews of students' assignments and observations of their class activities, there were quite a few problem-finding learning activities — both knowledge and experience — provided to the students in these programmes.

Students in those engineering programmes with only a few design subjects as elective subjects in the curricula could not gain any problem-finding knowledge and experience in *other* engineering subjects. Thus, the design subjects became more important for the students, since these subjects might be their only chance of obtaining problem-finding knowledge and experience (Siu, 2000b, 2001c). However, as problem finding was not considered as a key learning element in these programmes, there was no special request from the programme leader to the design subject coordinators and teachers to put problem-finding elements in the syllabi of these design subjects. At the end, both the teachers of design subjects and their students might not realise this lack in the programme, and consequently students could not obtain problem-finding knowledge and experience.

Students in an engineering program who were taking design subjects indicated that their professors only provided them with a list of project titles from which to select, even in their final year. (See Type (b) (i) in the previous section. The students did not need to identify a problem, but only had to pick up a title from the list and then tackle the project. As the students also pointed out, the subjects and the projects aimed at bringing the hard-core subject contents to them, instead of providing them with project experience — in particular, problem-finding experience. In short, generalizing from these interviewed final year students, students cannot gain any problem-finding experience before they leave university.

Most of the time, teachers' perceptions of the importance of problem finding influence whether and how problem-finding elements are incorporated in the curricula. Regarding the lack of problem-finding elements in the curricula, the interviewed teachers pointed out that problem finding was not a key learning element in their programmes. They argued that providing an understanding and some experience in research on the assigned title(s) was good enough, particularly considering the intensive and tight programme schedule. Thus, in their view there was no need to provide such knowledge and experience to the students. And, of course, the assessment of the projects did not include any weighting for problem-finding performance.

According to observation and interviews with the students, the situation mentioned above affected how they see both their projects and the importance of problem finding in the curricula; that is, their perception of and value judgement on the importance of problem-finding knowledge and experience in their learning. As a student stated:

> "Since we are not familiar with problem finding, we do not know what kind of things we will lose in not knowing about problem finding, and how important it is to us. However, I am sure that if problem finding is not considered as a part of the project requirements and an assessment criterion, I will not spend time on it. I would prefer the supervisors to provide me the project title so that I can minimise and concentrate my work."

Neglect of Problem Finding

As the review above shows, design students studying in the design school gained problem-finding knowledge and experience in different projects. However, this does not imply that problem finding is seriously considered and organised in the design school curricula. According to the interviews with the design teachers and students, and from reviewing the assignment documents and students' work (that is, students' project portfolios), it was noticed that even in the subjects offered in the design programmes in the design school, problem finding was not considered an important element in the project or as a critical stage in the design process. There was also no overall plan to nurture students in problem-finding knowledge and skills.

Referring to some of the assessment documents of the projects in the design school (that is, projects in the industrial design discipline) from 2003 to 2006, the weighting of problem finding in many projects was very low; that is, from 0% to 10%. In fact, as another study conducted in 1992 shows, low weighting percentage in assessment was one of the major reasons for de-motivating students as well as teachers from paying attention to problem finding (Siu, 1994; 2002b).

To have a more in-depth understanding of the issues above, the project performance in the final projects of the industrial design students from 2004 to 2006 was observed and their work were reviewed.[67] The focus was to see how much time the students spent on problem finding (including inquiry, problem identification, title

[67] Only some of the students were observed and their problem finding time recorded. As this review was only to give a rough idea of the students' performance, the author did not include all of the design students in the study.

identification) in their projects. The duration for the final project was 19 weeks (that is, 5 weeks in the first semester and 14 weeks in the second semester). The results indicated that the different average lengths of problem-finding time (of the randomly selected five students in each year) in three years were: 6 weeks, 7 weeks and 7 weeks respectively. In fact, the actual time on problem finding was longer. This was because there is a 6 to 7 week semester break between the first and second semesters. Of course, it was very difficult to review whether or how long the students worked on their projects during the semester break, or whether other things occupied them.

Nevertheless, as discussed with several design teachers (project supervisors) and the student there were some reasons (and correlated variables) why the students took so long to identify their project titles and problems. Collectively, they identified four significant reasons:

(i) The students did not feel confident (lacking in sufficient knowledge and experience) in problem finding.[68]

(ii) The students liked to change their project titles, since it was their final projects, and they continually wanted to change so as to have a *better* project title.

(iii) The students were under pressure from the final projects.

(iv) The students did not feel the pressure of the deadline of the projects since

[68] The confidence and the perception of the students about their own capability in problem finding are discussed in detail in the later paragraphs about the case study.

problem finding was done at the beginning of the project period. (As pointed out by the interviewed teachers, the semester break might give the students uncertainty that they would have a lot of time to handle the projects during the semester break. Thus, the students might not concentrate on their work for the five weeks in the first semester.)

The students and teachers agreed that students' experience (that is, Reason (i)) was the most significant of the four reasons. The students also agreed that all four reasons were correlated. Some of them further pointed out that problem finding was not an easy task. Before having to do it in the final projects, they did not realise the difficulty; in particular when they were under heavy pressure to make a *critical* decision on their final projects (that is, Reason (iv)).

On the other hand, students studying in the engineering programmes showed unsatisfactory performance in problem finding in design subjects. Some of the interviewed students pointed out that they had no experience in problem finding from their first experience studying design subjects in secondary schools. They further pointed out that their teachers did not care about it. As one of the students said:

"Before you asked me, I had not thought about the problem-finding matters. In the past, I had only thought several times why the teachers did not allow me to select a project title freely when I got some conflict and argument with the classmates in selecting a project title from a provided project title list. ... The teachers have also not mentioned to us the importance of problem finding. ... The most important thing is that problem finding is not considered as a factor in project assessment. To be frank, I will not consider it seriously."

Agreeing with this student's comment, another student added:

"I still wonder about the importance of problem finding in our discipline. We are different from design students. Although we have quite a lot of subjects with the word 'design' in the subject titles and we join the design school to study some subjects, our focus of study is still engineering and mathematics. We will be engineers in the future. Our job nature will be different from what you say about the job nature of designers."

"... I think the main reason for us to study design subjects, and the programme contains design subjects is to nourish our creativity. In fact, the same as some of us in here, I have no idea about whether problem finding is a kind of creativity."

In summary, both the students in design and engineering programmes showed unsatisfactory performance in problem finding (whether they experienced design content in the programmes or with design subjects). Some of them did not show any interest in problem-finding knowledge and skills. In short, some design students and many engineering students studying design subjects neglect the importance of problem finding, or do not take it as a serious and important area in their learning.

Although both observation of the students' performance and feedback from the design teachers showed that the students in design programmes had an opportunity to have problem-finding activities, this did not mean that the students got sufficient knowledge and experience in problem finding. The teachers also did not show their positive view in problem finding, though they did not deny the importance of it (verbally) (note: most of them are professional designers and experienced design teachers). The design programmes already have some problem-finding elements in the curricula. However, the curriculum setting lacked a good plan and organised manner to nourish students to view problem finding in a positive way and improve their problem-finding capability.

On the other hand, although the students in the engineering programmes had a chance to study some design subjects, the review and observation findings showed that the students did not have any chance to experience problem-finding activities. Even in final year study, students were still assigned project titles by their teachers, and, due to the specific requirements and practical constraints of the programmes, most of the interviewed students did not indicate that they were eager to know more about problem finding. Like the results of a similar study conducted in 2001 by the author, this situation shows that students lack not only knowledge and experience but also awareness of the importance of problem finding (Siu, 2001).

These findings show that the above situations did not only appear in a particular school and university. The interviewed programme developers and subject coordinators of other institutions agreed that similar situations also existed (and might be much worse) in their institutions. Thus, it is a common situation (and norm) in Hong Kong (see also Siu, 2001a). What should we do?

Chapter 5 Problem Finding Knowledge and Experience: Curriculum Planning and Development, and Assessment and Examination Perspectives

5.1 Curriculum Planning and Development Perspective

As the review in previous chapters demonstrated, the secondary level and the university level design curricula are related to each other. For example, the knowledge and learning experience obtained by secondary students affect their learning in their university studies. The expectation and requirements of the enrolled students and the emphasis of the contents and requirements in the degree level curricula also significantly influence the secondary level curricula.

However, up to the present moment (2007), there is still neither formal coordination nor work to consider how design curricula at these two different levels can be linked together (Siu, 2001a, 2002b, 2002c). As pointed out by the interviewed D&T curriculum development committee members and university design programme staff, the most disappointing and discouraging thing is that there is still no concrete plan to have more coordination and collaboration between the two levels of design studies. The only activities to be seen are some university programme or marketing staff giving student enrolment and career talks, and some university or school guided tours for secondary students. The Info-Days for secondary students that appear on different university campuses every year give no constructive improvement or practical results in either the curriculum exchange or collaboration between the two levels of design studies.

In the following paragraphs, specific issues in the two levels of design curricula will be discussed separately. In addition, some issues related to the two levels will also be discussed in order to form an overall picture and perspective on design curricula in Hong Kong. As indicated in the methodology of this study (see Chapter 2), the advantages, limitations, difficulties and possibilities of incorporating problem finding in the curricula are the focus of the discussion.

As also explained in the methodology, in-depth semi-structured interviews were the main methods of collecting the data (in Stage VI (a)). In order to present the data in a more direct way that assists discussion and offers the data without distortion, and after consulting the advice of the study supervisor, the views of the interviewees are set out directly in the following paragraphs (see also Liu, 2005; Priest, 1996). Nearly all of the interviews were conducted in Cantonese (that is, the most common language spoken in Hong Kong), and the views were transcribed from tapes. When some of the interviewees asked that their conversations not be recorded on tape, as is the very common practice of government and related officers, the views presented were extracted from notes. In the following paragraphs, the original tone of the interviewees' views is maintained, and notes on emphasis are in square brackets to assist the readers' understanding.

Advantages

As the review conducted in previous chapters showed, problem finding is an important design concern with respect to design students' knowledge, skills and experience. It is not only important at the senior but also in the junior level of learning. For example, the UK's National Curriculum documents indicated that need identification (or design brief identification) is an important learning area for students in design and technology, because it affects student capability. (Department for Education & Employment, 1999; Department of Education and Science, 1989, 1990, 1995; *The National Curriculum for 11 to 16 Year Olds*, 2007). This learning area is not only for stages III and IV, but also at earlier stages (Department for Children, Schools and Families, 2007). Although the curricula recommend different kinds of activities that can increase students' ability to identify needs, and nurture students according to their level, the core spirit of the learning objectives is to prepare the students (even junior students) step by step to gain this capability (Department for Education & Employment, 1999).

In-depth interviews with two curriculum development officers revealed that they agreed "in principle" that it was good to allow the secondary students to have knowledge and experience in problem finding. As one of the officers said:

> "As you know, need identification is a core part of the design process.[69] Not only the National Curriculum and other foreign design and technology curricula indicate this point, Hong Kong's D&T curriculum actually also indicates that need identification is important in a design process or a problem-solving process ... I agree that the importance in

[69] Most of the time, the interviewees liked to use the term "need identification" instead of "problem finding". The major reason was that need identification was more commonly used in curriculum and examination documents. As the discussion in previous chapter points out, this thesis adopts a flexible definition of these terms in discussion. Thus, this thesis records and presents the collected data (such as the responses of the interviewees) directly in order to reflect the exact views of the informants and the contexts of communication.

learning need identification is not only applied to senior form students, but also junior form students, for example, Form 1 [Secondary 1] students."[70]

He added:

"If we consider that need identification is part of the design process, then missing it means students are unable to fulfil or to go through a *complete* [the officer's emphasis] design process or problem-solving process by themselves. My meaning is that if students know how to identify project needs — I mean to identify a project title — and are capable of handling all other stages of a design process; then it means that the students can handle a complete design process. It is a complete problem-solving skill capability of the student."

A curriculum development committee member also pointed out:

"Our students are too passive to do things, even learning. ... In D&T design projects, if students are all the time only required to solve assigned project titles or project briefs, but not to find out problems by themselves, they are still too passive in design learning. ... I can say, the foreseeable main advantage for putting more problem-finding theories and skills in the D&T curriculum is to educate the students to take more initiative. I

[70] For the need identification information in the Hong Kong D&T curricula, see Curriculum Development Council (1993-2005). It should be noted that there are some slight changes in the curricula over the past 15 years. The direction of the changes can be referred to Chapter 1.

mean that the students will change to be more active and self-motivated to start and find out what thing should be done and what problem should be solved. I agree that problem finding should be one of the major objectives of D&T, and it is good to be more emphasised in the D&T curriculum."

During small group casual discussions[71] and interviews with other committee members, one of the curriculum development committee members (who was also a D&T teacher) expressed similar opinions. He added:

> "If a teacher can let his students identify project titles by themselves, it is of course good. It is because the students can start the projects that they are interested in. I can see that the students like to finish their projects more if the project titles are decided by themselves."

> "... Today, many students don't want to go to school. Most of the time, it seems that all lessons are not interesting for them, even D&T lessons which are not so boring as other lessons. You can also see many students today are not interested in what the D&T teachers ask them to do. As I told before, if a student can decide what he should be doing, I think he will be happier in his studies. At least he can decide what he wants to do in a D&T class."

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[71] Sometimes, the author attended curriculum development meetings to participate in casual discussion with committee members. As stated by Graves and Varma (1997), this kind of casual discussion might generate some insight because the respondents were not under pressure.

The linkage between the D&T curriculum and the university design curricula was one of the areas to which the interviewees responded. They stressed the importance of their relationship and the transition of students' learning. Most of the interviewees agreed that secondary schools should prepare the students to go on to higher education. In fact, this education goal has been mentioned briefly in the D&T curriculum (see Curriculum Development Council, 1983, 1991-2005; Fung, 1997a; Siu, 1997a, 1997b, 1999). If a certain degree of problem-finding theories and skills could be provided to the students, it would help students make the transition (Siu, 1999).

One of the D&T teachers stated:

> "I support that the knowledge and skills of project title identification are important to D&T students. It gives benefits to D&T students to fit into the university curriculum. I mean that such an arrangement can guarantee a basic foundation for students and a smooth transition for them to continue their study in higher education."

> "... I don't mean that our D&T students should know everything. We need to let our students be happy in the class instead of having a lot of pressure for the academic purpose. As I said before, I mean a basic fundamental knowledge and skill in project title identification. ... No matter in any way, I can see that allowing a certain degree of freedom to the students to find out the reasons and set their project titles in secondary school can help to prepare the students to face university study, which expects the students to be more self-centred in learning."

Nearly all of the interviewees in the programme planning, coordination and teaching staff of design programmes in the university[72] had a positive view about problem finding. Digging deeper into reasons, a programme planning coordinator held a view similar to that of the interviewees in the secondary level:

> "I think problem finding is part of a 'project.' [Instead of using the term "design process", this interviewee focused his opinions on a project]. Although we should know that students may have their own particular talents and strengths, in a university, it is better to provide space and facilities for the students to have an all-round development. I mean at least allowing the students to try and experience different things in their degree study. Once they go out to work, they may not have similar chances to try."

Regarding the issues related to curriculum, he further added:

> "I agree that it is appropriate to add problem-finding subject matters to the curriculum. You asked before whether our current design curricula are lacking problem-finding elements. I agree to some of your points and I know what you mean. This is also the reason I support putting problem finding as a kind of learning element in design study. As already stated, university design education needs to let the student to have an all-round development. It is also the reason the current design curricula become

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[72] For the selection of the university, see the details in Chapter 2.

more general then before. We are not training design students for a particular job. … But as a teaching staff person and also a programme planning person in the school of design, I think that, compared to other disciplines, we have provided quite sufficient knowledge and experience in this area to the students. Each subject has a certain degree of problem-finding and problem-solving subject matter. The differences are only the natures and degrees of them.

"… The main reason is that we want design students to know more things and try more things. I think finding out a worthwhile thing to do is important not only in the students' learning life but also in their future careers."

During discussions with the subject coordinators and teaching staff of two degree programmes, one of which was partially engineering based design programme, one respondent was a teaching staff member experienced in teaching engineering subjects in the engineering-based design programme. He pointed out:

"It is true that all of the current design engineering programmes[73] and engineering programmes do not include problem-finding knowledge and its practical experience in the curricula. This shortcoming in curricula means that the students do not have the experience to identify or fix a problem, or to solve it by themselves. The consequence of this situation is

[73] The university calls this kind of new engineering programmes with design subjects (core and effectives subjects) "design engineering programmes" (The Hong Kong Polytechnic University, 2005).

> that, compared to the design students in design schools, our students are weak in this area. I cannot say that whether our students will be unable to do it in their future careers. In fact, we [the teachers] can do it, even though we also did not get this experience when we studied in the university. However, I should agree that students will be weak in identifying problems when they first go out to work. … As one of you said before, our students are good at solving provided questions, but weak in problem finding. I agree with some of you that putting more problem-finding elements in the curricula can improve this situation."

In all of the discussions and interviews with the people working in and for the degree curricula, no interviewee pointed out the advantage to the learning process if problem-finding elements were put in the curriculum. After prompting interviewees with some initial interview topics, a design teacher did point out:

> "As our discussion shows, I think putting problem finding in the project can give some advantages to the students' learning. In a project, if the project title is not assigned, students are required to put effort on justifying 'why they need to do it' throughout the whole project. I think this kind of experience in problem finding not only gives benefit to a student at the beginning of the project, but also during the entire project when the student needs to review his original identified problem and objectives of the project."

> "… I think it is an important objective of design studies."

Almost none of the interviewees denied the importance and value of incorporating problem finding in the curriculum — verbally. However, when asked how and why problem finding was important in design, most of them could only provide some general and abstract reasons and justifications. In fact, as mentioned in previous chapters and also agreed by the interviewees, many of them did not have the experience of problem finding in their own learning process.

Some of the interviewees were D&T teachers in secondary schools or design teachers in the design school of a university. However, nearly all of the secondary school D&T teachers either seldom allowed or did not let their students identify project titles by themselves. The university design teachers also honestly pointed out that they had seldom thought about the importance of problem finding before. Providing some problem-finding activities in the curricula was just a common practice — it seems that it was a "must" in design curriculum (see Siu, 2001a). In other words, instead of going deep to think in detail about the advantages of putting problem finding in curricula or classroom activities, the programme coordinators and teachers just had a kind of abstract perception that it was not so good to make the students to do the projects assigned by teachers throughout all their years of learning, and that it was better to provide freedom to the students instead.

The interviewees also agreed that they put more emphasis on problem *solving* rather than problem *finding*. In fact, this kind of discrepancy between verbal recognition and real action by the interviewees more or less reflected some real situations in Hong Kong, and illustrates why problem finding is still a matter of little concern here. Together with other findings related to limitations, difficulties and possibilities, this point will be discussed in the later paragraphs.

Limitations

The interviewees in design education at both the secondary and university levels indicated that the major limitation in incorporating problem finding in the curricula was resource limitation — time, in particular. A D&T teacher (who was a also curriculum development committee member) pointed out:

> "Time is the major limitation and constraint for us to put problem-finding elements in the D&T curriculum. In general, the D&T subject only gets two lessons a week. However, there are a huge number of subject matters in D&T. We need to be selective. ... I agree that problem finding is good for the students, but we really don't have sufficient time to cater for so many aspects and requirements in D&T. In particular if the Form 4 and 5 students need to take the public examination, we need to spend a large portion of time in design and technology theories. So, I would prefer to take problem solving and realisation as the major D&T activities for the students in the project."

The above comment was similar to those of a subject coordinator (who was also a teacher of a design programme):

> "The university today on the one hand cuts time available for each subject, but on the other hand adds more subjects to the design programme. And, in order to cut some of the credits and allow students to graduate from the programme quickly, several subjects that once were

> originally independent may be combined together into a new subject.[74] ... And, as the public and industry demand higher education goals and expect more from the degree programmes we have no choice but to be selective in subject content. In carrying out a project exercise, problem-finding activities require a lot of time. And, fulfilling this skill does not generate any *visible outcomes* [his emphasis]. So, many teachers prefer not let their students spend too much time on it."

This comment was actually the same as the comment of a teacher teaching a design subject servicing an engineering programme:

> "You should know that our programme is very intensive. To be quick to let the students to start the project, the best way is to give clear instruction and manageable requirements of the projects to the students. Allowing the students to do research and then identify project titles freely is a time-wasting process, though as stated to you before, I agree that problem finding is important. ... We plan to provide this kind of experience to the students only in the final project."

Besides time, another major limitation is the lack of reference materials and resources for teaching problem solving. As agreed by the programme coordinators in the two levels of design studies, this limitation "frightens" the teachers from putting effort into problem finding. Review of the available design textbooks or reference

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[74] This is sometimes a tricky strategy. Today, many students aim at studying programmes with a smaller number of credits. This means that it can be easier to graduate. This situation is more significant in part-time programmes.

materials in the Hong Kong market result showed that there was nearly no reference material on the subject of need identification or problem finding available in the market. On the other hand, there were abundant materials about problem solving and technical skills.

One of the reasons there are no reference materials available is because of the lack of people who are experienced in the topic. For example, in Hong Kong most of the lower form design curricula were adopted from foreign countries. For about the past thirty years, the curriculum development officers and teachers have transformed most of the teaching and learning materials to fit the local contexts and needs. In the recent years, the CDC has tendered out the preparation and maintenance of teaching and learning materials to external consultants. However, a curriculum development officer stated that it was very difficult to find external agents to prepare the teaching and learning materials.

Regarding the resource issue, most of the interviewees pointed out that allowing students to identify and select titles freely would increase the pressure on resources. Some programme developers also indicated that allowing different students to do "what they want" individually and separately required more manpower, more diverse materials and a bigger stock of them. Furthermore, the time management of a whole class of projects became more difficult. A D&T teacher stated:

> "You can imagine how many different types of tools and materials I need to prepare if I allow the students to set their project titles freely. My teaching school does not allow me to do it, though the budget for D&T in Hong Kong is not small. ... I have the confidence to say that quite a lot of

D&T teachers want to have easy subject and classroom management, especially because in recent years the workload of teachers has been very heavy and other duties assigned to teachers are incredibly large in volume."

In addition to the lack of general resources, the interview findings indicated that availability of experienced teachers and project supervisors was another major limitation. As stated by a D&T teacher and an interviewed university design teacher, most of the design teachers in Hong Kong, no matter which level, did not receive any formal training in teaching students how to identify project titles. That is, the teacher education programmes and the post-graduate teacher training do not include problem finding in their curricula of design teacher education.[75] In other words, the subject coordinators plan the subject syllabus and the teachers do the teaching based only on their own project experience. A D&T design teacher said:

> "Although it looks quite simple and straightforward, it would be better if problem finding could be put into teacher training. It would let the curriculum planners and teachers realise its importance. Teachers can then have confidence, and then be willing to put problem finding as a kind of project requirement in the curricula."

If all of the current problem-finding elements in the curricula are based on the

[75] The author conducted a study from 1994 to 1997. Part of the investigation was related to teacher training on problem-finding capability (Siu, 1997b). The results were published and suggestions were also sent to different education colleges. However, there has not been any improvement in the situation up to the time of writing this paper (2007).

programme coordinators' and teachers' experience, the interviewees further pointed out that most of the teachers themselves also lacked sufficient problem-finding knowledge and experience. A D&T teacher pointed out:

> "We received D&T training in Hong Kong. To be frank, the traditional D&T education did not provide us problem-finding knowledge and skills, and in turn it is not easy for us to provide this kind of knowledge and skills to our students. If you ask me whether I can do it, I can say that I can do it. But I do not have confidence to do it in a good way — I mean in a well-organised way."

The "invisible" output of problem finding is another issue which is not considered seriously in either the design process or the whole design curricula. Reviewing different current curricula, including the National Curriculum (Department for Education & Employment, 1999), it is easy to notice that the expected learning outcomes and targets of problem finding are not so significant; that is, they are not as evident in a physical form as they are in problem solving. This hinders the curriculum planners and teachers from putting problem finding as a key area in design studies. A D&T curriculum development committee member stated:

> "In general, problem finding is at the beginning of a design process. It does not carry any physical output in the whole design process directly. It is also the reason many teachers and students focus their attention on problem solving and realisation; and even project evaluation. These stages in the design process bring physical outputs directly."

A D&T teacher who also worked as curriculum development committee member gave a similar response:

> "The school, parents and even the students themselves also apply pressure to the teachers, saying that they need to spend more time helping students to produce physical outputs from a project. The students will not feel happy, or it is difficult for them to feel happy, if they can only identify a title that is not concrete and is therefore difficult to measure. However, a student will easily feel happy if he can use a turning lathe to make a beautiful table lamp. That is the difference between problem finding and problem solving."

A programme coordinator of a design programme who had worked in design education for more than 20 years pointed out:

> "The major limitation of problem finding being put in the curricula is the nature of problem finding. Although a problem or a project title can finally be generated through the problem-finding process, it is not so easy to see it. Instead, I see that problem finding as a process. It is same as the evaluation done at the end of a design project. Frankly, many students are not interested in it. They just take it as a routine procedure."

> "... For example, if a project title must be defined at the beginning of a project, and then the teacher and students find out that the teacher can do it, many of them will prefer the teacher to do so. If it is the case, you can see that how simple it is. In the evaluation stage of a project, a similar

situation also occurs. Due to the time constraint, sometimes teachers will only give comments and grades on projects instead of asking students to do it seriously. Of course, comparing problem finding with evaluation, the former is much more easily neglected."

Difficulties

When asking the interviewees about the limitations and the difficulties, many of them wanted to reference (and explain their view on) the limitations and difficulties together — as a whole. The simplest reason offered was that the limitations generated practical difficulties for putting problem-finding elements in the design curricula. Nevertheless, this section of the discussion points out some practical difficulties in the curriculum planning and development perspective. Some of them are related to the limitations discussed above.

As the discussion of the limitations showed, in Hong Kong, there is very little — nearly no — reference material for teaching problem finding.[76] Although quite a lot of design references and related materials talk about enquiry and design research in different areas and at different levels (for example, Buchanan & Margolin, 1995; Fung, Lo & Rao, 2005; Kwok, 1997; Laurel, 2003; Leung, 2004; Norman, 1998;

[76] Right after the author published a chapter about project title selection (after his two other publications about the same topic of studies), he was invited to give an internal presentation on the topic to the curriculum development officers, and write an article related to the topic for the HKEAA. In fact, the studies were not as comprehensive as is this study, but they still aroused some attention at that time. However, since then, there have still been only very rare problem finding studies and references in Hong Kong. The author has some evidence that he is still the only one person to do this kind of research in Hong Kong.

Whiteley, 1993), it is very rare for them to be related to the issues of identifying needs and opportunities for design. This means that the teachers need to spend quite a lot of effort to digest these design research materials and then to change them into problem-finding materials for students. As indicated by one of the interviewed D&T teachers, such a situation significantly increased the teachers' workload and difficulties. As discussed above, the advantages of problem finding were not so significant — because they are neither concrete nor visible. Hence, the interviewed teachers pointed out that they would prefer to put effort into other design areas or stages of the design process. This is similar to what a D&T teacher said:

> "If you ask me to revise the existing curriculum or produce materials for problem finding, I prefer not to do it. It is quite difficult because there are no practical reference materials. ... In contrast, in recent years, there are more 'canned-food' materials to help D&T teachers to carry out a project. The project packages [including project materials and project guide booklets] are so convenient and are at a reasonable price for teachers to deliver to the students. Then, I can see and comment that there is no reason for the teachers to put themselves to so much trouble."

> "... If I need to tell students about problem finding, I would prefer just to tell students to do it according to my own experience. I think that it should be good enough. Or, I would only prefer to mention about such design skills in lectures and let the students to understand some critical considerations in problem finding."

A curriculum development officer commented that the CDC actually had put problem finding on the agenda for discussion in some meetings. However, it was very difficult to find reference examples to put into the curriculum, even if they included foreign examples and references. The officer also indicated that while they had searched the curriculum materials in different countries, such as the UK, the United States, Australia and Singapore, materials with practical examples for teaching were also very limited in these places. And, some of them were difficult to adapt to Hong Kong.

Besides resources, curriculum developers and teachers find that the nature of problem finding itself also presents difficulties for inclusion in the curricula and subject activities. A D&T teacher (who was also a curriculum development committee member and a committee member of a D&T teacher association) indicated:

> "One of the major difficulties of requesting students to do problem-finding exercises or identify project titles by themselves is the difficulties in giving hints and support. It is because when we give freedom to the students to identify and define a project title, it indicates that the students can be free to select how they want to proceed in a project. You can imagine that we have about 20 students in a class. But, we only get two to three 30 to 35-minute classes in a week — sometimes in a cycle.[77] How we can handle it? In particular in senior forms, the

[77] To provide more lesson timeslots for different subjects, instead of using a "week" as a framework/base for timetable, schools in Hong Kong in the 1970s has started to use a "cycle" system. It means that 6 or 7 days form a cycle. In the cycle system, the lesson timetable is not based on the conventional days (such as Monday, Tuesday, etc) as a definition. Instead, the cycle system uses Day

examination syllabus covers such a wide scope and needs to use many materials. Therefore, I prefer to skip this learning area [problem finding] by just simply giving a project title to the students. ... I would sometimes prefer to give some freedom to the students to modify the titles a little bit — under my title — if they have more time, instead of allowing them to identify a title."

A design teacher in a design programme also had similar comments about curriculum content and the number of students in a class:

"As you may know, design students and teachers in the past were very happy. The curriculum was not so intensive as the current state. The number of students in a class was small. Just about 15 years ago, I only got 12 to 15 students in a class. Now I have more than 50 students. Sometimes I get more than 120 students in a lecture."

"... Although I still prefer to allow the students to be free to define their design directions and project titles, I start to give more limitations [requirements] to the students. I mean that I would like to set up a more manageable scope for the project exercise. I know that it may block a certain kind of development of students, but I have no choice since I want to have a good project management under such a intensive curriculum

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1 to 6 or 7 as a complete cycle. One of the advantages of the cycle system is to allow more lesson timeslots in a cycle. Another reason is to prevent continuously missing some particular lessons on particular weekdays. For example, public holidays in Hong Kong are always on Friday. The cycle system can prevent a repetitive loss of Friday lessons.

and plenty of other subject administrative requirements."

A design teacher in who was also a programme coordinator an engineering programme offered similar comments:

> "Problem finding means that you cannot foresee what the students would like to do before they tell you. It is difficult for a project supervisor to give tutorials and supervision to the students with different project objectives."

> "... We have about 60 students in a class. Compared to the conventional design programmes, we have a big jump in the number of students in a class. Compared to us, the design teachers in the design school are happier all the time. Sometime they only get about 20 students in a class. This may be the reason that they allow students to define their project titles. ... For us, even in the final project, several teachers need to face more than 50 students. In order to prevent the difficulty in project administration and supervision at the beginning, we prefer to give a set of titles for the students to select. It is a good for classroom management and project management."

Regarding the curriculum contents issue, problem finding was not an easy task to be taught compared to other design areas, though some of the interviewees mentioned that problem finding was an easy skill for students to handle. A curriculum development committee member who was also a D&T teacher explained:

> "Problem finding is an area easily handled but difficult to teach."

A curriculum development officer stated:

> "In some committee meetings for the drafting of the consultation documents for new design curricula, some of the members mentioned that it 'might not be necessary' for students to gain problem-finding knowledge and experience (compared to other kinds of design knowledge and skills) at the secondary level. They said that students could learn it in a higher form.
>
> "A curriculum planning process is a game of balancing. We cannot cater all of the needs and requirements. I agree that problem finding is important skill in design. But as other committee members mentioned, we don't need to go in deeply into this area. We prefer to give more research experience to students for them to investigate some provided needs [titles]."

In fact, these kinds of comments and views commonly exist and are also quite commonly accepted in design education in Hong Kong. As two other studies conducted in 1992 and 1999 demonstrated, this kind of perception has made people put less and less attention and effort into problem finding (see Siu, 1994, 2001b).

On the other hand, success and more attractive elements in other areas of design studies also create difficulty in implementing problem-finding elements in the curriculum. As discussed in previous chapters, it is through projects that students can gain relatively more satisfaction from problem solving and realisation of design ideas. This further implies that the students gain relatively less satisfaction from problem-finding activities, which can be too abstract for them to know and gain the feeling of success (Siu, 2001b; see also Runco 2003). As stated above, the outcome of problem finding sometimes is "invisible"; that is, not so concrete as the outcome of problem solving and realisation. Such a situation also de-motivates subject coordinators and teachers from putting problem-finding elements in the curricula. One of the curriculum development committee members (who was also a D&T teacher) had rich experience in this matter:

> "I think one of the major difficulties for putting problem finding in the curriculum is that 'it is not attractive'."

> "For example, starting from the late 1990s, some teachers introduced robotic elements as a kind of problem-solving exercise in D&T subject. Within just several years, this has attracted more than half of the D&T schools in Hong Kong to become involved in it and to join local and international competitions. ... Most of the time, these robot projects are under some quite rigid predetermined goals and objectives, such as designing a robot able to move along a predetermined length of path quickly, or a robot that is able to lift the greatest load. This kind of activity attracts hundreds of students. It also attracts teachers as well as principals and parents. You can see now some schools nearly spend 100% of their lesson time on a robot-building exercise. Some of them totally put the official curriculum aside .... Some of the teachers even argue that robot exercises also include some problem-finding skills such as finding

out the problem of robot movement. But it is still very biased. I think it is different from what you and me mean about problem finding."

"... Compared to realisation, problem finding is very unattractive, in particular for lower form students. In contrast, problem solving is so abstract for students. You can see a student willing to spend several hours to polish resin into a shiny surface, but it is difficult to find a student willing to spend twenty minutes to find out a problem and then tell you what he wants to do. The difficulty of implementing problem-finding elements in the curriculum is because of the nature and activity characteristics of problem finding itself. It is also why we always emphasise that it is difficult to put more problem-finding elements in the curricula."

Possibilities

When asking the interviewees whether there was any possibility of implementing more problem-finding elements in the curriculum, most of them stated that they would take a positive view towards finding possibilities. However, some of them further stated that this was not easy to do on a large scale. They suggested starting on a small scale to demonstrate results as examples, if they turned out positive. A curriculum development officer suggested:

"According to more than 50 years of education development in Hong Kong, there has not been any successful large scale change. Design is still a relative small discipline. Starting from some particular schools or programmes may be easier to gain a better and constructive result."

Identifying the possibility of changes in curricula can be referenced to the identified limitations and difficulties. While reviewing the list of summarised limitations and difficulties above, it is not difficult to notice that a lot of barriers must be overcome from the curriculum planning and development perspective if problem-finding knowledge and experience are to be put in the curricula in a more formal and comprehensive way — in particular referring to some of the particular local issues.

Nevertheless, as identified by the interviewees, Hong Kong has begun to change its education system at secondary and degree levels. Secondary schools are provided more freedom in school administration and academic matters. For example, under the recent educational reform, schools have more freedom in both school administration and teaching and learning activities. Instead of taking the role of controllers and inspectors, government departments and related boards and committees become more like advisors to assist schools to gain their defined goals and objectives (Educational Bureau, 2007).

The changes in the university education polices can be considered as a significant possibility as well as opportunity. Starting from 2012, universities are approved to change degree programme structure from 3-year programmes to 4-year programmes (University Grants Council, 2007). This change implies that more resources (including time and money) will be available as well as flexibility for the universities to develop programmes with better quality.

Most of the interviewees agreed that these critical changes may make it possible to bring some fresh and new opportunities to design education. For example, a curriculum development officer indicated:

> "The schools under the new Direct Subsidy Scheme [DSS] have more freedom to do what they want. These DSS schools claim to have new visions and missions and provide a better quality education for students. These schools also have higher flexibility and autonomy to define their curricula [or select curricula from different education systems — including the foreign systems]. Thus, there may be a chance to improve design curricula in these schools.
>
> "... I know that a school plans to adopt the National Curriculum D&T syllabus and their students will take the UK's examination also. I cannot comment whether this school is successful or not. It is too early, as it has not come true yet. But at least they are trying to make a new D&T curriculum with some other subject elements."
>
> "... Not only in the DSS schools, under the education reform more schools have a greater flexibility to revise their curricula to fit the schools' and students' particular needs. Therefore, I can say that problem-finding elements as well as other new elements may possibly be added to the curricula, under the condition that it is well-justified to give benefit to the schools and students."

A D&T teacher (who was also a curriculum development committee member) stated:

"I don't dream of having critical changes in all schools. But the education policy allows and supports more schools to change in order to survive. If some schools start to put more need identification or provide more freedom in projects for the students and in turn the result is positive, I can't see that there is any problem for other schools to *follow* [his emphasis]. ... Yes, I mean 'follow' because Hong Kong schools like to follow what other successful schools do and then do the same thing."

Therefore, as this teacher indicated, successful cases were important to increase the possibility of problem-finding elements being implemented more in the curricula. This view brought out a quite fresh idea in the interviews and discussion: that it might be a good idea not to aim at a large scale of comprehensive implementation of changes, but rather to encourage pilot curriculum reform projects in design curricula. A programme coordinator of an engineering programme with design subjects advanced a similar point regarding the changes in degree design studies:

"The coming new four-year degree programme policy offers the possibility to the senior management, curriculum planners and teachers to have more time to plan and implement a more comprehensive design programme for students. If problem finding is important to design, I can't see that there is any difficulty for us to allow students to take more initiative in problem finding and assignment title identification."[78]

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[78] The interviewee insisted on using "assignment" instead of "project". He indicated that freedom for identification should not only be applied in project titles, but might be extended to other types of assignments.

> "If we get some successful cases such as some graduates with good capability in identifying opportunities which bring good comments from the industry, I can't see who can stop the changes of the curricula."

> "I want to specify that such curriculum change may not necessarily be big. Putting some regular problem-finding training in a particular design curriculum or some particular subjects as a trial may be a good idea to see the result."

Besides changes in education policy of the kind mentioned in the review in Chapter 1, some interviewees pointed out that changes in the industry's needs could also offer a possibility for implementing more problem-finding elements in the design curricula. A subject coordinator of several servicing design subjects indicated:

> "Because of transition within the industry, the employers need more self-initiated design graduates from the universities. ... Ideally, problem-finding training can bring students to be more capable of identifying opportunities for a company. I think the employers can appreciate this kind of students' capability. Then, I think that it can push design curriculum planners to put more effort on the problem finding — at least to think about it in a more serious way."

On the other hand, referring to the limitations and difficulties discussed above, a curriculum development committee member pointed out that there was a request for a smooth transition between the secondary level and degree level. This request brought more attention to the curriculum planning at the secondary level. For example, more consultation meetings and experts from the universities were invited to participate in curriculum planning meetings. He pointed out:

> "This phenomenon illustrates one important situation, that is, secondary level curriculum planners have started to think about how the curricula in the secondary level can be fitted into the university curricula. Among all the changing items, problem finding may be one. This is because it is one of the weakest areas in the design process in the secondary design curricula."

Regarding the qualification of teachers, the interviewees in the two levels originally did not have any comment. After prompting with some questions to request their opinions and comments on this area, some of them agreed that many new teachers had better qualifications. Some of these new teachers also had learning experience in foreign countries. As a curriculum development committee member indicated:

> "Many new teachers have better qualifications and some of them have foreign [studying and learning] experience. I don't know whether they have sufficient experience in handling all the things or not, or whether their teaching is necessarily better than some experienced teachers. In fact, I doubt it. ... However, at least most of these new teachers are willing to try new things. In a similar way, the new D&T teachers in the mid-1980s brought a new era to the D&T education in Hong Kong as they emphasised design capability instead of conventional technical skills. The fresh teacher education graduates in the mid 1990s also brought

some foreign design knowledge and new projects to the curriculum. ... I notice that many new teachers are starting to provide more freedom to the students. It may be an opportunity for us to make some critical changes in problem-finding elements in the D&T curriculum by using this new teaching force."

In fact, the interviewees' observations are very accurate. Starting from the late 1990s, a new teaching force has been entering the design education field, in particular at the secondary level. For example, before the late 1990s, most of the D&T teachers came from a local teachers' college. However, since the late 1990s, secondary schools have started to appoint engineering graduates or design graduates to teach D&T instead of the D&T teacher education graduates from The Hong Kong Institute of Education (HKIEd).[79] While the teaching methods and classroom management of teachers in this alternative group may not be good, their subject matter and design experience are strong. These teachers eventually bring some breakthroughs in D&T teaching and learning activities (Siu, 2005).

Summary of the findings: from the Curriculum Planning and Development Perspective

<u>*Advantages*</u>

- Provides a more complete design process for the students (includes the entire problem-solving process);

[79] Such changes as appointing non-education college graduates to be the teachers also accelerated the closing down of several D&T teacher-training programmes in the HKIEd.

- Offers a more balanced development in design curriculum (see in foreign curricula);
- Nurtures all-round students;
- Provides better and more comprehensive basic knowledge and skills for junior students to fit into the higher education curricula; that is, allows for a smooth transition to further study;
- Gives advantages to students as they study at higher levels (not only in design studies, but also in other studies);
- Allows students to take more initiative and be more active in their projects as well as learning;
- Helps students know "why", instead of only knowing "how";
- Makes projects as well as learning more interesting, since problems (and project titles) are identified by the students themselves;
- Benefits students' learning throughout the whole project process, in that they both can and need to evaluate the objectives of their projects, and also focus on their learning objectives in a more active way;
- Offers advantages to the students for their future career;
- Fits the new and changing industry requirements, in particular the need for all-round designers with initiative.

Limitations

- Time constraints; that is, limited lesson time, small number of lessons in a week, intensive timetable;
- Lack of reference materials and support;

- Lack of resources required due to the diversity of problems identified by the students in a project;
- Lack of teacher training in problem finding;
- Lack of teaching experience in guiding students in problem finding;
- The perception that, unlike other stages in a design process, problem finding is a stage which can be done by other people, instead of students themselves;
- Lack of "visible" outcomes from problem finding in the evaluation;
- Pressure on the "visible" design outcomes from school and external requirements.

Difficulties

- Lack of resources, which in turn creates difficulty in implementation;
- Relatively greater difficulty in giving hints and support to students in problem finding;
- Difficulty managing the resource and classroom activities;
- Difficulty having good project time management, in particular if the class size is large;
- Difficulty that design (including D&T) is a subject with a lot of learning elements and targets;
- Relatively greater difficulty of setting up learning targets compared to other stages of a design process, such as solution proposal and realisation of ideas;
- Difficulty of controlling the subject elements in the project;
- Difficulty of having a balance with so many elements;

- Relatively lower learning motivation of students in problem finding compared to other project elements;
- Relatively low student satisfaction.

Possibilities

- Education reform or policy change in secondary and degree levels brings more flexibility and resources for the change of design curricula;
- New expectations of employers and new job requirements; that is, all-round and more self-initiative designers;
- A request from the public for a better transition between secondary level and degree level;
- More new and well-trained teachers to bring new and updated insights and experience to the curricula;
- Teachers from different fields to bring new and updated insights and experience to the curricula;
- The possibility of having changes in some schools first (as pilot runs), so that the result can work as a justification or sample to encourage change.

5.2 Assessment and Examination Perspective

Starting from its early stages, examination has always been the focus of Hong Kong education; and some people occasionally say that it is the only focus and motive. The older generations always mention that the examinations in the old days were much more serious and difficult than today. Many older faculties in universities are still proud of their examination results and state that an "A" in the 1960s was much more difficult to obtain than several "As" in current public examinations. Of course, on the other hand, the new generations always look down upon the old generations and state that the new assessment methods nowadays are much more scientific and comprehensive. The coverage of syllabi is much wider than before. Young people take it as a joke that their parents only knew how to remember 300 poems in their Chinese lessons. However, the current students are required to analyse a Chinese article from different perspectives, sometimes with scientific analysis. In fact, all of these points of view create endless arguments between the generations at home, or provide topics of conversation among old friends who cherish the past in Chinese tea restaurants. No matter who wins in these endless battles, it is very clear that even to the present time, examinations as well as other kinds of assessments and comparisons are always the focus of teaching and learning in schools in Hong Kong (Stimpson & Morris, 1998), and also that assessments and examinations always make both teachers and students become crazy.

However, assessment and examination do give significant influence to the curriculum planning and development in Hong Kong (Morris, 1990, 1995; Stimpson & Morris, 1998). According to the discussions with curriculum development officers and examination officers at different occasions, people easily perceive that examinations (for example, contents, format, weighting, etc) must follow the trend of curriculum planning and development. In fact, this is only partially true. Sometimes, curriculum planning and development in Hong Kong are led by examination and assessment policies and requirements. In other words, sometimes assessment and examination influence the plan and development of curricula — and to a quite large extent. Of course, some people may state that curriculum and examination are two inseparable parts in education. Thus, to take it from a positive perspective, examination officers and curriculum development officers in these two educational sectors should work closely to meet the education goals.

Nevertheless, this thesis does not aim at the discussion of the relationship among curriculum, assessment and examination. However, it is a fact that assessment and examination significantly influence problem-finding knowledge and experience in design curricula. For example, as the author's 1992 study of the rationale for project titles selection in design and technology subjects significantly illustrated, the format (that is, arrangement, requirements, setting) of project examination influence teaching and learning activities as well as curriculum development (Siu, 1994). Several similar studies conducted in the later 1990s and early 2000s further illustrated this with results similar to the earlier study (Siu, 2002b). Also, according to some other investigations in the degree level design studies since mid 1990s, assessment significantly affected the students' choice and performance in learning. Such influence also generated a ripple effect in subject planning (Siu, 2001b, 2002c, 2002d, 2002e, 2003).

Regarding problem finding in specific, the discussion in the last section presents the advantages, limitations, difficulties and possibilities of incorporating problem finding in the design curricula from the curriculum planning and development perspective. Reviewing the findings, it is easy to notice that assessment and examination requirements significantly influence teaching and learning in design project activities.

Based on the interviews with the examination officers, examination committee members, and the programme planning, coordination and teaching staff at both secondary and degree levels, the following paragraphs aim to discuss the problem from the assessment and examination perspective. As in the last section, the views of the interviewees are presented directly in the following paragraphs in order to present the data without distortion and in a manner that assists discussion.

The terms "assessment" and "examination" are frequently used in the following sections. This thesis does not intend to go into depth when discussing the definitions of these two terms. To be convenient for discussion, "examination" refers to a more specific meaning such as HKCEE, and other formal arranged examinations, etc. "Assessment" refers to general activities that assess the abilities of students, such as homework, projects, exercises, etc. Therefore, in a general discussion context, assessment covers the meaning of examination — unless specified.

Advantages

According to clear and honest indications from examination officers and committee members at the secondary level of design studies, including problem finding as a teaching and learning element in the curriculum (and for assessment) does not give any significant advantage to the administration of assessment and examination. Rather, it inconvenienced examination administration. Simply speaking, it created one more item for assessment.

However, from an assessment perspective, putting problem finding in the design curricula in a more regular and formal way means that there would be one more item possible for assessment. A programme coordinator of a degree design programme indicated that increasing one more subject element or increasing the volume/scale of an existing subject element means that the coverage of the subject area is extended wider:

> "It is very easy to see an obvious advantage of it. If problem finding is incorporated in the design curricula, it will then be considered as a kind of subject element and area for assessment and examination. Or say, if you don't put problem finding in the curriculum in a more formal way, it would not be considered to be assessed."

A design teacher gave his positive comment on including problem solving more formally in the curricula:

> "At least it gives a clear picture to let the students and teachers know that problem finding is an important element in design studies, and it has similar importance for other elements in a design process, such as design investigation, problem solving, realisation."

A D&T teacher who was also an examination committee member pointed out:

> "D&T is a subject which covers a wide scope of learning targets. According to the curricula, D&T covers a lot of design theories, technological knowledge and skills. But this specific characteristic of the subject does not mean that it is sufficient enough. I would suggest, if possible and if students are capable, more elements should be added and assessed. Therefore, for me, problem finding is an important stage in a

design process. No matter how it is assessed, it is better to include it as an element for assessment."

In fact, the interviewees indicated that emphasising one more subject element — problem finding — not only widens the scope for teaching and learning (and assessment), it also lets the assessment of the design subjects become more comprehensive.

This recalls a Chinese saying, "If the title of a person is not well defined and recognised, what he says is informal and improper." In the same way, nearly all of the interviewees agreed that if problem-finding elements were formally incorporated in the curricula, assessments related to problem finding would become more formal and recognised. This situation is also similar to what a design coordinator in a design school mentioned:

> "If problem finding is considered as one of the critical elements or stages in a project, but we have never assessed it, then I can say that the assessment of the subject is not comprehensive enough. If so, the assessment of the design subject is biased."

In fact, nowadays the assessment of design subjects is quite biased. A programme coordinator of a design programme pointed out that, most of the time, the focus of assessment of a project is put on problem solving and realisation. Problem finding, title identification and evaluation are always neglected. That is, assessment most of the time is based on the visible items and work. As further indicated by the programme coordinator:

"Although process is always emphasised in design practice, teaching and learning, most of the assessment is still put on the '*able-to-be-seen*' products [his emphasis]."

A D&T teacher also pointed out:

"There has been some improvement in the assessment weighting distribution in the D&T project paper of HKCEE in recent years. The ratio of marks is better distributed than before. At least you can see that a more reasonable percentage of marks is given to the investigation during the concept development and the evaluation at the final stage."

"However, there is still no mark given to problem finding. This is because problem finding is not required in project examinations. And, in many general assessments of students' performance in schools, teachers also don't put problem finding as a key area for assessment."

Limitations

In the same way as "project evaluation", problem finding is always commented upon as a design stage or element or skill that is difficult to assess. One of the reasons is that assessing students' problem-finding performance (skills, quality of work) is too subjective, or at least relatively more subjective than assessing other stages of the design process. An examination officer pointed out:

> "I don't object to putting problem finding in the design curricula. Even putting it as a core part of a design process or a design project, I will also support. I support all these. And, I also don't object to having assessment on students' problem-finding capability, but under one condition: it should not be in public examinations. I mean, it is okay to assess the students' problem-finding capability internally inside a class or a school, but not in a scale such as HKCEE. My major reason is that assessing a student's problem-finding capability is relatively more subjective than assessing other capabilities. For example, for idea generation in a design process, you can compare the performance of students by reviewing and comparing students' sketches, drawings and mock-ups of their design ideas. For assessing realisation of design ideas, you can review the appearance of the final products or compare the workmanship among different students. However, it is very difficult for you to assess which project title is better than others. Even if you can compare the research work, you still cannot point out '*which title is found to be a better quality*' [the officer's emphasis]. It is particularly too dangerous to do it in a public examination."

An examination committee member (who was also a D&T teacher) held a similar point of view, and he also indicated that he did not recommend assessing students' problem-finding skills in public examinations due to foreseeable difficulties:

> "Problem finding in general consists of two major kinds of knowledge and skills: research and making decisions. I think the students can perform similar things in other stages of the design process."

"And, project titles are so varied in their nature, level and difficulty, etc. It is unfair to assess students' performance in terms of their defined titles with such a large variation and in so many aspects. For example, if a student defines a bookrack as his project title, and another student defines a car as his project title, although the teacher can assess these two titles according to some objective criteria, such as time availability, it is still difficult and unfair to compare two titles with so much difference in different aspects.

"Therefore, I am the one supporting not to assess problem-finding skills in HKCEE. I would more prefer to remain in the current state where the HKEEA gives a set of titles to the students."

Time is one of the major limitations for incorporating problem finding in the design curricula — no matter in what levels of design study. All of the examination committee members gave a lot of opinions and comments when prompted with "time" as an initial topic for the interviewees. Their major consideration was that problem finding required a lot of time, which was not feasible under the current intensive timetable and in particular the short and fixed project duration in public examinations. A subject coordinator of design subjects of an engineering programme stated:

"Allowing a student to find a problem and then define a project title is a time consuming process. This is because all the things, such as the requirements and objectives of the project, are out of prediction and control before the project title is set. In a project exercise, it is more convenient and straightforward if I give a title to students. I can say that the scale, requirements and objectives of the project are under my control. If I allow the students to define their own project titles, then a project will become many projects. You can imagine how complicated it would be if a class of students choose different projects according to their research and preferences. I had some experience that some students spent more than half of their project time, but still could not finalise their project titles."

Insufficient experience in assessing students' problem-finding capability is another limitation raised by an examination committee member of the D&T subject and a subject coordinator of a design programme. As pointed out by the examination committee member:

"Saying 'put problem-finding elements in design curricula' is easy. But we lack people with experience to do it. Even inside the curriculum development committee and the examination authority, I cannot find any experienced people to deal with this issue. When we review the National Curriculum, you may find out that the contents are also quite abstract, and it is difficult to modify and adopt it in the Hong Kong curriculum.

Difficulties

The outcomes of problem finding are not clear, as was mentioned in the last section regarding the limitations to incorporate problem finding in the curriculum. Therefore, it is difficult to carry out assessment on this learning area.

The feedback from the interviewees was similar to the discussion presented in the last section. That is, it is difficult to assess problem finding due to its own special nature. It is too easy to be biased, subjective and sometimes lose direction and ground in assessment.

Most of the time problem finding is at the beginning stage of a project or an assignment, as discussed in the context of design processes in Chapter 3. This particular characteristic of problem finding in the design process also creates more difficulty in assessment. This is because at the beginning stage of a design process, most elements have not been established and confirmed. For example, problem finding is different from the design idea generation process or the realisation process. The latter two stages at least are based on some directions, objectives and requirements to proceed. A design teacher in a degree programme mentioned the following statement according to his rich project supervision experience:

> "Although sometimes project supervisors may give some directions, hints or requirements to the students to help them define their project titles, problem finding is still in the first stage. ... most of the time, it seems that problem finding starts from *nothing* [his emphasised]."

Some interviewees raised the problem that it was difficult to set up assessment criteria for problem finding. A D&T teacher pointed out:

> "It is not easy to set up a set of more objective assessment criteria for the outcomes of problem finding. I have some experience here. A student

came to me and asked how I could assess her project title. She was keen to get a good grade in her project and wanted to know how I could compare her work with other students' work. ... Although I had told her that I would focus on the process such as her research work and reasoning in defining the title, she went on wondering and kept on asking me how she could evaluate the title by herself."

"She raised one question to me: What is a good title? I really don't know how to answer her."

The D&T teacher's concern is also the concern of many curriculum planners, examiners and teachers in Hong Kong. Some foreign reference materials on problem finding, need identification and title identification have identified some "related areas" (for example, degree and quality of research, decision skills and analytical skills) (see Department for Education & Employment, 1999). However, there is still no well-organised and more specific reference material that provides a more comprehensive set of "related areas" and set of assessment criteria to assess these "related areas". Moreover, most of the research materials are only related to theoretical discussion on the topic and there are no practical materials to assist curriculum planners and teachers (Runco, 1994, 2003; Siu 1994). What available materials there are offer only some brief guidelines incorporated in some foreign curriculum documents. In short, shortcomings in reference materials create difficulty in assessing problem-finding outcomes.

Due to the difficulties identified above, the interviewed teachers responded that it would de-motivate the teachers at the frontline to put problem-finding elements in the curricula, in particular related to the difficulties in assessment. As stated by a D&T teacher:

> "If I don't know what should be assessed and how to assess it, how can I be convinced to put problem finding in the curriculum?"

In fact, during the interviews, it was observed that not only teachers, but also most of the interviewees showed little interest in improving the current setting of the curricula and assessment methods. In fact, this is the most significant barrier to putting problem finding in the curriculum. As an examination committee member said,

> "By creating a new learning area you can foresee that there are going to be quite a lot of barriers, and I don't think too many people would like to take this challenge. In particular, the people working in the assessment and examination sector only have a few people to handle so many things. They also need to take care of other subjects. Without more significant support and preceding cases and experience, I can see that putting problem finding in the curricula is full of barriers."

Possibilities

Reviewing the interviewees' comments above, the identified possibilities actually were quite similar to those stated by the curriculum planning and development persons. The major difference was that the interviews with the former involved possibilities viewed from assessment perspectives.

The examination officers of the secondary D&T studies and the programme coordinators in the university design programmes identified that there was more popular recognition of the importance of assessment on "process" rather than only on "outcome". They all took it as a good opportunity for more people to consider the importance of problem finding as well as some other design stages, such as "evaluation". The interviewees working in or for the degree levels design education also pointed out that recently, better organised and formal marking schemes in the design subjects gave the opportunity and possibility for problem finding to survive.[80] As a programme coordinator pointed out:

> "The change in the focus of assessment to pay more attention to process gives people a chance to become more aware of problem finding. ... Although we focused on the design process before, the fact was that final outcome of a design was still the main and nearly only focus. I can see that assessment criteria for design projects in the recent years have achieved some changes. The weighting of both research for the design needs and title identification in a project are more emphasised."[81]

He further specified later:

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[80] Since the early 2000s, design schools required subject teachers to have more formal market schemes. This requirement is mainly in response to the University Grants Committee's suggestion of the "Outcome-based Learning" policy.

[81] The programme coordinator showed the author a market scheme of a project in the design school. The weighting of research, design brief and title identification was 15% of the overall weighting of the project. It was a big improvement compared to the past serious neglect on these items.

> "In the past, many project supervisors always claimed that they would consider the whole development of a project. In fact, when a project supervisor saw a *beautiful* [his emphasis] design output, most of the time he [/she] might easy neglect all other considerations. One of the reasons was that many project supervisors were based on a loose and abstract assessment method. I mean impression marking. I believe that this situation was quite apparent in higher level design programmes in the past."

> "... But now the situation is better. Every item of the design process is identified and noted in assessment schemes. I think that such kind of improvement in assessment gives opportunity to problem finding to be maintained as an assessment criterion."

An examination officer at the secondary level also stated:

> "The recognition of the importance of whole development of a design process makes the teachers in schools consider all of the areas and steps of the design process. According to my observations in schools during the project examination periods, I notice that an increasing number of teachers put more effort to nourish students in how to evaluate their projects. Some teachers have started to require their students to do more serious research on the project design briefs, even though the titles were still assigned for the convenience in administration in assessment and examination. The students also put more effort into the report of initial research on the assigned titles. ... I foresee that if problem finding and its

importance is increasingly promoted by the curriculum development committee, it would be get more attention in the coming years."

As stated in previous sections, the new education policies at different levels provide more flexibility and autonomy to schools in curriculum planning and to individual teachers in subject planning. Such changes also promote change in assessment, in particular "all-round" and "full-people development," which are hot topics and terms in educational field these days. A D&T examination committee member (who was also a D&T teacher) stated:

> "In recent years, more schools conduct open days [to the public and parents in particular] and other functional days that exhibit their students' work. Instead of the traditional practice once a year, today a school may have several open days with different attractive titles. I notice that more schools start to show their students' thinking and management talents instead of only technical skills and performance. I can also see some reports and presentations are exhibit on these days. Besides some huge side final products, many schools show their students' research reports."

The committee member further specified:

> "Regarding the changes in assessment, the change in lower form assessment D&T has been more significant in recent years. It is because the education department and the schools give more freedom to the teachers to set the syllabus and assessment methods. In addition, the education department also has looser inspection and requirements for

> lower form teaching. As indicated by an inspector, lower form D&T is expected to attract students to enjoy and then like the subject, instead of giving them pressure. Moreover, there is no pressure on public examination in lower forms. All of these let the teachers to do what they like with the subject with less constraints."

When following up this response and asking about the chance of change in syllabus, the member further stated:

> "I cannot say that these situations necessarily make putting problem finding in the curriculum any easier. Up to now, I have not seen any change. But at least it shows that there is some possibility of having change in curriculum. If the teachers take problem finding as an important element in the design process, at least a change in curriculum will not be subject to strong opposition."

When degree design teachers were prompted with the same issue, one of the teachers indicated:

> "I cannot see the degree lower form having a greater flexibility in syllabus and teaching and learning activities. In fact, sometimes lower forms, in particular the first year, have a more rigid syllabus and intensive subject contents. So, I cannot see any advantage in putting problem finding in the curriculum."

But he added:

"I can foresee that university programmes in the coming years will change to a longer programme duration, starting in 2012. This change will bring more time for the students' learning. A looser and more flexible curriculum and more comprehensive assessment criteria will be probably be established. Some projects will probably be longer in duration. These situations may result in more possibilities of putting problem finding in the curriculum."

In addition, some of the interviewees thought that the change of examination policy in the secondary level examination might increase the chances of putting problem finding in the design curriculum. An examination committee member explained:

"The examination authority in recent years has implemented the school-based assessment in a more serious way, in particular for projects and lab experiments. This situation reflects that comparison among students' performance [with respect to a fixed title] will no longer be the assessment method. This means that students no longer need to take exactly the same project title any more. Like the Art and Design (A&D), under the school-based assessment policy, students are free to make choices about their art projects. I can foresee that the similar situation will be applied to D&T."

"... Of course, the implementation of school-based assessment of projects does not imply that problem finding will be a key assessment criterion in public examination. The possibility of this change still critically depends

> on whether the examination authority recognises the importance of problem finding, and whether teachers have sufficient knowledge and experience to get the examination authority to trust them to can assess project professionally."

Further to the discussion above, reference material is one of the critical factors for putting problem finding in the curriculum. As also stated, more reference materials at the secondary level have been tendered out for external companies to produce and maintain. If the government rates a tender more according to quality than price, and the government develops more recognition of problem finding as a key learning area in design, there will be a greater possibility that the external company will put effort on problem finding in order to get the tender contract. However, as a D&T teacher pointed out:

> "The critical point is still how both curriculum and examination departments see the importance of problem finding."

Summary of the findings: from the Assessment and Examination Perspective

Advantages

- A wider scope of elements can be assessed;
- A more comprehensive assessment in design, in particular related to project elements becomes possible;
- A clear definition of areas for assessment is created;
- A more balanced assessment results.

Limitations

- Internal assessment is fine, but not feasible for public examination;
- It is relatively more subjective in assessment and thus it is easy to create unfair — subjective — assessment;
- Project titles with large variation in terms of nature, level, difficulty easily lead to unfair assessment;
- There are time constraints in public examinations;
- Hong Kong lacks sufficient experience in this area of assessment.

Difficulties

- It is difficult to assess, since the outcome of problem finding is not so obvious as other stages;
- It is difficult to set up scope for assessment;
- It is difficult to define a set of objective assessment criteria due to the diverse outcomes of problem finding;
- There is a lack of reference materials for more objective and organised assessment;
- Currently there is little motivation among curriculum planners, examination officers and teachers to put problem finding in the design curricula.

Possibilities

- More people recognise the importance of "process" instead of only "product";
- More well organised and itemised assessment schemes offer advantages for problem finding to be more considered in assessment (or, at least kept as an assessment criterion);
- New education policy and education reform attract changes in assessment;
- More freedom is apparent in assessment in lower forms;
- Longer learning duration in university allows for more flexible assessment in different skills;
- Changes are taking place in examination policy, specifically, school-based assessment;
- More teaching materials are tendered out for production.

5.3 Summary of Two Perspectives

When the interviewees were asked to give comments on incorporating problem finding into the design curricula, it seemed that they were more able to identify limitations and difficulties than to see advantages and possibilities. In addition, the advantages identified by the interviewees were quite abstract.

When reviewing the responses of the interviewees in detail, it is apparent that the importance and significance of problem finding were more from a theoretical understanding and perspective rather than experience. The interviewees also very seldom thought about the possibility of changing the situation. This was because they faced the concrete limitations and difficulties of teaching and learning every day. So it was easy for them to point out many concrete and valid limitations and difficulties. However, very few of them had put problem finding regularly in the curricula in any organised fashion.

Similar to the interviewees involved in Stage III of this study, most of the interviewees in Stage IV (a) and (b) were not willing to make a start when they saw the practical limitations and difficulties. For example, most of the time, when an interviewee mentioned an advantage to putting problem finding in the design curricula, he would further point out limitations and difficulties to explain how such identified advantages might not work. In addition, in identifying the possibilities to improve the current situation, it was quite easy to see some disappointment on the interviewees' faces due to the foreseeable practical limitations and difficulties. In fact, the interviewees were more willing to talk about the details of limitations and difficulties. All of these interview responses and situations might illustrate why problem finding has been so neglected in the design curricula. Nevertheless, more discussion on this point will be presented in the case study in Chapter 6.

The similarities and differences of the perspectives of "curriculum planning and development" and "assessment and examination" can be summarised as follows:

- The interviewees were more able to identify limitations and difficulties than to see advantages and possibilities.
- The advantages identified by the interviewees were quite abstract.
- The importance and significance of problem finding were more from a theoretical understanding and perspective rather than experience.

- The interviewees also very seldom thought about the possibility of changing the situation.
- Most of the interviewees were not willing to make a start when they saw the practical limitations and difficulties.

Chapter 6 Problem Finding Knowledge and Experience: School Perspective

6.1 Case Studies at Secondary and Degree Levels

The discussion in the following paragraphs is based on the findings of a case study in two secondary schools and a university design school. The major objective of the case study was to explore how problem-finding elements could be incorporated in the design curricula of the schools with respect to the different levels, natures, settings, teaching and learning activities, educational goals, teachers' and students' backgrounds and experiences, etc.[82]

6.2 Backgrounds of the Students and Teachers

(A) Students in the Secondary Schools

According to the basic school records, the backgrounds of the students in two secondary schools were quite similar. Both schools were located in public estates and most of the students were living in the estates or the surrounding districts. The students came from higher-lower class or lower-middle class families. This study confined its scope to the selected two secondary schools with students having similar living standards and living environments. Besides the practical difficulties and

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[82] For the details in the methodology and research setting of the case study, see Chapter 2.

limitations of involving the schools,[83] the major reason for this scope was that there were already a significant number of variables in the study, such as the level of studies, gender, learning experience in problem finding, etc. Therefore, after considering the feasibility of data collection and analysis, and to have a more focused discussion in the relevant sections, this study chose students from similar family and living environment backgrounds as informants. Of course, the influence of family background on problem finding in the design curricula is a factor worth study in the future, but it was not the focus of this study. Nevertheless, by using the results of this study as a reference and starting point, it is expected that other researchers can achieve useful results. Where necessary, the following discussion refers to the students' individual family and living environment backgrounds.

Levels of studies and number of students:

- Secondary Two (School A): 18 students
- Secondary Four (School B); 12 students

Gender distribution:

- School A: 18 boys
- School B: 3 girls and 9 boys

The students in the same level had the similar ages:

[83] For additional material on the difficulties in contacting and inviting schools to participate in the case study, see the detailed information in Chapter 2.

- Secondary Two: 12-13 years old
- Secondary Four: 14-15 years old

With respect to design learning experience, all of the students who participated in the study had studied D&T before this study started. The S.2 students already had completed about one year of D&T learning experience in School A, while the S.4 had completed about three years of D&T learning experience in School B. No students were transferred from other schools.

According to the teachers' information, none of the students had any apparent physical or mental disabilities, and none were specially gifted or talented in design and other areas of learning. In the words used by one of the teachers, the students were quite "average" and "normal" in ability.

(B) Students in the Design School of the University

A group of full-time Year One and a group of part-time Year Two degree students were invited to participate in this study. They were studying in a design and engineering-related programme, which was co-hosted by a design school and an engineering department in the same university. The design school offered the design subjects of the programme, while the engineering department offered the engineering subjects. The students' backgrounds were quite varied, with respect to educational and family backgrounds. The details of the students were as follows:

Levels of studies and number of students:

- Year One group: 24 students
- Year Two group: 18 students

Gender distribution:

- Year One group: 14 boys and 10 girls
- Year Two group: 12 boys and 6 girls

The full-time Year One students were all of similar ages, that is, from 20 to 22 years old. The part-time Year Two students had significant differences in their ages, from 19 to 37 years old.

The full-time Year One students also had quite similar educational backgrounds. Some of them came from S.7 with their Advanced Level examination results; and some of them were higher diploma graduates. None of them had any long-term working experience other than short-term summer jobs. These students attended the programme in the daytime.

The part-time Year Two students varied in educational and working backgrounds. Some of them had from one to fifteen years of working experience in the industry, while some of them had just graduated from higher diploma programmes and were without any working experience. Among 18 students, 5 had an engineering education background, and 3 of them a design education background in their higher diploma studies. The remaining 10 students had finished their S.7 study and then entered the university with their Advanced Level examination results.

These students took the programme mainly in the evening, although sometimes they were required to take some time (such as workshop training) on Saturday in the daytime.

Among the 18 part-time students, 16 students were working. The two non-working part-time students mentioned that they were treating the programme as a full-time study. Their major reason was that they had originally applied for the full-time programme. However, because they could not enter the full-time programmes, they successfully applied for the part-time programme. These two students liked to call themselves full-time evening students. They came to the programme from the S.7 level with Advanced Level results. Compared to other students, these two students were younger and did not have any working experience. Except for these two, there were no significant differences among the students in the same year of the programme.[84]

Some of the part-time students had design knowledge and experience from design-related programmes and/or were working in the industry.[85]

According to the information provided by the teachers, none of the Year One and Year Two students had any apparent physical and mental disabilities, or possessed particularly brilliant talents.

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[84] Some of the differences in the individual performance of these two students in the case study will be discussed in the coming paragraphs as necessary.

[85] More detailed students' background will be presented in the following paragraphs where necessary for analysis and discussion.

(C) Teachers in the Secondary Schools

A D&T teacher in each school was invited to participate in the study. Two school teachers had D&T teacher training from the institute of education. The two teachers are males.[86] Teacher A in School A was 28, and Teacher B in School B was 38. The two teachers had teaching experience in D&T at both junior and senior secondary forms, even though School A did not offer senior form D&T. The younger teacher had 6 years D&T teaching experience, and the older teacher had 15 years teaching experience in D&T. They were both D&T subject panel teachers/coordinators in their schools.

Besides regular D&T lessons, two teachers also organised extra-curricula activities related to design activities after school. One of them also participated in a D&T teachers association as committee member.

According to the comments by the principals of the two schools, the two D&T teachers were both good and experienced in teaching and helping students. Observations in the D&T workshops confirmed the principals' comments.

[86] There are very few female D&T teachers in Hong Kong. During the study period, there were 2 to 4 female teachers involved in D&T teaching. There was neither a female examination officer nor a curriculum development committee officer. About ten years ago, there was one female D&T teacher who participated in the examination and curriculum development committees. Later, she was no longer involved in voluntary education service. This situation also explains why the interviewees mentioned in pervious chapters are men.

(D) Teachers in the Design School of the University

Two university teachers who were also project supervisors[87] were invited to participate in the study. Teacher C taught a design subject to the Year 1 students, and another Teacher D taught a design subject to the Year 2 students in the same programme.

These two teachers were males.[88] Teacher C had industry experience before he joined the university as professor. Teacher D had no long-term industry experience, but he had higher academic qualifications in design studies. They each had more than 10 years of teaching experience in design studies and project supervision. Their major design area was industrial and product design. They participated in the teaching of design subjects to both the design and the design and engineering programmes.

According to the comments of the students who participated in the study, the two teachers were good at teaching and helpful to students. From observation during the case study period, the teachers were also willing to help to the students.

[87] For easy discussion in this thesis, the term "teacher" will be used in the following paragraphs.

[88] There were no female design professors teaching in the industrial and product design programmes in the university. There is no restriction or bias on the gender with respect to the professors in the university. Nevertheless, the gender of the teachers was not the focus of this thesis since, though the gender issues will be discussed in the following sections where necessary.

6.3 Previous Problem Finding Experience of the Students

(A) Previous Problem Finding Experience in the Secondary Schools

The S.2 students had about one year's D&T learning experience, and the S. 4 students had about three years before participating in this case study. From the outset, and including design and technological theories, the project experience of the S.4 students was better than that of the S.2 students. The S.4 students also had better knowledge of and skills with handling hand and machine tools.

On the subject of problem-finding experience in the secondary schools, according to the teachers and the questionnaire[89] completed by the students, the two levels (classes) of students who participated in this study had received no particular organised problem-finding knowledge or experience in the schools or in any other schools. Some of them were members of extra-curricula activities and interest groups related to design knowledge and skills, for example, designing and making a paper weight or a photo frame by using simple hand tools.

Regarding projects in the D&T lessons, neither the S.2 nor the S.4 students had been required or allowed to find problems and define project titles by themselves. As indicated by the teachers, the students in general were provided a title in their D&T projects. After that, the students, particularly those in the lower form, were required to tackle the problem directly and propose some design ideas and solutions. After selecting a final solution, the students were required to produce the design outcome.

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[89] See Appendix III.

Realizing final solution was considered a very important step in the design process at these schools.[90] The students spent most of their time on this stage of work. As D&T is a product-design oriented subject, most of the time the produced outcomes were three-dimensional.

The senior form secondary students were sometimes required to carry out simple research related to the assigned project brief, instead of only directly generating design ideas. The students were required to get an endorsement from their teachers on the design direction.

On the other hand, some S.4 students stated that they had some experience in problem finding by joining non-D&T extra-curricula activities. For example, in some social service activities in the school, the students were required to dig out issues and then define the direction of their contribution. As stated by one S.2 student:

> "I like the experience. It is because I could use time to find out what I needed to give help to the society."

However, the students also indicated that they had not had this kind experience in their regular D&T curriculum.

In addition, both S.2 and S.4 students had only done individual projects in D&T studies. They had not done any group projects before. The teachers specially pointed

[90] This is also very true of the situation in other schools, because the D&T curriculum in Hong Kong is still very biased towards the final physical output of a design; that is, its physical outcome.

out that asking students to handle group projects was very complicated, and sometimes troublesome to assess. The teachers believed that the students were not mature enough to handle group design projects, particularly in the realisation stage. Teacher A indicated that he had tried to arrange group project with students several years before. However, the result was not satisfactory because he needed to spend a lot of time helping the students organise the work among group members, and he found it quite difficult to do the assessment. On the other hand, the students mentioned that they had done some group research projects in other subjects, such as English, Social Science and Geography. After playing back these students' comments to the D&T teachers, one of the teachers further indicated that he had thought about having the students do group research on the assigned topic and then do the realisation of the project individually. However, in the end, he had not done it. He pointed out that the research period for the students is so short — just as little as one week — and it was not worthwhile under such tight project schedules.[91]

The previous problem finding experience of the secondary students can be summarised as follows:

- The S.4 students had got more project experience and knowledge than the S.2 students.
- Nearly all of the two levels (classes) of students had received no particular organised problem-finding knowledge or experience in the schools or in any other schools.

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[91] Group projects in design in secondary and degree levels are another good topic for further study. However, very few people in Hong Kong have done this kind of research. The author did some studies on this topic focusing on group thinking; that is, "relay thinking" (see Siu, 2000d).

- Only some S.4 students had some experience in problem finding by joining non-D&T extra-curricula activities.
- Neither the S.2 nor the S.4 students had been required or allowed to find problems and define project titles by themselves.
- The S.4 students were sometimes required to carry out simple research related to the assigned project brief, instead of only directly generating design ideas.
- Both S.2 and S.4 students had not done any group (design) projects before, though they had done some group research projects in other subjects.

(B) Previous Problem Finding Experience in the Design School of the University

The design experience of two groups of degree students were slightly different, since the Year 2 degree students had taken one more year of study. According to the teachers' information, Year 2 had tackled three more different design and engineering projects than Year 1 students.

Moreover, the degree students had more project experience. As one of the Year 2 students stated:

> "Unlike secondary school, nearly all of the subjects in the design school [of the university] require students to do projects. It is what we call the project approach. We also do not have an examination like those in other departments. Therefore, we have a rich experience in projects"

However, degree students in both levels (classes) had still had no problem-finding experience in projects in their degree studies.[92] According to the teachers and the questionnaire to the students,[93] titles had been assigned by the teachers in the subjects that they had studied so far. For example, some projects focused on sustainability design, some focused on human factors and some focused on fulfilling a particular technical or engineering task.

When the students who had taken D&T or other design-related subjects in the secondary school were asked whether they had problem-finding experience in their degree studies so far, there was only one student in the full-time group (Year 1) and three students in the part-time group (Year 2) who had problem-finding experience in their other subjects.

The Year 1 full-time student stated that he had the problem-finding experience because he had studied in an international school in Hong Kong. The school adopted the D&T syllabus from England.

One of the Year 2 part-time students stated that she had problem-finding experience when she was studying a design diploma programme in a college in Canada. She had finished the diploma programme, and then returned Hong Kong with her parents. At the time she was interviewed, she was working in a design firm as an assistant product designer. Another two part-time students stated that they had problem-finding experience in their final projects in their diploma studies (that is,

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[92] As stated before, this programme was different from conventional design programmes, though it was offered in a design school. The programme had both design and engineering elements in the curriculum. Besides taking core engineering subjects, the students were also required to take some design subjects as their core and elective subjects.

[93] See Appendix IV.

before they entered the university).

Like the secondary school students, the degree students pointed out that they had some "informal" or "non design subject-related" problem-finding experience in other school or social activities. For example, a student mentioned that he had some experience in problem finding when he joined programmes at a youth centre. The activities were related to youth development. Another student mentioned that he had some problem-finding experience when he was a scout at his secondary school. Some kinds of training required him to find problems in a provided situation. He then had to solve the problems with other scout members in the same team.

There were in general two major types of titles assigned to the degree students by the teachers in a project, unlike from the secondary students who only got experience in individual projects with single assigned title:

- An title assigned to all of the students in a class;
- An list of project titles assigned to all of the students in a class.

Besides the number of titles available for selection, there were also different settings for the projects in the degree levels. The settings included whether the projects were individual or group projects, and whether the project titles in a list were allowed to be repeated or not. According to the students' questionnaire feedback, they had both individual and group design project experience before the case study. As reflected by the Year 2 students, group projects or assignments were quite common in the design programme.

The previous problem finding experience of the degree students can be summarised as follows:

- Unlike secondary school, nearly all of the subjects in the design school of the university require students to do projects.
- Nearly all of the degree students in both levels/classes had still had no problem-finding experience in projects in their degree studies.
- Only very few students had problem-finding experience if they had studied in international schools or in other countries.
- Some had received some "informal" problem-finding experience in other school or social activities.
- Most of the time, in the subjects that they had studied, titles had been assigned by the teachers.
- There were in general two major types of titles assigned to the degree students by the teachers in a project: (i) an title assigned to all of the students in a class; and (ii) an list of project titles assigned to all of the students in a class.
- The degree students had more group-project experience.

6.4 Case Study: Problem Finding Activities in a Project

(A) Problem Finding Activities in the Secondary Schools

The two secondary teachers who participated in the case study were invited to discus the detailed arrangements for putting problem-finding elements in the projects for the students. The detailed arrangements of the projects were confirmed as follows:

- A new 7-week project was started in each class (that is, a class in S.2 and a class in S.4).

- The project was an individual project for each student. One of the reasons for this arrangement was to observe the individual performance of each student in problem finding. Another reason was to eliminate the relatively more complicated variables, such as the group dynamics and individual group members' contribution, even though group projects are a worthwhile subject for future studies.

- Each student was required to identify a project problem and then a project title by him or her self. There was no restriction on the title of the project, including the time allotment, though the teacher offered constant supervision and advice on the students' progress, in order to make sure that they could finish the project on time.

- The students were required to finish the whole project within seven weeks and to submit the final solution and a 5-minute verbal presentation with some presentation aids (that is, by using their 2-dimensional or 3-dimensional output, or some visual aids).[94]

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[94] The quite short presentation was mainly due to the constraints of the lesson time. There were only about 70 minutes (two periods) for the D&T lessons each week.

- In order not to create unnecessary variables or factors affecting the study, no particular technological theories and skills were taught during the project. The students could use their existing knowledge and skills to finish the project. Thus, the main objective of the project was to see the result of implementing problem finding in the design process.

Students were given some directions to meet some D&T syllabus objectives and to help them in problem finding. The students were asked to find a problem that could help deprived people in society. Such people included older people, the visually impaired, physically disabled people, and those living in poor environment without sufficient basic necessities, etc. The students were required to use hand tools and simple machine tools in the workshops to produce their final solutions. Since the natures, scales and dimensions of the students' final outputs were different; the students might product a scale model or prototype of their concepts instead of a full-scale functional final output.

As indicated in Chapter 2, besides investigating the students' background understanding in the questionnaire[95] and interview, the following research activities were carried out during the project to review the problem-finding performance and the comments and feedback of the teachers:[96]

- Observations throughout the whole project.

- Interviews with all of the teachers at the middle of the project period (week 4).

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[95] See Appendix III.

[96] For the details, see Chapter 2.

- Interviews in the form of casual talks with the students at the middle of the project period (week 4). Due to the time constraints, only some students were randomly selected for interview.

- Interviews with all of the teachers at the end of the project period.

- Small group discussions with all of the students at the end of the project period.

- Interviews with randomly selected students, including individual interviews and small group discussions and interviews. Compared to the group discussions with all of the students indicated above, these interviews and small group discussions in this stage were more in-depth in nature, in order to elicit more specific and individual comments on the problem-finding experience.[97]

This stage of understanding students' feedback could be considered the most important part in the case study. It was an in-depth review of the performance of the students, and also helped understand the change in students' thinking as a result of the project.

(B) Problem Finding in the Design School of the University

The two university teachers who participated in the case study were invited to have

[97] For the sample of the in-depth interviews and small group discussions, see Appendix V. The sample was a record of small group discussion with the university design students. Similar notes were recorded during the discussions with the secondary students.

discussions about the detailed arrangements for putting problem-finding elements into the students' projects. These project arrangements for the degree students were similar to those in the secondary students' projects, though some of the arrangements had to be different due to the different natures, levels and setting of the learning environments. The major reason for the similar settings in the case study at two levels was to see whether there was association or relationship between the two levels. The detailed arrangements of the projects were as follows:

- A new 14-week project was started in both classes.

- The projects in Year 1 and Year 2 were individual projects for students. Like the case study in the secondary schools, one of the reasons for this arrangement was to observe each student's performance in problem finding. Another reason was to be more focused in the study; that is, to eliminate the relatively more complicated variables, such as the group dynamics and individual group members' contribution that are present in studies about group projects.

- Unlike the common practice of teachers providing well-defined scopes, directions, topics or data sets, the students were required to identify problems and project titles on their own, and then to propose solutions. There was no restriction on the title of the project, including the time arrangement, though the teacher gave constant supervision and advice on the students' progress in order to allow them to finish the project within 14 weeks.

- Instead of simply recognizing existent problems, the students were encouraged to discover emergent problems and identify potential ones.

- The requirements of the project were that the students had to finish the whole project within 14 weeks. Finally, they had to submit the final solution and a 15-minute verbal presentation with some presentation aids (that is, by using their 2-dimensional or 3-dimensional output, or some visual aids).

- In order to be focused and not to create unnecessary variables or factors affecting the study, no particular technological theories and skills were taught during the project. The students were required to use their existing knowledge and skills learned to finish the project. If they needed special help, they could ask the teachers and technicians to give advice and assistance.

After discussing with the teachers how to avoid the students being entirely free "to do what they wanted" and perhaps get lost in the projects, some simple guidelines and requirements were set for the benefit of the students to help them in problem finding. That is, the students' identified problems needed to be related to the "daily life of Hong Kong people".

Similar to the study setting in the secondary schools, all the degree students were required to design a project title based on the problem they identified. Each of them also had to carry out research and then use what they learned to produce a final solution, and make a presentation at the end of the project.

The overall structure of the research activities in the design school was nearly the same as in the secondary schools. The major difference was in the project duration, due to the practical constraints and more rigid timetable at the university. This similarity was expected to show whether there was any relationship of the findings in two levels.

Besides the background understanding of the students from the questionnaire[98] and interview, the following research activities were carried out during the project to review the problem-finding performance of the students and the comments and feedback of the teachers:[99]

- Observations throughout the whole project development.

- Interviews with all of the teachers at the middle of the project period (that is, the 8th week).

- Interviews in the form of casual talks with the students at the middle of the project period (that is, the 8th week). Due to the time constraints, only some students were randomly selected for interview.

- Interviews with all of the teachers at the end of the project period.

- Small group discussions with all of the students at the end of the project period.

- Interviews with some of the randomly selected students (including individual interviews and small group discussions and interviews). Like the setting in the secondary schools mentioned above, these interviews and small group

[98] See Appendix IV.

[99] For the details, see Chapter 2.

discussions at this stage were more in-depth in nature, in order to elicit more specific and individual comments on the problem-finding experience.[100] Similar to the case study in the secondary schools, this stage of understanding students' feedback could be considered as the most important part in the case study. It had an in-depth review of the performance of the students, and also helped understand the change of students' thinking before and after the project.

6.5 Findings and Discussions of the Case Study

(A) Case Study in the Secondary Schools

The findings and discussion of the case study in the secondary schools are presented in the following sections. Most of the time, the findings in the S.2 and S.4 classes are offered together for the discussion convenience. For example, similar results in two classes are discussed together. Sometimes the findings of a particular class are picked out to draw attention to a special case or situation.

<u>Performance between male and female students</u>

As stated in the review of the backgrounds of the two classes of students, no girls participated in S.2 class in the case study.[101] There were 3 girls and 9 boys in S.4 class participated in the case study.

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[100] For a sample of the in-depth interviews and small group discussions, see Appendix V. The sample was a record of small group discussions with the university design students.

[101] For reasons and justification for this limit to this study, see the above section about the

Overall, there was no significant difference between the responses of boys and girls in the questionnaires and the interviews.

As agreed by Teacher B, there was also no significant difference in the overall project performance between boys and girls in his D&T class (School B). In particular, the number of the total students participated in the study was not so great (for example, only three girls in S.4 class). There was no significant evidence to illustrate a "general" difference in performance between boys and girls.[102]

According to the feedback of Teacher B and the observations during the project, the only relatively more noticeable difference between boys and girls in classroom or workshop performance was that girls were more likely to come to the teacher to ask questions. Teacher B pointed out that it was a quite common norm in Hong Kong, not only in this project.

Students' initial perceptions

According to the questionnaire (see Appendix III), before the project started, 14 out of 18 students in the S.2 class and 9 out of 12 students in the S.4 class strongly agreed that problem finding was important.

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backgrounds of the selected students.

[102] For the constraints of finding girls to participate in the study, see the previous discussions about the methodology and the background of the students.

The questionnaire and interview findings showed that most of the students in the two classes had a common perception that problem finding was not so difficult, or at least that it should not be more difficult than problem solving. The questionnaire findings showed that 13 S.2 students and 5 S.4 students had a neutral opinion, disagreed or strongly disagreed with the statement that problem finding was difficult. Although the sample of the students was somewhat small to represent a generation comment, the finding raised the possibility of having further studies on whether younger students would think that problem finding was not difficult.

In the interviews with the students, several students pointed out that learning problem finding was "unnecessary", since it was quite simple. In fact, these kinds of students' perception were similar to those in two smaller-scale studies on a similar topic in 1992 and 1999 (Siu, 1994, 2002b). Without real practice in problem finding, many design students perceived that it is easy to handle problem finding.[103]

When asked in the interviews why they held this opinion, one of the students in the S.4 class stated:

> "Just finding a problem — I don't think it is difficult. You just need to find and point it out. You don't need to guarantee anything. I can give you hundreds of problems now. For example, why cannot I fly? How I can I run faster? How can a dog swim under water? How can a space shuttle return safely to the earth? However, I think that solving problems

[103] For the changes in students' perception about the difficulty of problem finding, see the discussion in the later paragraphs.

is much difficult. Very simply, some problems are difficult to solve — without any solution."

Another S.4 student stated that his teacher had told her about this:

> "I asked my teacher last year whether I could identify a title by myself in the project. I also told the teacher that it was because I wanted to try. However, the teacher told me that finding a title was not so difficult and I could be allowed to do it in later in my studies."

Both the questionnaire and interview illustrated that the students in two classes had no problem-finding experience in their D&T lessons, but that some of them had problem-finding related experience in other subjects, extra-curricula activities and activities outside the schools. However, there was very little of this experience. The students also indicated that this kind of experience was piecemeal, and there were no well-organised activities to let them to understand more about problem finding. As pointed out by a S.4 student who had this kind of experience before:

> "This kind of problem-finding experience obtained in other activities gave very little help in problem finding in the design project. It is because problem finding in other activities was just for fun, and there was no systematic or organised way to do it. ... But I guess problem finding should not be so difficult in design, since I could handle it well in other activities."

There was a quite interesting point referring to the findings from the questionnaire and interviews: on the one hand, a majority of students thought that problem finding was important, while on the other hand, many of them were not willing to spend time on it — even in a trial. In addition, a significant number of the students believed that problem finding was easy to handle and required no special learning or practice. Whether the students changed their opinions or perceptions is discussed in later sections.

Teachers' perceptions

The two teachers' responses both pointed out that problem finding was important. Unlike many of the students' views, the teachers pointed out that problem finding was not an easy task in design. When asked why they thought that problem finding was not easy, they simply pointed out that they had tried it before.

However, the teachers also said that the students were quite young and it might not be necessary for them to have problem-finding knowledge and experience in junior form. As Teacher B pointed out, the students would get it in their later studies, such as university studies. The teachers also further explained that intensive D&T curriculum and limited time for D&T lessons (for example, two 35-minute classes a week) were two major reasons that hindered them from giving such experience to the students.

The teachers' perceptions could also give some hints about why problem-finding activities are so rare and relatively less of a concern in schools. The teachers' *theoretical* perception of the importance of problem finding did not imply that the teachers would put problem finding as a "must" in the curriculum. In another conversation Teacher A also agreed:

> "Problem finding — I mean need identification — should be important in D&T. If not, it should not be included in the National Curriculum. However, compared to other knowledge and skills in D&T, I would prefer to allow the students to spend more time on other skills, such as design thinking and generation of design ideas."

Moreover, as discussed above, the teachers agreed that problem finding was a difficult task in design. However, this "difficulty" was not a reason to push the teachers into putting problem finding into the D&T curriculum and making the students learn it. Instead, the teachers only put it as a kind of activity, which could be and should be learned only at higher levels of education.

In addition, the findings of the interviews with the students illustrate a point, which had not been discovered in previous studies; that is, the teachers' responses and perceptions that the "intention" of the students' requesting problem-finding activities hindered or de-motivated the students from participating in problem-finding learning. A girl in the S.4 class stated:

> "I haven't asked the teachers to let me identify my project title. It is because I am afraid that the teachers may think that I want to make some personal items for myself in the D&T lessons, such as decoration gadgets."

Another student added:

> "I haven't asked to my teachers about this before also. I think if I ask, it will make the teachers think that I am lazy and want to make my project easier."

Process and performance

The teachers agreed that nearly all of the students could focus their investigation and thinking within the suggested scope; that is, the needs of deprived people.[104] However, the two major areas of weakness in the students' performance were how to collect the related data and how to critically organise and select the data for consideration and analysis.

From observation, students facing difficulties in problem finding were more obvious at the beginning of the project. At the beginning of the project, both classes of students had difficulty in identifying problems. As pointed out by the students, one of the simple and direct reasons was that they had no experience. They did not know how to *start*. After the teachers gave some guidelines and suggestions to the students to help them understand the scope (such as what was the meaning of deprived persons) and some ways to start to search the data, the situation improved. Teacher A who took care of the junior form students said:

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[104] The author did observe quite frequently during the projects. However, it was not possible for him to stay in the classroom at every minute during the students' projects. Therefore, the teachers were interviewed for their observations on the students' performance.

> "I think that the students cannot do problem finding well by themselves if they do not have any advance experience. Therefore, giving guidance is very important."

Both S.2 and S.4 students' responses were similar to Teacher A's opinion. The students felt that problem finding was difficult. They stated that it was because many of them had no experience in it. The requirements of previous projects had mostly just required the students to "solve" a pre-determined problem, or select a title from a set of provided titles and then solve it.

As discussed in Chapter 3, problem finding includes the elements of enquiry and research (Getzels, 1987, Runco, 1994, 2003). Before the case study project, the students had done very little research activities related to design projects. The students pointed out that in their past projects, they had not been required to do any *serious* research on the assigned topic or title. They also had not been given any time to do it. They had only needed to sit down, think and generate design ideas for an assigned design brief or title, and realise the ideas. A S.4 student pointed out:

> "Most of the time, we received project title in D&T class. We started to *do* (做)[105] the assigned project right after we received the title. We needed to stay in the workshop[106] to start the project on the same day of

[105] The student emphasised the word "do" (in Chinese: "做"). In Chinese, the word "做" has a connotation related to "making" rather than "thinking". This student's feedback more or less reflects the current public impression and the students' impression that D&T is more related to making a good physical output than thinking about a problem.

[106] D&T workshop in Hong Kong is the combination of classroom and workshop. For a standard school, the facilities, including drawing facilities, are quite good for the students to do their design

the title delivered to us. I can still remember, in one of my projects, I asked the teacher to allow me to go to the library during the D&T lesson. He refused me to do it since I needed to stay in the classroom. Therefore, what we could do is to think about the project title instead of doing any research on it."

Another S.4 student added:

"A D&T project in general lasted for three to six weeks. Most of the time, after we received a project title, we were only allowed to think about it and then to start generating some rough ideas within the class on the same day. ... Unless we had a very strong reason to change the direction of the design, most of the time the teacher would not allow us to change the design direction once it was set."

Teacher A stated the same situation and constraints in D&T lesson:

"One of the reasons for such situation is that most of the time students are required to finish their projects in the D&T class. The very common practice in Hong Kong is that a teacher gives a title to the students, and then asks the students to think it for a while — say, a period [two periods per week] — and then to start sketching some rough ideas on paper. This situation is more apparent and a common practice in the junior forms. So, research activities in D&T are not as significant as people think."

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development and realization work of their projects.

"… In recent years, there may have been some changes in this situation, because some D&T workshops have computers connected to the Internet. Some teachers allow students to do research through web search in the workshop. However, it is still not so common, since most teachers want their students to be focused on design idea development. And, accessing Internet in workshops may create classroom management problems. For me, at least I will not allow students to do it."

"… Of course, students' research is important for the S.5 public examination project. The students are required to spend quite a lot of time in research since they need to submit a research report for assessment."

Compared to the S.2 students, the S.4 students showed better performance than S.2 students in investigating a possible topic. As pointed out by the teachers, the senior form students at least had more research experience in idea development. They also had some research experience in other subjects. And, they were required to gain research experience to prepare them to do research for their HKCEE project in S.5. Thus, the students knew how to find some facts and evidence to support their problems and project titles.

Regarding the students' overall performance in problem finding, the teachers pointed out that nearly all of the students did not have the confidence to identify a problem on their own. Some of students repeatedly came to their teachers to say that problem finding was difficult and some then asked for a problem or a title assigned by the teachers. Some of the students came to the teachers frequently to "check" whether the problems they had found were good enough to be acceptable by the teachers. The situation reflected that the students were unable to make judgements whether their identified problems and titles fitted the project requirements. As Teacher B pointed out:

> "Instead of providing evidence and reasons to support their thinking, many students expected to ask for the endorsement, and asked me for reasons to justify their choice in project titles."

In the final evaluation of the projects, the students gave feedback that they sometimes felt frustrated in problem finding, since it was difficult for them to judge "critically" whether a problem was good (that is, correctly identified or defined) or not. A S.4 student pointed out:

> "There is no systematic way to allow us to judge whether or not a problem is good. When I asked my teacher, he also could not give me a more concrete answer about it. He only asked me to think about it and make a decision. However, I noticed that he was the only person to tell me whether or not the problem I identified was good enough to proceed. It was also the reason why I always asked the teacher questions"

A student in the same class further compared problem finding and problem solving:

> "If it was difficult to judge objectively whether or not a solution was good, then judging a problem objectively should be even more difficult."

Therefore, according to the observation, the students' most common questions to the teachers were:

"Can this be a problem and a project title?"

"Can I change this problem to a project title?"

"Is this title good?"

Moreover, the students also found difficulty in converting a problem or several problems to a project title. Borrowing Jay and Perkins' (1997) definitions, the students experienced difficulty defining and formulating the actual problem statement (or problem topic, title or brief) and carrying out continuous problem reformulation. This was the reason why some students always submitted several problems to the teachers and requested their help in making a decision.

In addition, according to observation of the students' performance in class, the flexibility of problem finding was a source of difficulty and confusion for the students. As stated by a S.2 student, problem finding was different from idea generation. In generating design ideas, he could ask particular questions related to the assigned title or topic — a well-defined title or topic. However, the most difficult thing in problem finding was that even he himself did not know how to ask or what should be asked, since his problem/title of the project was not well defined.

As referred to in another study, the difficulty students faced in problem finding in the design process could be more or less reflected in the time the students spent on it (Siu, 2002b). Regarding the time the students spent conceiving the problems and formulating the problems to the project titles in a 7-week project, the mean value was three weeks. Three students in S.2 and one student in S.4 needed to spend more than 4 weeks to find a problem and generate project titles. As pointed out by the teachers, without them pushing the students to submit the identified problem and project titles, more students would be delayed more.

According to the observation, besides starting slowly in problem finding, another reason for the long duration was that the students liked to change their identified problems and project titles continually. In other words, they could not confirm their identified problem and title. As discussed above, the students like to pick several problems and titles and then ask for the opinions and in particular their teachers' endorsement. Many students stated during the group discussions that they really did not have any experience or confidence in make the decision. They also agreed that their teachers had the authority and experience to make a "better" decision then them.

Besides experience, another reason was that the students would change their identified problems and titles due to the foreseeable difficulty of the project in the later stages of a design process. When asked why he continually changed his project title, a S.2 student replied:

> "When I tried to find a problem about the deprived people, I did not think about the difficulty of the design development. I thought that my defined

problem was good. However, when my classmates asked me how I would do it, I then realised that I would be in trouble later. ... My teacher also asked me the same question. Therefore, I decided to change my identified problem and also the title."

Another student responded the same question from another perspective:

"When I started to search for a problem. I know that it would finally become my project title as the teacher had stated at the beginning of the project. I continuously kept in my mind that my project should not be a difficult one — I mean that I could be able to make it."

Referencing several previous studies on the similar topic (Siu, 1994, 2001b), the findings of this study in the secondary schools were slightly different from the previous findings. In particular, the junior form students seldom mentioned the terms "assessment", "examination" and "grades". Their concern was whether an identified problem could be converted to a title that was possible for design development. Of course, they also considered whether they could finish it. When the teachers were asked about this situation, both of them pointed out that it might be the low examination pressure in D&T in junior form. Teacher B stated:

"D&T is an easy subject. Teachers seldom fail students. We expect the students to enjoy it in lower forms, even though the curriculum is very intensive if a teacher follows the recommended syllabus by the HKCDC. From Form 1 to Form 3, students need not face a public examination. Most of them will also not study D&T in their higher forms nor take any public examination.[107] So, not so many students worry about the result of D&T subject."

"... But of course, most of the students want to finish their projects — to see the final product. It is also why D&T is abstract to many students. They can *make* [his emphasis] what they want. They can get a high degree of satisfaction from it. It is also the reason that many of the students don't want to think but rather want to 'make something' in the lesson; they want the final output. You can imagine how happy a student is if he can show his design output to other people. On the contrary, it is not easy for him to show his identified problem to other people — at least not so people that would appreciate it."

Regarding the levels of problems (that is, project titles) found by the students, there were:

- 14 existent problems, 4 emergent problems, 1 no potential problem (by the S.2 students);
- 9 existent problems, 3 emergent problems, 1 no potential problem (by the S.4 students).

When the students were asked about the levels of problems they found, some students pointed out that they did not know what was the difference among these three types of problems. As one of the S.4 students stated:

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[107] There are very few students taking HKCEE and AltS levels of D&T examination. D&T is only a recommended subject for junior form students, that is, S.1 to S.3.

"Even though the teachers told us about the levels of the problem in the briefing of the project, I have no idea about the difference among them. I only think that it was lucky that my teacher endorsed my problem and allowed me to start another stage of the project."

Nevertheless, the result above illustrated that students were very weak in discovering emergent and potential problems, especially potential problems. In fact, it was not a very special situation. As stated by Dillon (1982) and Runco (2003), *presenting* a problem situation is much easier than *discovering* a problem situation. Potential problems are difficult to discover because they do not yet exist as a problem (Runco, 1994, Starko, 2000). The teachers agreed that the students who had no prior experience in identifying and presenting existent problems gave a creditable performance in their first problem-finding projects.

At the end of project, the teachers reviewed the students' designs (that is, final outputs such as models).[108] Both teachers pointed out that the outputs of the students in the project were different from the students' earlier projects.

The first significant difference was that the types of the designs were much more diverse than before. As pointed out by Teacher B:

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[108] As indicated in the Chapter 2, this part of the review relied on the work of the teachers, since only they had seen the students' earlier work.

> "This situation was very obvious and easily to understand since the problems and titles were identified by the students freely. Thus, the titles were diverse, and hence the design outputs were diverse too."

Second, the physical quality — appearance and workmanship — of some designs was not as good as before. When students were asked about this situation, they said that it was because they had relatively less time to produce the final output. A S.4 student stated:

> "The overall project duration of this project was nearly the same as the previous projects. However, I spent quite a long time in research in order to identify a problem and define a title before starting to think about the design ideas. I lost a large portion of time for the realisation of the design ideas. Thus, the quality of the appearance of my final outputs is not good."

Third, besides the difference in the physical quality of the design outputs, the nature and format of the design outputs were also different from before; that is, they were more diverse. For example, a S.4 student presented a schematic diagram with some simple models to illustrate how to help older people stand up from sitting on a water closet after using the toilet. Another student in the same class used a computer programme to assist a single-parent child to cook simple food in home when his/her parent was not at home, while another one made a perfect final functional product to help wheelchair users hang the clothes out of their apartment window safely.

As pointed out by Teacher A:

"In an assigned title, the objectives of a project are the same for all students. The project requirements were also the same for all students. These fixed objectives and requirements more or less directed how the students think, generate and present their design ideas. Therefore, the students' design outputs were quite similar in nature and format at the end."

"... Moreover, sometimes others influenced the students. Some also might copy and modify the good ideas from their classmates. All these situations made the students' design outputs quite similar too."

Change in students' perception

There were some changes in the students' perception of problem finding. As mentioned above, most of the students thought that problem finding was not difficult. During the project period, some students pointed out that problem finding was much more difficult than they had thought when they actually attempted to it. As pointed out by a S.2 student during the project:

"Although the teacher gave some guidelines for us to think about how to help deprived persons, it was really difficult to find a problem. The reason is that a problem is so abstract. It seems that anything can be a problem and then a project title."

> "… I spent more than two weeks thinking about the problem and project title. However, I could not be sure my problem was well identified."

As another S.4 student indicated:

> "Problem finding is not just naming a problem. When I wanted to define a problem well and change it into a project title, I found out that it was not easy. It was because I needed to search data related to the nature, characteristics and contents of the problem."

According to observation, due to the difficulty in problem finding, some students requested their teachers to provide them with a fixed scope or a clearly defined project title. The teachers stated that there were two most difficult time periods for the students in problem finding. The first one was the beginning of the project when the students did not have any clues to follow. The second one was when the students saw that some of their classmates had successfully identified titles and received endorsement from the teachers, while they were still struggling with problem finding. This situation was much apparent in Week 3 and 4 of the project.

On the other hand, although the students found problem finding difficult, their thinking was significantly changed at the end of the project. The findings of the discussion with all students in a class at the end of the project illustrated that more than half of the students in each class indicated that they would prefer to identify project titles — find problems — by themselves in the future.

Some students stated that finding problems by themselves provided them with more space to develop their thinking and imagination. They stated that if a problem (that is, a project title or a set of titles) was determined by their teachers, the latitude for thinking would be narrower. In fact, this response from the students illustrated a very significant change in perception among some of them that more students started to treasure the opportunity of problem finding after overcoming barriers in problem finding and getting some experience in it. As a S.4 students stated in a group discussion:

> "Problem finding is very difficult, but quite interesting. ... Once you get some hints on how to proceed and break some barriers, you will get more motivation to do it."

As another student pointed out:

> "Defining a project title by myself would allow me to have more freedom to do what I want."

Of course, this was not the feedback from all the students. A S.4 student responded to the above opinions:

> "You like it and you want to do it again because you have forgotten the pain at the beginning of the project."

In addition, comparing the students' original thinking on problem finding with their thinking after finishing the project, there were other some changes in students' perception. The changes included some students who originally thought that problem finding was not interesting, and who at the end of the project agreed that problem finding was quite interesting, even challenging.

Before the project started, more than half of the students in S.2 and S.4 classes responded that there was no need to learn problem finding in their junior form study. Also nearly half of the students in S.2 class and one-third of the students in S.4 class agreed that the experience of problem finding would be obtained in the workplace and thus there was no need to have this kind of experience at school. However, after the projects, most of these students changed their minds. Several of them further pointed out that problem-finding experience should be obtained "as early as possible".

Some S.4 students pointed out in the interviews before the project started that problem finding — title identification — was a conceptual skill, and it was not necessary to gain practice in it. At the end of the project, these students agreed that it was better to have more practice in their projects.

At the beginning and middle of the project, more than half of the S.2 and S.4 students thought that satisfaction with a project came mainly from the success of final output — the design solution. At the end of the project, this perception did not change greatly. However, more students recognised the importance of problem finding. Some students also started to treasure some well-identified and justified problems. As a S.4 student pointed out:

> "When I saw the presentation and the project title of Chan Tai-ming [fictitious name], I found out that his research was very good and the title was well-defined. I found myself thinking that I could not do as well as he did."

In fact, similar feedback was given by some of the students in the interviews after the project. The students started to appreciate the creativity of their classmates not only in the final products but also in their ways of *seeing* things and then finding out problems and titles for the project.

Teacher B indicated that the students found D&T *more* interesting since they could see that designs under a same scope could be so diverse in directions and solutions at the end. He explained:

> "If a project title is defined by a teacher, I can be sure that the design outcomes will not be so diverse and interesting. Such as a bookrack project defined by a teacher. No matter how creative and diverse the final designs are, all you can see are still bookracks with different forms presented at the last lesson."

> "… I can say allowing students to identify their project titles at least gives one advantage to the students' D&T learning that, through seeing more diverse design titles and final solutions, they can see and then learn more within a limited time."

(B) Case Study in the Design School of the University

There were two classes of degree students in the design school of the university that participated in the case study. They studied in the Year 1 (full-time) and Year 2 (part-time) of a same design programme. Problem-finding elements were incorporated in two compulsory design subjects. The findings and discussion of the case study are presented in the following sections.

As in the discussion of the findings in the two secondary schools in the previous section, most of the time the findings in these two degree classes are arranged so that they are convenient for discussing similar results in the two classes. Sometimes the findings of one class are picked out because of particular or special cases and situations.

In addition, unlike the last section where the focus of discussion is only on the secondary schools, some of the discussion in this section includes the findings collected in the secondary schools. The major objective of including the secondary school findings is not to compare the collected results between secondary and degree levels. Instead, its key purpose is to see how problem-finding elements could be incorporated in the curricula of the schools at different levels, natures, settings, teaching and learning activities, educational goals, teachers' and students' backgrounds and experiences, etc. In other words, the following discussion expects to generate information to help explore whether there were some related, associated or even contradictory matters in incorporating problem-finding elements in the curricula of these two levels.

Performance between male and female students

There were 14 male students and 10 female students in the Year 1 class, and 12 male students and 6 female students in the Year 2 class who participated in the case study.[109]

Overall, there was no significant difference in performance on the project between male and female students. There was also no significant difference between the responses of male and female students in the questionnaires, interviews and group discussions of this study. As the two teachers (Teacher C and Teacher D) as well as the students themselves also agreed, the most apparent difference between the male and female students was that the male students in Year 2 were more willing to express their opinions in some group discussions. Sometimes they dominated the discussions, requiring the author to stop and ask questions of other students.

The two teachers of these two classes also stated that there was no significant difference between male and female students in general design performance in each class with respect to their previous design projects and assignments. The teachers pointed out that the female students in general were more hard-working and they were would more like to follow the instructions and requirements of the teachers in projects and assignments. From observation, with respect to the project of the case study, the fact that the female students worked harder than many males gave them advantage in research work and in turn also allowed them to collect sufficient evidence and information to fix their project titles earlier than most male students.

[109] For the details of the backgrounds of the students, see the beginning of this section.

In the same way as the S.4 girls in the secondary school, in general, the female students requested help from teachers more frequently than male students. On the other hand, some male students also asked for help frequently. As the teachers stated, the major difference was that most of the female students came with research data to seek for further advice in the tutorials, while many male students (in particular the part-time male students) brought nothing to the tutorials.

Performance among students in a class

The performance of all of the Year 1 students on their projects was quite similar. Because of their different backgrounds, some students were smarter in design while some of them were better in engineering.

There was more difference in project performance among those in Year 2. Some of the students had been working in the industry for many years. These students saw a project and tackled it quite differently from students with less working experience. The difference went to two extremes. Some of the students with good work experience constantly wanted to skip some work and make the thing as easy as possible. For example, these students might be more likely to identify or present a simple existent problem and then finished the project as soon as possible. They did not want to spend more time on "discovery". They continually asked the teachers: "Is it sufficient?" and "Will I get a pass grade by doing this?" A Cantonese saying that describes this kind of study and work attitude: "My goal is to take the most convenient way". This attitude also accords with a very popular saying by students in the part-time programmes in Hong Kong: "I just want to get a pass". On the other hand, some of the students with good working experience wanted to get a better result in their studies. They were hardworking and always pushed themselves to be the best in class. They were also the group who always came to their teachers to seek for additional tutorials and endorsement of their work. The quality of the presentation of their projects was related to the aggressive way they pursued a good grade. Most of the time, they would use their work places' professional facilities to generate a perfect presentation of their work. However, they were the minority.

The students with less working experience were the younger members of the class. Many of them were relatively better in theoretical studies. However, most of them were "followers" in class. Most of the time, they would see how the senior students reacted and then took action. This situation did not exist in the full-time class because the age and experience of the students were the same.

In addition, the students with more work experience were more willing to express their opinions. For example, in the discussion of problem-finding knowledge and experience, the students with more work experience always actively pointed out their difficulties and constraints in problem finding. To prevent the feedback of this senior group of students influencing others, some individual interviews and small group discussions were conducted during the project in order to collect students' feedback from different perspectives.[110]

[110] For the justification of the research methods, see Chapter 2.

Comparing performance of two classes of students

The project performance between the full-time (Year 1) students and the part-time (Year 2) students was quite different. In addition to the individual student backgrounds in the different classes, a major cause of difference the modes of study of Year 1 and Year 2. For example, the studying time and project time for the full-time students were more flexible than those of the part-time students. They could more conveniently access the university's resources, including university libraries, special workshops and other supporting departments such as the Industrial Centre. The full-time students also approached the teacher more frequently than the part-time students, since they had more time at the school. As indicated by one of the Year 2 students at the end of the project:

> "Studying in a part-time mode involves facing quite a lot of limitations and constraints. In this project, our project supervisor expected us to do research, such as field visits and interviews, before fixing our own project titles. The practical situation was that it was not easy for me as well as many of us to do it. For example, I wanted to see how the public transport policy in Hong Kong was affecting people's daily lives and then do some design to improve the situation. However, it's very difficult for me to hold interviews with government officers out of the office hours, and I needed to work during the office hours."

The different learning attitudes of two classes of students also resulted in different performance. The teachers pointed out that, in general, the full-time students were more willing to participate in new things and classroom activities. On the contrary, as mentioned above, most part-time students just wanted to meet the basic learning requirements. They did not like "additional" things. As another popular saying in part-time study in Hong Kong: "If it is not necessary to do it, I will not do it." This situation could be paralleled by the difficulty of inviting part-time students to participate in the group discussions and interviews after school that were necessary to do this study. At the beginning, many students wanted to reject the invitation to participate. In consideration for these constraints, some of the interviews were conducted during the breaks in the middle of the lessons.

During the projects, the part-time students indicated that most of them were not very committed. A major reason was that they were under job pressure in the daytime. They were older than the full-time students, and about one-third of the part-time students had their own families and children. On the other hand, none of the full-time students was married. Thus, the part-time students were under family pressure, which significantly affected how they aw the project and their performance in it.

In addition, due to the difference in year of study, the students' experience differed in both design studies and project experience.

Nevertheless, as stated in Chapter 2, this study did not intend to compare directly the differences in performance of full-time and part-time, or of Year 1 and Year students. Instead, all the differences mentioned above are mentioned to provide an understanding of the reasons behind the different performance and reaction of students in problem finding. More detailed description of the difference among students will be presented in the following paragraphs, as necessary.

<u>Students' initial perceptions</u>

According to the questionnaire before the project started (see Appendix IV), there were 23 out of 24 students in the Year 1 class and all 18 students in the Year 2 class who agreed or strongly agreed that problem finding was important. Among all seven common stages of a design process (that is, identifying a problem, limiting the problem to a project title, generating an idea, proposing a final solution, realising the solution, evaluation and presentation), a total of six out of 42 students ranked "identifying problem" as the most important and 29 students (including the six students) included "identifying the problem" in the top-three matters of importance in the design process.[111] These views illustrate that most of students *theoretically* and *conceptually* agreed that problem finding was important. It was because only few of them had been practically involved in problem-finding activities in design studies (that is, one in Year 1, and three in Year 2) and job before (that is, six in Year 2).[112]

This result showed that the senior students (that is, more experienced students and designers) tended to have a greater recognition of the importance of problem finding. In fact, this situation also existed in the two different levels of the secondary schools. Referring to the discussion in last section, a higher ratio of S.4 students than S.2 students agreed that problem finding was important. Referring to some other similar studies conducted in Hong Kong before, the results were nearly the same. Senior and more experienced students and designers tended to have higher degree of recognition

[111] For the details of the question, see Appendix IV.

[112] For the details, see the students' backgrounds in previous sections.

of the importance of problem finding, even though they might not have any similar experience in their design studies and/or practice before (Siu, 1994, 2002b, 2002e, 2003).

When some Year 2 students and the teachers were asked about these responses, Teacher D explained:

> "Designers always claim to be more open-minded — no matter whether it is exactly the case or not. So if you ask whether problem finding is important, I think not so many designers would say 'no'. Even if you ask the importance of other stages of a design process, we — especially the mature design students and designers — would also say 'yes'. However, most of the time such responses are only at the conceptual and theoretical level. What designers do and how their decisions match with what they say sometimes is another issue."

The teacher's observation and feedback was quite significant. As with the findings of previous studies (Siu, 1994, 2002b), most of the respondents would provide quite positive view on problem finding before attempting the problem-finding exercise. However, whether this positive view was as a result of their conceptual and theoretical recognition or their practical experience was another issue. This issue and the changes in students' perception are discussed further at the end of this section.

In addition, the questionnaire and interview findings showed that there was one student in the Year 1 class and three students in the Year 2 class who had problem-finding experience in design projects (in design studies). In their responses to the questionnaire, they agreed that problem finding was difficult. On the other hand, among all students in two classes with work experience, only 6 of them had problem-finding experience in their jobs.[113] Two of them agreed strongly and four agreed that problem finding was difficult. As a student working in a design firm for more than twelve years indicated:

> "Problem finding is difficult since it starts from nothing. Most of the time, it is a process to discover and identify something. ... For me, problem finding is much difficult than problem solving. Problem solving most of the time is based on some concrete facts that are already well identified, such as well-defined goals. So, problem solving is relatively easier though it may take a longer period of time in the process."

Not only the people with problem-finding experience indicated difficulty in problem finding. The findings showed that about half of the students in the two classes who lacked problem-finding experience in school and work place also strongly agreed that problem finding was difficult.

However, referring to a question ranking all seven common stages of a design process in the questionnaire (see Appendix IV), (that is, identifying problem, confining the problem to a project title, generating idea, proposing a final solution, realisation of the solution, evaluation and presentation), only three students out of 42 students in the two classes ranked "identifying the problem" as the top difficulty and

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[113] According to the interview questions (follow-up questions supplementary to the questionnaire), the students interpreted problem finding in their job environments differently. Some considered it as identification of project direction, while some considered it as new product development, etc.

14 students (including the three students with work experience) included "identifying the problem" in the top-three most difficult in the design process.

In sum, most of the students agreed that problem finding was important and also difficult to handle in a design process. However, compared to other common stages of a design process, many students put the difficulty of problem finding in a fairly low ranking, in particular compared to the top-ranked stage of "generating an idea".

Since the sample of the students was quite small, it is both insignificant and inappropriate to produce general statements and conclusion on the above findings. However, these results give some insights for further investigations and discussion about the following relationships in the future:

- Problem-finding experience vs. recognition of *importance* of problem finding;

- Problem-finding experience vs. recognition of *difficulty* in problem finding;

- Recognition of *importance* of problem finding vs. recognition of *difficulty* in problem finding.

- Relationship of problem finding with other stages in the design process.

In contrast to the findings above, according to the interviews with the students, about half of the students pointed out that learning problem finding was "unnecessary". This situation was more significant in the Year 1 class. When discussing this issue with the students during the project, some of them stated that they *believed* that they would get such kind of knowledge and experience in their jobs in the future and they would be able to handle it.

In fact, these quite contradictory responses to different issues about problem finding (that is, importance, difficulty, and necessity to learn) more or less reflected of the thinking of the design students as well as designers. As the discussion at the beginning of this section stated, most of the time, the students did not deny the importance of problem finding from theoretical and conceptual perspectives. However, as illustrated in the review of the background of the university students, not so many of them had experience in problem finding. Thus, how they responded about the difficulty in problem finding and the need for problem-finding learning in curricula was also mostly conceptual. In short, they had no concrete experience of problem finding. These situations match with the findings of two studies on the similar topic (Siu, 1994, 2002b).

Furthermore, regarding the students' problem-finding experience, the findings from both the questionnaire and interviews illustrated that the students in two classes had no problem-finding experience in the programme. As described above, the programme was different from most of the existing design programmes. The objective of the programme was to train designers who had knowledge and skills in engineering. Design studies was only part of the syllabus of the programme, and quite a large portion of the curriculum was related to engineering elements, such as mechanics, mathematics, information technology, manufacturing process, etc.

Moreover, similar to the findings in the secondary schools, the students had not much experience in problem finding from extra-curricula activities. Even when they had, the students' responses illustrated that these non-regular and piecemeal experiences did not help problem-finding knowledge and experience very much, especially with respect to design discipline. A Year 2 student who actively participated in the university's social activities stated:

> "I have learned some problem-finding and problem-solving skills through the non-classroom activities in the university. I would prefer to consider it as a kind of general study. The activities helped me to have a better thinking strategy and organisation, but to put in design practice is an idea I can't take seriously."

In addition, *before* the project started, when the students were interviewed to see whether they would like to put some time into problem finding and title identification in the project, most of the Year 1 and Year 2 students were neutral in opinion and did not have any negative comments about the arrangement. In the case of Year 2 students, some of them immediately raised their concern about the ways and the weighting of assessment.

Teachers' perceptions

The two teachers who participated in the case study were both experienced in design education and practice. According to observation and discussion in the form of casual talks, the teachers saw problem finding in a positive way and they considered it as a fundamental and critical stage in the design process. They taught design subjects in other design programmes and supervised projects, including final projects.

They agreed that for students to identify titles for projects was a quite basic and common practice in these programmes.

The teachers also agreed that problem finding was not an easy task in the design process, and that students needed to have more learning experience in it. Teacher C stated:

> "I have a long work experience in the industry. I notice that in recent years more employers expect their design staff to have more initiative in finding out [design] opportunities for the companies. In particular today many companies are facing the market of Mainland China, where employers expect their staff to tell them what and why to do, instead of only how to do."

> "... However, I also notice that quite a lot of design graduates nowadays are weak in this capability. ... I agree that on-the-job training is important, in particular referring to the particular natures of particular design companies. However, more employers expect their newly appointed staff to have some basic knowledge and experience in helping the companies find potential markets and users' needs."

Responding to a question whether there was any good policy on problem finding in design curricula, the teachers agreed that there was no well-planned policy and activity that nourishes problem-finding capability in the current design programmes. Teacher D stated:

> "Even those of us with experience in teaching and practice [in design], easily overlook the importance of problem finding. Sometimes we give guidance to the students in identifying their project titles, but I can say that we have not done it in a systematic way. … We have programme coordinators for our programmes, but it seems that every teacher is doing things as he or she likes. … We have a good plan in developing different skills of students in problem solving. We specially design activities to cover most of the creative thinking and problem-solving skills. We also buy a lot of facilities, such as high-end rapid prototyping machines for the students to realise their ideas. However, we overlook the importance and need of problem finding."

Unlike the teachers in the secondary schools, the two university teachers agreed that students should take problem-finding learning activities as early as possible. Teacher D stated:

> "I would like to see problem finding as a kind of life-long learning element for designers. It is same with problem-solving knowledge and skills. Young children also need to learn them. So, problem finding should be learned as early as possible. I think the only difference in the learning for different ages of people is the nature and degree of difficulties."

Teacher C added:

> "I think we can consider it a very fundamental element in design. As we always state that we need to teach our young children how to ask, problem finding may be considered as a kind of questioning. Before we solve a problem, we need to have person to ask first. … I support the idea that we need to let the students to have problem-finding experience as early as possible."

When asking why problem-finding elements had not been put into the two subjects that they were teaching, the teachers explained that it was the overall policy of the programme. Teacher C pointed out:

> "The intensive curriculum gave us very little time for design projects. You can see that the original syllabus of my subject required the students to learn a lot of practical skills in design, such as computer rendering. This time I make special arrangement for the study and put a more '*free*' project in this subject [his emphasis]. I still need to find extra time to work with another staff person from the engineering department to give remedial classes for the students who need to cover the missing contents of the subject."

When asking whether problem finding should be formally assessed in the project, the two teachers held different views. Teacher D preferred to put a significant weighting for problem finding. His justification was that the students would take the problem-finding requirements in a more serious way. Moreover, quite a large number of the students in his class (that is, Year 2) had an engineering background and had studied engineering subjects for more than one year. These students valued "grades" as an important element in their learning. On the other hand, Teacher C held a different perspective. He suggested that a more relaxed learning environment allowed students to take problem finding as a learning element in their project:

> "From my understanding, the students have had no problem-finding experience in their previous assignments in this programme. Giving them assessment pressure in problem finding may frighten them and affect their performance. ... I am not saying that problem finding should not be assessed as other stages and elements in a design process. But I would prefer to allow the students to 'taste' it under no pressure at the beginning."

Process and performance

From observation, most of the students seemed not to have any difficulty in or worries about problem finding and project title identification in the first week of the project.[114] When the teachers explained the scope, requirements and arrangement of the project to the students (including some lectures and workshop arrangements), the students still seemed happy and confident that they could handle this first stage of the project well. Although the students were not excited and had no special feeling about being free to select a project direction and title in this first project in their programme, some of them agreed that they were happy to identify the project titles by themselves.

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[114] Each of these two subjects had 3-hour lesson per week in 14 weeks. Sometimes the students had lectures, in classrooms or workshops where they could remain to carry out their projects, so long as they did not need to go to another lecture or tutorial.

On the contrary, several Year 2 (part-time) students indicated to their teacher that they would like to have an assigned title. Their reasoning is apparent: they wanted the project — assignment — to be simple so they could start doing the project immediately.

Unlike the secondary students who did not know how to start and even how to ask, the two classes of degree students asked quite a lot of questions in the first week. However, as mentioned by the teachers, nearly all of the questions were not directly related to the problem-finding matters, but only to the detailed requirements (such as the time and format of presentation, format of the project) and the marking scheme of the project.

As it was the first time that most of the students were required to identify titles for their projects in the programme, the teachers set 15% as the weighting of the marks directly related to problem finding and title identification.[115] This weighting of marks required each student to offer a clear presentation of enquiry materials, a well-defined problem and project title, and a good justification of the selection of the project title.

From observation, in the second week, the situation changed critically. Most of the students from two classes started to feel confused about what they needed to do and how they needed to do it. The students started to ask quite a lot of questions related to the project. Many of them also started to talk about how difficult it was for them

[115] This weighting was same as that of other subjects related to problem finding (that is, first problem finding experience to the students) in other design programmes in the university.

to find a problem and define a project title. For example, a Year 1 student stated that she found out that problem finding as well as title identification was not an easy task. She further pointed out that it was not so difficult for her to point out an abstract problem, but having it well justified and clearly defined was very difficult.

Also from observation, there was some significant difference between the questions raised by the Year 1 and Year 2 students. The Year 1 students tended to ask questions to clarify their understanding of the scope. In other words, the students wanted to get more information from the teacher and then to narrow down the boundary. As a Year 1 student stated:

> "The scope of the project is too abstract to us, although the teacher said that he wanted to provide us more flexibility. I want to ask more about the scope and then set a smaller boundary for my research and thinking."

Unlike the Year 1 students, most of the Year 2 students tended to ask some "yes or no" questions. Instead of expecting a clearer boundary and a more precise direction for research and thinking, many students — especially the more mature students who had more work experience — practically and tactically preferred to ask the following types of question directly:

> "Is XXX a problem related to daily life of Hong Kong people?"

> "Can I put XXX as a project title because of YYY?"

> "I have two ideas about the project titles. They are XXX and ZZZ. Which one is better?"

According to observation, many of these Year 2 students had already got something in hand and then asked. However, as Teacher D pointed out, many of these students had not thought seriously about the problems and titles. The questions raised and the so-called well-thought project titles were just the result of five minutes work before the lesson. Teacher C also pointed out that these kinds of questions were just trial-and-error questions to the teachers. The students did not think carefully, but just took some of their *rough* ideas and then tried to see — test — the feedback from the teachers. Just as the situation in the secondary school, the students expected to get a "blessing" from their teachers to start the other stages of the project quickly.

On the other hand, the two teachers pointed out that some students started earlier than expected that (that is, only in the second week of the project) to request a title from the teachers. As indicated by a Year 2 student:

> "It is so abstract for us to do it. I would rather prefer as before that the teacher gives me a project brief and then I can define a title and then start the project."

Similar to other responses discussed above, this response of this Year 2 student more or less illustrated how some of the students saw "problem finding" and "title identification". They did not consider problem finding and title identification as a part of the project. According to their general responses and comments, many students liked to say in this way that they could "start" to do the project "after" the title was fixed. This situation was probably due to the common practice in schools of teachers assigning or providing a project problem or title. The students' responsibility was just to *solve* the provided problem. It was easy for them to consider problem solving equivalent to a project or a complete design process. Of course, if a student was asked what was the first stage of a design process, the apparent *conceptual* model answer would still be "problem finding" or "need identification". Yet, how the students practically considered it was another issue.

Instead of requesting an assigned title, some students took another tactic. They requested the teachers to give them some "samples". Teacher A had this comment about samples:

> "Theoretically, samples or examples can stimulate students' thinking. However, I seldom give other students' work directly as samples to use as reference. The main reason is that giving samples to students in this way may have the drawback that the samples easily direct the students' ways of thinking. According to my experience, this situation is much apparent in part-time courses. Many students just want to copy a sample and then modify it slightly in order to fulfil the project requirement in quick."

Instead of giving the students samples in problem finding, giving guidance and help on students' research work is more constructive to the students' learning. According to several previous studies (Siu, 1994, 1997c, 2002b), teachers easily fall into the trap that problem finding and need identification are very flexible, and thus there is no right or wrong way to do it. Therefore, some teachers claim to provide the greatest flexibility to the students and let them to do it *freely* without providing any guidance. However, another study illustrated the situation to be exactly the opposite. While problem finding most of the time is at the beginning of a design process, there are no already-founded elements of the project for the students to follow or make reference to. Therefore, during the problem-finding activity, teachers need to work as a "facilitator" to give more guidance than in the other stages of the design process (Siu, 1999b).

Moreover, although many people criticise students with engineering backgrounds as not creative enough, the observation on the performance of the students illustrated that the students with an engineering background, in particular those with working experience, were good in collecting, organising and selecting the data for consideration and analysis. A Year 2 student who had an engineering background and more than 15 years of work experience in a research and development section of an engineering design company pointed out:

> "We are good in data collection and analysis since our studies in engineering subjects make us have a critical mind in analysis. Some people said that engineering studies would make us more stubborn and we are not suitable for studying design. I agree with this to a certain extent. Yet I also hold another view that sometimes the techniques learned in engineering subjects can give me an advantage in analysis — especially quantitative analysis. ... Regarding this project with problem-finding requirement, I think that my knowledge and experience in research give me advantages in enquiry and identification of problems and project titles."

Of course, being good in research does not mean that the degree students could finish their task of problem finding and title identification quickly. In fact, from observation, many of the students struggled for a very long time during the project period in making the *decision* on their project titles. For the 14-week project, the approximate average time for the Year 1 students to fix their project titles was 6 weeks, while the approximate average time for the Year 2 students to fix their project titles was 4 weeks. These average times did not include several students who still changed their titles after the 8th week.

Moreover, the shorter average time for the Year 2 students in title identification also did not imply they had a better performance in problem finding and title identification. As pointed out by Teacher D:

> "Some of the [Year 2] students fixed their titles early only because they did not care about the quality of their work. Even though sometimes I warned them that their quality of work was not satisfactory enough, they still kept on going and did not to show any significant improvement in their work. As indicate by one of my students, he only wanted to get a 'pass'. His learning strategy was start fast, and finish fast."

To sum up the causes for the unsatisfactory performance of some of the students in problem finding as well as title identification, there were two major causes:[116]

[116] For part of the detailed discussion record, see Appendix V.

- Different difficulties encountered by the students during the problem-finding process;
- The current solution-and-result-oriented learning attitude of the students.

Regarding the first issue: *difficulty*. The two teachers stated that during the project, many students continually came to them to complain that problem finding was a difficult task. As stated before, one of the reasons was that many of the students had no experience in problem finding. As a Year 2 student pointed out:

> "Most of us had not had this kind of experience before. Moreover, in our programme, the assessment method for most of the subjects is examination. Even when we need to tackle projects, their focus is only on problem solving, not problem finding."

The student added:

> "Due to our lack of experience, we also didn't know how much time should be spent on problem finding. Although our teacher suggested that we should have us good time management by allotting different periods of time for the different stages of a design process, many of us failed to do so."

> "... For me, it was quite logical to plan the time of the project according to the weighting of different parts of a project. If this was true, then we were only allowed to use two to three weeks to fix our project titles. However, the fact was not like this. I could not confirm my project title

until the 5th week. … When I looked at the time running away and saw that the title was not yet fixed, I felt scared and frustrated. In fact, this situation was also happened to my classmates."

"… Although the teacher taught us how to confine a project title, I could not handle it well. I still did not know how detailed the title should be, and what the degree of depth should be."

Regarding the difficulty in time management for the project, in a group discussion at the end of the project, a Year 1 student pointed out:

"With reference to the weighting of the assessment and the objective of the project, I think that we should not put too much time on problem finding and title identification. Instead, I think that we needed to spend longer time in tackling the identified title — I mean proposing solutions."

However, some students held another view. A student in the same discussion group indicated:

"I don't think so. If you set a very bad project title, no matter how good your outcome is, it will be meaningless. So, we need to spend more time in order to have a good start of the project."

The first student argued:

> "However, if your title is identified very well but you cannot propose a good solution, it will also be meaningless."

Another Year 2 student responded to the student:

> "The critical point of the slow progress was that we didn't know what a good project title was. The difficult was that it seemed that anything could be a project title, and anything could be done. I don't know how to make a choice due to the lack of experience."

Regarding the second issue: *learning attitude*, as stated in the introduction of this section, most of the students were solution- or result-oriented. This learning attitude affected the quality of their performance in problem finding and also the quality of the found problems (or, identified project titles).

From observation, students liked to *change* their project titles. It was also the reason that many of the students could not fix their titles earlier in the 14-week project period. According to the students, there were several causes making them change their identified problems and project titles all the time, and in turn affecting their performance in problem finding and the overall project performance. The most critical cause was *solution* — the possibility of a solution for the identified title. As a student pointed out in the small group discussion:

> "I think some of the titles I identified were good. However, they were difficult to solve when I started to analyse and propose solutions. So, as the projects were to be assessed according to not only the identification of

the project title but also the solution, I preferred to select an easy project title. That is, I would prefer to play safe to get a higher mark in problem solving."

When asking the student why he did not aim at a higher mark in problem finding, he responded:

"It was difficult to judge whether a problem or a title was good or not. But it was more *objective* (his emphasis) to judge whether a solution was good or not. ... Moreover, the weighting of mark for the design solution was higher than problem finding and title identification."

Also as a Year 2 student described his performance:

"At the beginning of the project, I spent two days finding problems, but I could not find one. I walked on the street, as my teacher suggested. Sometimes I was very happy, since I thought I had found some potential topics for my project. However, when I thought about them more carefully, I abandoned the topic. ... It's because I could foresee the difficulty in producing solutions for these potential topics."

"... Sometimes, when I found a project title and thought it was good, and tried to propose solutions, some of my classmates or my teacher would tell me that the problem had some existing good solutions. Then I would give up the title, particularly when my proposed solution already existed on the market."

> "… Sometimes, I found that it was impossible for me to tackle it, or it seemed that the existing solutions for the problems were good enough. My work seemed meaningless and redundant."

> "… Sometimes, my identified problems seemed too small. And my classmates also seemed to have no difficulty in proposing very good solutions right after I told them my identified problem. It seemed not worthwhile for me to go further."

Referring to the description of experience above, it is not difficult to notice that "solution" would become a main hindrance for quality problem finding if design students or designers are too focused on the solution of a design process. However, as the discussion in Chapters 1 and 3 stated, "problem" and "solution" are two fundamental, critical and inseparable elements in design. While reviewing the teachers' and degree students' responses and performance in problem finding, it comes to a finding that a *balance* between the emphasis on problem and solution is very important and critical.

Regarding the levels of problems (that is, project titles) found by the students, there were:

- 15 existent problems, 6 emergent problems, 3 potential problems (by the S.2 students);
- 13 existent problems, 3 emergent problems, 2 potential problems (by the S.4 students).

When the students were asked about the levels of problems they found, in the same way as the situation in the secondary schools, some students pointed out that it was difficult for them to distinguish the difference among these three levels of questions, though the teachers had explained the difference to them at the beginning of the project.

In the same way as the secondary students, the teacher pointed out that *presenting* a problem situation was much easier than *discovering* a problem situation. Potential problems were difficult to discover because they do not already exist as a problem. The teachers agreed that nearly all of the students had no prior experience in identifying and presenting existent problems.

Although the Year 2 students had more project and working experience than the Year 1 students, the result of the levels of their identified titles illustrated that the Year 2 students proposed more existent problems than those of the Year 1 students. After talking to the students in the group discussion, one of the major possible reasons was that the Year 2 students did not want to spend time on discovering and inventing problems. And, as stated by a Year 2 student:

> "To be frank, it is a play-safe strategy for me. An existing problem is more straightforward to identify. I also did not want to spend too much time on problem finding and title identification after three weeks of struggling at it. I am not speaking for my classmates, but I think that many of us have the same kind of thinking."

According to other in-depth individual interviews with the students, their feedback matched with the above comments. Many of the students preferred to select an "easy" problem since there was no project requirement for them to discover or invent emergent and potential problems. This attitude of many of the students, especially the Year 2 students, also explained why quite a lot of projects were quite simple and straightforward in nature. As the students further commented, they would prefer to spend more time on the realisation of their design solutions. A student stated at the end of the project:

> "Although some marks were given to the problem finding, it was still not so 'heavy' as idea generation and realisation. Therefore, I preferred to spend more time to make the final output of my design idea to be perfect in appearance. It's easy to get a better grade."

At the end of project, the teachers reviewed the students' designs (that is, final outputs such as models).[117] Similar to the situation in the secondary schools, the teachers pointed out that the types of the designs were much more diverse than before.

However, in a different way from the projects of the secondary schools, the teachers stated that the physical quality — appearance and workmanship — of some designs did not have any great changes. Teacher B pointed out:

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[117] As indicated in the Chapter 2, this part of review relied on the work of the teachers, since only they had seen the students' earlier work.

> "It may be because of the students are more mature. I think that they can fine tune their time to maintain the quality of the output. Some of them always aim at a better grade. Moreover, some of the part-time students went back to their working places to produce the final outputs.[118] I always don't need to worry about the outlook of the part-time students' projects. They have a very strong team in their working place to give support."

In the same way as the secondary students' project, the nature and format of the design outputs were different from before; that is, they were more diverse. The apparent reason was that the titles were identified by different students. Moreover, they differed from before in that previously, the teacher assigned the titles, so that the background, context and nature of the project to every students were the same. However, while the students had the freedom to find problem and identify titles by themselves, most of them did so in ways related to their living and working environment. Whether the rationale behind the students' choices was that they wanted an easily handled project, or that they were really interested in the things related to their living and working environment, the project outcomes were more diverse. As agreed by most of the students at the end of the project, this situation was good for them. A Year 2 student pointed out:

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[118] According to the school policy, design students can seek outside assistance in the production of the prototype and models if they can provide a justification for it. One of the reasons is that it can save the students from a long model-making time. Moreover, the objectives of most of the subjects are not focused on the appearance of the output. In addition, the students can produce better quality of final output that it gives advantage to the school for the exhibition of students' work at the end of the year. To compensate the drawback of this policy, the school provides some training in the Industrial Centre to allow the students to learn more workshop skills.

"I can see one of the major advantages for us to have freedom to identify the project title is that I can see different kinds of ideas for different kinds of problem. I think it benefits our learning. We are design students who need to have more stimulation like this. To be frank, some of the previous projects were very dull. All of the outputs and presentation were nearly the same. You can imagine how hard it was to sit in classroom and hear about 20 similar PowerPoint presentations."

Change in students' perception

In the group discussion with all degree students at the end of the project, the students agreed that the most significant and also most important change in their perception was in realizing that it was necessary for design students to have problem-finding knowledge and experience. The students observed their lack in this kind of knowledge and experience in their early levels of studies and their existing programme. As a student pointed out:

"When I started to identify a project title by myself, I suddenly realised that I did not know how to do it. What I had thought easy to handle became abstract and uncertain. Perhaps problem-finding skill is not an in-born skill."

"I support the idea that problem finding should be provided in earlier levels of learning, such as primary and secondary schools. I believe in practice making perfect. Therefore, earlier learning in problem finding would give benefit to design students and designers in their later study or career development."

Regarding whether it was important to put problem finding in early level curriculum, most of the students supported it. Teacher C also pointed out:

> "According to my experience in the design industry, many of the design companies do not offer the chance for designers to learn problem-finding skills. Even they have them, their ways of doing things are too specific — or too narrow. Thus, it would be better if students can gain a more comprehensive and organised experience from and early stage of learning."

On the other hand, after the project, students still held that problem finding was both important and also difficult. Yet, unlike their earlier conceptual and theoretical recognition of the importance and difficulty of problem finding, the students' realization was now from experience. As a simple comment from one of the Year 1 students:

> "Now I know how difficult it is to identify a problem."

In addition, some students pointed out that it was difficult to decide whether a title was suitable or not. So eventually they needed to spend a lot of time on it, which meant that they did not have enough time to concentrate on the development of their projects. Therefore, they still preferred teachers to set project titles for them.

However, according to the in-depth interviews at the end of the project, some students still maintained that problem solving was more important than problem finding. A Year 2 student pointed out:

> "The major and also only objective of problem finding is to find out a problem for problem solving and then reach an end to have a solution for the problem. In this way of thinking, problem finding is for the need of problem solving."

Another student also agreed with this and further explained:

> "The outcome of problem finding is an identified problem for problem solving. The outcome of problem solving is a solution. What we need is a solution. Therefore, I would say that putting problem solving in the curricula is more important than putting problem solving in the curricula."

One of the students raised a point during the small group discussion:

> "I agree that problem finding is important and difficult. However, because of its difficulty, I don't support that it is necessary for *all* (his emphasis) design students to learn it. Moreover, not all of the designers in a company are required to identify needs for design. I therefore support the idea that problem finding may put in the curriculum as an optional or elective subject."

Although these students' comments finally received quite a lot of criticism, it was a fact that a majority of these 42 students (2 classes) still put problem solving in the highest rank among all stages of the design process. On the other hand, more students recognised the importance of problem finding. Compared to the questionnaire result before the project, more students at the end of the project gave problem finding a higher rank of importance in the design process.

In addition, after the project, just as with the responses of the secondary students, there was a significant increase among the degree students who were willing and expected to identify project titles — find problems — by themselves in the future. As stated by one of the Year 2 students (who was one of the students requesting the teacher to assign titles to them in the 2nd week of the project):

> "I agree that a project title assigned by a teacher is easy for me to handle. I only need to pay attention and effort to generating ideas and putting the ideas into real products. However, I should also agree that defining a project title by myself is more fun and challenging. It also provides higher satisfaction."

> "... I would say that my preference on whether a title is defined by me or not depends on different situations. If the assessment of the project is not so critical, there is no harm for me to try to find a problem and identify the title by myself. On the contrary, if the project were seriously assessed and critical to me no matter in what sense, I would continue to support the idea that it is better for the teacher to assign a title. It is not only

because it is simpler in terms of project requirement, but it is also fairer in assessment."

6.6 Summary of Case Study Findings at Secondary and Degree Levels

The discussion presented in Section 6.5 is based on the findings of a case study in two secondary schools and a university design school. As stated above, the major objective of the case study was to explore how problem-finding elements could be incorporated in the design curricula of the schools with respect to the different levels, natures, settings, teaching and learning activities, educational goals, teachers' and students' backgrounds and experiences, etc. The summaries of the findings and discussion are as follows:

Secondary Level

<u>*Performance between male and female students*</u>

- There was no significant difference between the responses of male and female students in the questionnaires and the interviews.
- There was also no significant difference in the overall project performance between male and female students in the D&T classes.
- The only relatively more noticeable difference between male and female students in classroom or workshop performance was that female students were more likely to come to the teacher to ask questions.

Students' initial perceptions

- Before the project started, a significant number of students strongly agreed that problem finding was important.
- More than 70% of the students in the two classes had a common perception that problem finding was not so difficult, or at least that it should not be more difficult than problem solving.
- Some students pointed out that learning problem finding was "unnecessary", since it was quite simple. Without real practice in problem finding, many design students perceived that it was easy to handle problem finding.
- More than 80% of students thought that problem finding was important while, on the other hand, many of them were not willing to spend time on it.
- More than 70% of the students believed that problem finding was easy to handle and required no special learning or practice.

Teachers' perceptions

- The teachers agreed that problem finding was important.
- Unlike many of the students' views, the teachers pointed out that problem finding was not an easy task in design.
- However, the teachers also pointed out that the students were quite young and it might not be necessary for them to have problem-finding knowledge and experience in junior form.
- The teachers pointed out that intensive curriculum and limited time for lessons were two major reasons that hindered them from giving such experience to the students.

- The teachers' theoretical perception of the importance of problem finding did not imply that the teachers would put problem finding as a "must" in the curriculum.
- The teachers agreed that problem finding was a difficult task in design. However, this "difficulty" was not a reason to push the teachers into putting problem finding into the curriculum and making the students learn it.
- The teachers' responses hindered or demotivated the students from participating in problem-finding learning.

Process and performance

- The two major areas of weakness in the students' performance were (i) how to collect the related data, and (ii) how to critically organise and select the data for consideration and analysis.
- Students facing difficulties in problem finding were more obvious at the beginning of the project.
- The students felt that problem finding was difficult because they had no experience in it.
- Time limitation in the project affected the performance of the students in problem finding. The students did not have sufficient time to carry out "enquiry and research", in particular the students were required to finish their projects in the class.
- Compared to the S.2 students, the S.4 students showed better performance than S.2 students in investigating a possible topic. One of the major reasons was that the senior form students had more research experience in idea development.
- Lower examination pressure resulted in a better performance in problem finding.

- Nearly all of the students did not have the confidence to identify a problem on their own. The students were unable to make judgements whether their identified problems and titles fitted the project requirements.
- The students found difficulty in converting a problem or several problems to a project title.
- The students experienced difficulty defining and formulating the actual problem statement and carrying out continuous problem reformulation.
- One of the reasons for the long time students took to identify problems was that the they continually changed their identified problems and project titles.
- Another reason was that the students would change their identified problems and titles due to the foreseeable difficulty of the project in the later stages of a design process.
- The students were very weak in discovering emergent and potential problems, especially potential problems.
- If the project titles were identified by the students, the types of the designs (that is, final design outputs) were more diverse.
- The physical quality — appearance and workmanship — of some designs was not as good as before.

Change in students' perception

- Some students pointed out that problem finding was much more difficult than they had thought when they actually attempted to it.
- Due to the difficulty in problem finding, some students requested their teachers to provide them with a fixed scope or a clearly defined project title.

- Although the students found problem finding difficult, their thinking was significantly changed at the end of the project. More than half of the students in each class indicated that they would prefer to identify project titles by themselves in the future.
- Some students stated that finding problems by themselves provided them with more space to develop their thinking and imagination. They stated that if a problem was determined by their teachers, the latitude for thinking would be narrower.
- More students started to treasure the opportunity of problem finding after overcoming barriers in problem finding and getting some experience in it.
- Some students who originally thought that problem finding was not interesting, and who at the end of the project agreed that problem finding was quite interesting, even challenging.
- Before the project started, more than half of the students responded that there was no need to learn problem finding in their junior form study, and the experience of problem finding would be obtained in the workplace and thus there was no need to have this kind of experience at school. However, after the projects, most of these students changed their minds.
- Some students pointed out before the project started that problem finding was a conceptual skill, and it was not necessary to gain practice in it. At the end of the project, these students agreed that it was better to have more practice in their projects.
- More than half of the S.2 and S.4 students had thought that satisfaction with a project came mainly from the success of final output — the design solution. At the end of the project, this perception did not change greatly. Nevertheless, more students recognised the importance of problem finding.

- The students started to appreciate the creativity of their classmates not only in the final products but also in their ways of seeing things and then finding out problems and titles for the project.
- The students found D&T more interesting since they could see that designs under a same scope could be so diverse in directions and solutions at the end.

Degree Level

<u>*Performance between male and female students*</u>

- There was no significant difference between the responses of male and female students in the questionnaires, interviews and group discussions of this study.
- The most apparent difference between the male and female students was that the male students at senior level were more willing to express their opinions in some group discussions.
- There was no significant difference in performance on the project between male and female students.
- The female students in general were more hard-working and they were would more like to follow the instructions and requirements of the teachers in projects and assignments.
- The female students worked harder than many males gave them advantage in research work and in turn also allowed them to collect sufficient evidence and information to fix their project titles earlier than most male students.

Performance among students in a class

- There was more difference in project performance among those at the senior level.
- The students with working experience in the industry saw a project and tackled it quite differently from students with less working experience.
- The difference went to two extremes: (i) skipping some work to made the project as easy as possible, and (ii) wanting to get the best result in their studies.
- Most of the younger students were affected by the attitude and performance of the senior/older students.
- The students with more work experience were more willing to express their opinions.

Performance between two classes of students

- The project performance between the full-time students and the part-time students was quite different.
- The studying time and project time for the full-time students were more flexible than those of the part-time students. The full-time students could more conveniently access the university's resources.
- The full-time students approached the teacher more frequently than the part-time students, since they had more time at the school.
- The different learning attitudes of two classes of students resulted in different performance.
- The full-time students were more willing to participate in new things and classroom activities.

- Most part-time students just wanted to meet the basic learning requirements. A major reason was that they were under job pressure in the daytime. They were older than the full-time students, and about one-third of the part-time students had their own families and children.

Students' initial perceptions

- Nearly all students agreed or strongly agreed that problem finding was important. Among all seven common stages of a design process.
- Most of students theoretically and conceptually agreed that problem finding was important.
- The senior and more experienced students tended to have higher degree of recognition of the importance of problem finding.
- Most of the students offered a quite positive view on problem finding before attempting the problem-finding exercise. However, whether this positive view was as a result of their conceptual and theoretical recognition or their practical experience was another issue.
- Most of the students agreed that problem finding was important and also difficult to handle in a design process. However, compared to other common stages of a design process, many students put the difficulty of problem finding in a fairly low ranking, in particular compared to "generating an idea".
- Most of the senior students put the ways and the weighting of assessment as their major concern in projects.
- How the students responded about the difficulty in problem finding and the need for problem-finding learning in curricula was also mostly conceptual. They had no concrete experience of problem finding.

- Based on the results, some directions were worthwhile for further investigation: (i) problem-finding experience vs. recognition of *importance* of problem finding; (ii) problem-finding experience vs. recognition of *difficulty* in problem finding; (iii) recognition of *importance* of problem finding vs. recognition of *difficulty* in problem finding, and (iv) relationship of problem finding with other stages in the design process.

Teachers' perceptions

- The teachers saw problem finding in a positive way and they considered it as a fundamental and critical stage in the design process.
- The teachers agreed that problem finding was not an easy task in the design process.
- The teachers agreed that students needed to have more learning experience in problem finding.
- Unlike the teachers in the secondary schools, the two university teachers agreed that students should take problem-finding learning activities (as a kind of life-long learning element) as early as possible.
- The teachers considered problem finding as a kind of questioning that it was important to all students.
- The teachers held different views on whether problem finding should be formally assessed in the project: (i) a significant weighting for problem finding would make the students to take the problem-finding requirements in a more serious way, (ii) a more relaxed learning environment allowed students to take problem finding as a learning element in their project:

Process and performance

- Most of the junior students seemed not to have any difficulty in or worries about problem finding and project title identification in the first week of the project. However, some senior students worried about the difficulties in problem finding, They requested the teacher to assign them a project title.
- Unlike the secondary students who did not know how to start and even how to ask, the degree students asked quite a lot of questions in the first week.
- There was some significant difference between the questions raised by the junior and senior students. The junior students tended to ask questions to clarify their understanding of the scope. The senior students tended to ask "yes or no" questions.
- During the problem-finding process, most of the questions raised by the students were just trial-and-error questions to the teachers.
- The students did not think their questions through carefully, but just took some of their rough ideas and then tried to see the feedback from the teachers. Many students expected to get a "blessing" from their teachers to start the other stages of the project quickly.
- More than half of the students did not consider problem finding and title identification as a part of the project.
- More than 70% of the students considered problem solving equivalent to a project or a complete design process.
- If a student was asked what was the first stage of a design process, the apparent conceptual model answer would still be "problem finding" or "need identification". However, how the students practically considered it was another issue.

- Instead of giving the students samples in problem finding, giving guidance and help on students' research work was more constructive to the students' learning.
- The teachers agreed that it would be good if teachers could work as a "facilitator" to give more guidance in the problem-finding stage.
- Many of the students struggled for a very long time during the project period in making the *decision* on their project titles.
- There were some major causes for the unsatisfactory performance of the students in problem finding: (i) lacking problem-finding experience; (ii) different difficulties encountered by the students during the problem-finding process (for example, time management); and (iii) the current solution-and-result-oriented learning attitude of the students.
- The students agreed that it was difficult for them to distinguish existent, emergent and potential problems.
- With more working/project experience, the students were more capable and had more evidence to propose existent problems.
- Most of the students preferred to select an "easy" problem because the students would prefer to spend more time on the realisation of their design solutions.
- A balance between the emphasis on problem and solution was very important and critical for promoting problem-finding learning experience.
- If the students were allowed/required to identify their project titles, the nature and format of the final design outputs were much more diverse.

Change in students' perception

- The students agreed that the most significant and also most important change in their perception was in realizing that it was necessary for design students to have problem-finding knowledge and experience.
- More than 80% of the students supported that it was important to put problem finding in early level curriculum, most of the students support it.
- Nearly all of the students held that problem finding was both important and also difficult. However, unlike their earlier conceptual and theoretical recognition of the importance and difficulty of problem finding, the students' realization was now from experience.
- Some students pointed out that it was difficult to decide whether a title was suitable or not. So eventually they needed to spend a lot of time on it.
- Some students still maintained that problem solving was more important than problem finding.
- Nevertheless, compared to the result obtained in the first week of the project, more students at the end of the project gave problem finding a higher rank of importance in the design process.

Chapter 7 Conclusions

Responding to the key questions identified in Chapter 1, this study has successfully identified the deficiencies of the current design curricula, in particular in the aspects related to design processes. Under the current solution- and examination-oriented curricula and learning attitude, most of the time, students' learning in design is biased because they do not know how to *initiate* questions and directions for design. That is, they cannot identify problems to be solved. However, as the evidence and arguments presented throughout previous chapters indicate, without the capability to recognise, discover and invent problems, students are deficient in both their design learning and future careers in the design industry, which expects them to offer more initiative in finding directions for development.

By reviewing the different natures and definitions of "problem" and "problem finding", the study has established a foundation for the next stages of study, and for future investigations by other researchers. This foundation is important and necessary, since it illustrates the importance of problem finding and its relationships with other elements and stages in a design process. It also gives a reference to help curriculum planners and developers, examination officers and teachers first to review, and then to discover the limitations and difficulties of incorporating problem-finding elements in current curricula.

The study's findings, which were generated from the in-depth interviews, questionnaires, and empirical studies at secondary and degree levels, illustrate that problem finding is a critical and fundamental element in design. This is so, not only because of the importance of problem finding as the first key stage in most of the design processes, but also because of its educational value. The incorporation — inclusion — of problem finding in design curricula can nurture all-round design students. The particular findings of case studies conducted in the secondary schools and the design school further indicate that providing problem-finding knowledge and experience to design students can positively and constructively affect their (a) learning processes, (b) performance in design, and (c) perception of the importance of different stages in the design process.

The advantages, limitations, difficulties and possibilities in enhancing problem-finding knowledge and experience for design students have been identified in the study. These findings offer knowledge for curriculum planners and developers, examination officers, programme and subject coordinators, teachers, and other educators and researchers, so that they can improve the design curricula, examination syllabi and practices. The thesis establishes a foundation for and generates insight into further investigations on this relatively unexamined topic.

This research is significant and important to design curriculum development and practice. In fact, for the past few decades, discussions concerning the significance of new approaches to design have been conducted frequently. How design can be enhanced in practice and education has also been a heated topic for the past nearly half century. However, these discussions have mainly focused on the performance of designers and students in the idea-generation, realisation and sometimes evaluation stages of the design process. Seldom is consideration given to how designers and students find — *present*, *discover*, *invent* — problems and identify needs and opportunities for design.

When we review the current practice in design industry and education, it is not difficult to notice that "problem solving" attracts nearly all of the focus in design. Thousands of professional and commercial publications and tools related to creative thinking and problem solving have appeared in the market over the past ten years (for example, Aspelund, 2006; Fung, Lo & Rao, 2005; Hick, 2004; Papamichael, 2003; Peto, 1999; Puccio, Murdock & Mance, 2005; Robertson, 2004; Wilson, 2000). Resource on and discussion of problem finding seem extremely weak. What we mostly get is just a few pages of brief introduction to problem finding and need identification that appear in some academic books about design process. Although problem finding is still theoretically included in the design process in general, taking a Chinese term, it is always considered as a "chicken rib" which means it may or may not be needed in the design process.

On the other hand, more researchers have pointed out that designers should not only be able to solve problems, but also to find problems. Borrowing Mark Runco's (1994) simple by authentic statement: "Without people who discover problems, there would be no creative solutions". Although today this kind of voice is still small, starting in the last century some people have urged a serious consideration of the importance of problem finding in the thinking and design process. As the review in Chapter 1 states, these people include the great thinkers and researchers such as John Dewey, Albert Einstein and Max Wertheimer.

Since the 1990s, studies on problem finding, need- and opportunity-identification and project title identification have been conducted in Hong Kong. Most of these studies are small in scale and focused on particular situations. The key objective of these studies is to explore the importance of problem finding in design process and generate insight for the benefit of design practice and education. One of the key findings is that Hong Kong designers and students are confident in problem solving but weak in problem finding (Siu, 2001b, 2002d). In fact, as illustrated in Runco's (1994, 2007) books, this situation is a very common in design thinking and process all over the world nowadays (see also Jay & Perkins, 1997).

Stimulated by the findings of the studies, the more comprehensive study presented in this thesis was started in 1997. The major objectives of the study were to explore the importance of problem finding — where less attention has been paid — in design, and to discuss how current design curricula should be improved to nurture all-round design students. The study reviewed the significance of the skills and experience of problem finding in design practice and the importance of problem finding in design process. Taking Hong Kong as a case study and reviewing the development of design curricula at the secondary and tertiary levels, the study identified some deficiencies in the current design curricula. The research activities included literature reviews, document reviews of the curricula at different levels, interviews with curriculum planners, examination officers, school principals, teachers in secondary schools, professors in tertiary institutions, students, and questionnaires completed by students. Through a case study in two secondary schools and a design school in a university, as stated in the introduction of this thesis, this study explored and discussed whether and how problem finding affected design students in three aspects: learning process, performance in design, and perception of the importance of problem finding.

As the review in Chapter 1 states, the stable situation in education policy and curricula in Hong Kong has started to receive criticism that the outdated policy and curricula cannot prepare students to meet changes of the local society and the outside world (Siu, 2000c, 2001c; see also Stoll & Fink, 1996). For example, many people are critical of some so-called design related subjects, where the major role of students is just to *follow*, with little opportunity to explore, discover and think (Siu, 2002d). On the one hand, just as in the generation in the 1970s, teachers drill students to be perfect in skills. The only difference between the past and today is that in the 1970s, students were drilled to use hand and machine tools to produce a product in perfect dimensions and finishing, while students today are drilled to be skilful in using computer software to generate perfect renderings. On the other hand, the so-called creative thinking exercises in schools are seriously biased. Some of the students put all their focus and effort only on one or two particular topics, such as robotic control competition. These kinds of topic offer a certain attraction and satisfaction to students, but they also drag all of their energy away so that they cannot do any thing else in design. Some teachers run their design classes strictly according to the curricula. However, as reviewed in Chapter 1, the deficiencies of the curricula finally cause the knowledge and learning experience of students to become biased. The students lack opportunity to explore, discover, think and also ask.

In any design process, the importance of problem solving is so often the focus of attention that other elements — stages of the design process — are easily overlooked. Among all the others, problem finding and evaluation are always the losers. For the past ten years, due to the promotion of the importance of quality control, self-assessment and evaluation in working environment and schools, people have started to focus attention on evaluation. This increasing emphasis is apparent from the increase of the weighting percentage on "evaluation" in different public design project examinations, such as the HKCEE and AltS D&T design papers. In contrast, problem finding is neglected, to an extent that it has not been considered as an area for study and an element for assessment in all secondary level design examinations and many of the design programmes in the universities. Even though sometimes problem finding is put in the curricula; both teachers and students do not take it seriously. As an experienced design professor described,

> "Problem-finding requirements most of the time just look like a decoration page in a curriculum document."

To enhance the problem-finding knowledge and experience in the design curricula, the findings of this study show that there are three perspectives that should be considered. The first perspective is the curriculum planning and development. The second perspective is assessment (and examination), while the last on is the school (and university).

The findings show that curriculum and assessment perspectives are tightly correlated (see also Stimpson & Morris, 1998). From each perspective, there are some *advantages*, *limitations*, *difficulties* and *possibilities* for incorporating problem finding in the design curricula.

Among all the advantages, it is apparent that incorporating problem-finding elements in the curricula can strengthen students' problem-finding capability, and in turn nurture them as all-round designers (see also Siu, 2002c). As discussed in previous chapters, to be an all-round capable person is important for designers as well as design students if they are to face the current rapidly changing society. It also allows designers to have high competence in the local and global markets — and in changing markets. For design students, to be capable all-round in different areas of the design process — that is, not only problem solving — can allow them to have high flexibility to attach themselves to other interested disciplines for further studies and to take more initiative in their future career.

In addition, the existing assessment policies and systems in Hong Kong, in particular the public examinations cannot perform as promised to offer a balanced and comprehensive assessment on students' performance (Siu, 1994, 2002b). Problem finding is always neglected. Therefore, incorporating problem finding in the curriculum as well as including it in the examination syllabi can improve the current situation.

Limitations of time, materials and space within the curricula, and difficulty in teaching, evaluation and teaching teachers are always the major excuses — sometimes the weapons of those who choose — not to change the curricula (Siu, 2002b). For example, intensive curriculum contents and practical limitations in resources (including lacking experienced teachers) always make the curriculum planners, programme coordinators, subject teachers and students fear to change the curricula. Changes in assessment, in particular in the public examinations, are always not welcomed by the public — with the exception of the publishers.

Because the nature, objectives and contents of problem solving are also quite abstract and not well discussed, and its available references and tools are rare, it can be foreseen that incorporating problem finding in the design curricula will face large resistance. In addition, the current weak communication and collaboration between the curriculum development committee and assessment authority also generate more barriers for incorporating problem finding in the design curricula (Siu, 2002b).

However, all of these limitations and difficulties should not be excuses to neglect the importance and needs of problem finding in design practice and education. Instead of only looking at the limitations and difficulties, it is preferable to see how the current situation can be changed to create possibilities. In other words, policymakers, curriculum planners and teachers should be more proactive in exploring and exploiting the current practical situation in the curricula from the overall environment to the specific design issues. Based on a good understanding of issues, they can then and transform the limitations and difficulties as possibilities for incorporating problem finding in design curricula. In recent years, the education reform and policy changes in secondary and degree levels are cannot-be-missed possibilities. Including the positive change of the public's view on design education and the available of new resource (such as new teaching force), all these give a green-card to the curriculum planners and teachers to be more flexible to implement problem finding in the design curricula. Of course, the most important possibility is that more people see the need for change in design curricula.

No matter how good a plan is, its final success critically relies on its implementation in schools — the frontline. The findings of the case study on incorporating problem finding in the design curricula of two secondary schools and a design school in a university illustrated that we should integrate problem-finding knowledge and experience in the curricula in three aspects: the learning process, performance in design, and perception of the importance of problem finding. Or by using Dudek & Côté's (1994) terms, the issue of problem finding should be examined on two levels: the *ideological* level, which relates to students' perceptions of problem finding (that is, perception of the importance of problem finding); and the *practical* level, which relates to the implementation of problem finding (that is, learning process, and performance in design).

According to the results of the case study, the crucial first step in strengthening students' problem-finding capability is to change their misperceptions. For example, according to the findings of the case study in the design school, even though the students might not agree that problem finding is a more *important* than solving an assigned question, they nonetheless held the inappropriate perception that problem finding was a "second class" or "may or may not be needed" stage in the thinking process (see also Mackworth, 1965). To change students' misperceptions of problem finding, one of the best ways is to allow and encourage them to have more practice and experience in the process (Houtz, 1994; Tan, 1996). The findings of the case study indicated that the problem-finding activity made the students (including those who had worked in the industry for a long time) change their perceptions of and attitudes to problem finding. When the students gained more experience in problem finding, they had a better understanding of the difficulties involved (Siu, 2002b). They recognized that problem finding was not an in-born or easy skill, as some of them had originally thought (Siu, 2002c).

With reference to the students' feedback in the case study, many students did not consider problem finding as a *necessary* skill. In particular, students studying subjects which conventionally only require model answers or well-predetermined and defined solutions seldom thought that it was important to discover or invent "something to do" or "something to think". Compared to science students taking conventional experiments in laboratories requiring to find out well-defined outcomes, or engineering students taking conventional examinations requiring to present their mathematical and engineering skills, skills in problem finding seem relatively less important. Even though some of the students in the case study might realise that problem-finding skills were essential for their future study and work, some of them still thought that it was easy for them and that it should not be necessary for them to have this kind of practice (that is, experience) in their learning.

On the other hand, in the case study, students and even teachers often associated "creativity and innovation" only with solutions, and not with problems. The major reason for this situation is that in the thinking process, people always emphasise the *end* — the solution. In other words, teacher would call a student unsuccessful if he/she could only get the *start* but had no guarantee of a satisfactory *end.* It is clear that this kind of thinking is deeply implanted in students' as well as teachers' minds. In addition, curriculum planners and programme coordinators have made little effort to establish a kind of assessment (or, a set of assessment criteria) which can seriously and effectively evaluate students' performance in problem finding (for example, performance in conducting research and in turn recognising, discovering or inventing a problem, and finally in identifying a project title or direction).

Regarding the consideration at the *practical* level, problem finding involves conceiving and envisaging the problem, defining and formulating the actual problem statement and assessing the quality of the continuous formulation of the problem and its solution (Getzels, 1982; Jay and Perkins, 1997; Runco, 1994; Siu, 2002d). The case study findings illustrated that all of these require the students — an individual or a group of problem discoverers (or observers) — to have a comprehensive knowledge of different areas, rich experience in problem finding and also critical minds. Without comprehensive knowledge, students might have a narrow perspective, like the secondary students in the case study. This would make it difficult for them to be "sensitive" to their surroundings and to have sufficient knowledge to make judgments and carry out analyses. Without experience and a critical mind, the students — problem discoverers — would not have sufficient confidence to go further to define and formulate problems, or to make critical judgments on the collected data. As stated in a previous chapter, it was also the reason why the students frequently came to their teachers to ask them to make it easy by offering a set of potential titles. In short, due to their lack of experience, the students did not have sufficient confidence.

From observation in the project, students were weak in discovering and inventing problems. One of the reasons was that students lack guidance in recognising, discovering and inventing problems, in particular the latter. As demonstrated by the students' feedback in the questionnaire and interview discussed above, it was not difficult for them to recognise existent problems. However, when it came to discovering problems, the students honestly responded that they had no concrete idea of "what is a problem?" and "how to start?" As the Year 1 students in the design school indicated in the group discussion, many of them always had questions on their minds, such as, for instance: "Is it a problem? It seems so simple." "Is it a problem for my learning discipline? I have the impression that it belongs to another discipline and I am not suppose to care about it." Obviously, it is relatively more difficult for the students to invent potential problems.

The students pointed out that one of the major barriers to their inventing a problem is the elaboration from an "interesting situation" to a "problem". Moreover, as stated by the teachers involved in the project, many students always asked the teachers to make decisions for them by asking: "Is it a good project title (problem)?" This kind of enquiry reflected two common weaknesses of students and one current curriculum constraint. The students had neither the confidence nor the experience to make judgements on an emergent or potential problem, and they did not have enough experience to fine-tune or modify their defined situation. The students continually worried about their grades and expected to seek the teachers' approval of their defined problems in order to get higher marks, rather than seeking advice on the problems that would allow them to improve. It is clear that the current solution-oriented and grade-oriented learning attitude limits students' willingness and courage to discover and invent problems.

If the students' judgement relies heavily on the teachers' decisions, and there is insufficient step-by-step guidance for students in making decisions by themselves, they will fail to improve their problem-finding abilities. With reference to the experience of the project, one of the possible ways helping the students is to set up scope or steps according to the qualifications and experience of the students (see Siu, 1997b). Such as the S.2 students in the secondary school, they did not have any experience in problem finding and they also got very limited experience in research. The possible ways might be providing a smaller scope for the students' project and giving some guidance and existing research tools for the students to do the background research related to the scope. Teachers need to be careful that this kind of arrangement and requirement in problem-finding activities in project should not be set up as barriers for the students' enquiry and development of their project directions. Instead, these activities should be carefully planned and implemented as constructive assistance for the students. Another useful way is to require the students to engage in more critical discussions with their classmates and teachers. They should learn how to accept critical comments, as well as provide them. As Einstein said (1938), only through raising more questions can we make real advances in our discipline.

To nurture students to be *all-round* designers in terms of enabling them to find problems (that is, recognising, discovering and inventing problems), according to the interview responses of the curriculum and examination people and the findings of the case study, there are key areas that curriculum planners and teachers should keep in mind in providing project experience for students. First of all, as just stated in previous paragraph, more experience should be provided to the students. In other words, the experience of problem finding for students should not only be available in extra-curricular activities. This is insufficient. Instead, the experience should also be provided in the regular curricula.

Like other problem-solving activities, problem-finding experience should be provided as early as possible (Department of Education and Science, 1989, 1990; Jay and Perkins, 1997; National Curriculum Council, 1990). The only difference should be in the level of guidance provided by teachers, the nature of activities, and the difficulty of requirements.

The assessment criteria of the project should not only be related to the final outcome, but also to the process, particularly the ability of students to find a problem, need and design opportunity, and to identify a project title. This means that assessment of projects should not just be outcome-oriented, but also process-oriented. Students (as well as teachers and examiners) should accept problems that may not have solutions at the present moment. The possibility of a final outcome should not be a factor which affects students' consideration of a problem (a need) for further investigation.

As stated above, insufficient confidence most of the time is due to insufficient experience, and this generalization applies to teachers, examiners and curriculum developers as well as students. As the case study in the university design school shows, the students who had obtained problem- finding experience before performed better in the project. As they also agreed in the group discussion, the smooth running of their projects was because of their experience and their confidence. This shows that the experience of students in problem finding can be accumulated. Therefore, through providing references (preferably not samples), helping students to confine their titles, and setting particular scopes, teachers can help students to build the confidence necessary to enable them to set their own project titles. As stated by Houtz (1994), these kinds of activities can range from concrete to abstract, simple to complex, small to grand, and local to global (see also Dillon, 1982; Runco, 1992)

According to the results both in the secondary schools and the design school, teachers should realise that letting students define project titles or find problems can result in a higher motivation for students to tackle projects — to learn (Houtz, 1994; see also Atkinson, 2000). Thus, providing an opportunity for students to identify their project titles or to find out "what should be solved?" should not be considered as an inconvenience and barrier to teaching and project guidance, even though teachers are sometimes faced with diverse needs and preferences of students (Siu, 1994, 1997b, 2002d). Instead of misusing the idea of "fairness" to condemn all students to the level of those few who fear problem finding because they are not confident, the more adventurous students should be taken as the norm to which the others should aspire, even though there may be more changes for both success and failures.

Moreover, teachers should always remind students that they should appreciate others' found problems, particularly the invented problems which seem ridiculous and do not make any sense. In fact, there are no nonsense questions, but only nonsense solutions. According to the experience in the case study in the design school, the supportive manner of some Year 1 design students motivated some of "weak" students to continue their projects. In contrast, the relatively less supportive learning atmosphere in the Year 2 class made some of the students always wanted to quit from the problem- finding activity and requested the teacher to provide them an assigned project title.

In addition, teachers should be aware that balance in problem finding and solving is very important. They should also remind themselves and their students that problem-finding learning and practice should not only aim at instant return. Only constant practice and positive and constructive reinforcement for *brave* discovery and invention (in problem finding as well as problem solving), will enable students to be the all-round designers and enable them to survive in the ever-changing world. On the contrary, teachers' negative recognition of the importance and advantages of problem finding may cause a "ripple-effect" causing the students to make the same comment about problem finding. When one of the secondary teachers in the case study presented his negative feeling on problem-finding activities in the classroom, observation showed that some students were affected by the teacher and in turn showed their unwillingness to do the project.

Students may learn facts and skills from teachers, but they often learn attitudes and aspirations from their fellow students. On the one hand, in classes where influential students do the least they can to get a pass, the overall performance of all but a few strong-minded individuals is pulled down towards the lowest common denominator; on the other, there are some classes that exhibit a more favourable attitude towards success, in which even the less-than-outstanding students are drawn upwards towards emulating the accomplishments of the leaders.

Referring to the experience and findings of the case study in the secondary schools, teachers always mentioned the limitations and difficulties of administration and classroom management on carrying out problem-finding activities. However, to nurture this critical and fundamental design element, convenience in administration should not be the most crucial factor to affect the design and arrangement of projects. They should not be the factors that limit the opportunity of students to gain problem-finding experience. Administrative convenience should never trump educational factors.

However, the present situation in Hong Kong's design education is exactly the opposite of the ideal. For the convenience of project administration and assessment, many teachers prefer to set a title or set of titles for students. Even in tertiary level learning activities such as projects, there is very little freedom for students to identify their project titles or topics. Moreover, because of the common emphasis on the final solution and the relatively greater weighting on the "solution", both the teachers and students often neglect the importance of experience and capability in problem finding, or prefer to pay little attention to it.

In the case study, teachers played a very important role in problem-finding activities for students. Therefore, attention should also be put in initial teacher education programmes. Since student teachers should be drawn from the most mature students studying design, more freedom in problem finding should be provided to encourage them to hand on this legacy. Besides learning how to identify needs and opportunities, student teachers also need to learn how to guide their students to build the skills necessary for project work, including problem finding. The scope of learning provided in teacher education should be wide and deep enough to build students' confidence and experience so they can face their future duties.

To conclude, since the new needs of industry and education require employees and students to take more initiative, we need to enhance our students' problem-finding capabilities. This means that the success of a student today lies in not only following and answering, but also in asking and identifying. To meet this educational goal, we should facilitate a good learning environment, introduce reforms to our curricula, provide more guidance and motivation, and evaluate students' performance in a more balanced way, in order to encourage them to try not only to solve but also to recognise, discover and invent problems.

Last but not least, we cannot deny that there are many limitations and difficulties in incorporating problem finding in the design curricula. However, as the findings of the study illustrated, the educational value of "problem finding" itself should be emphasized at all levels and in all aspects of teaching, administration and evaluation.

It is not just theory but also the findings of the case study that show problem finding leads and pushes design students to face challenges and change. Today, students need to be motivated or even required not to sit there passively waiting for missions and jobs *assigned* by *others*. Instead, they need to be active and show initiative. This thesis maintains that problem finding encourages and helps students take a more active role in recognising, discovering and inventing opportunities that will enhance their education in schools today, and their future careers in society.

References

The 1998 Policy Address (1998). Hong Kong: The Hong Kong SAR Government.

The 2001 Policy Address (2001). Hong Kong: The Hong Kong SAR Government.

Aberdeen Technical School. (1985). *Aberdeen Technical School golden jubilee (1935-1985)*. Hong Kong: Aberdeen Technical School.

Allender, J. S. (1969). A study of inquiry activity in elementary school children. *American Educational Research Journal, 6*, 543-558.

Aspelund, K. (2006). *The design process*. New York, NY: Fairchild.

Atkinson, E. S. (2000). An investigation into the relationship between teacher motivation and pupil motivation. *Educational Psychology, 20*(1), 46-57.

Babbie, E. (2004). *The practice of social research* (10th ed.). Belmont, CA: Wadsworth/Thomson Learning.

Batchelor, M. C. (1989). Strategies for planning and monitoring design and technology in the school curriculum. *2nd National Conference Design and Technology Educational Research & Curriculum Development*. Loughborough: Department of Design and Technology, Loughborough University of Technology.

Barlex, D., & Kimbell, R. (1986). *CDT: Projects and approaches*. Basingstoke: Macmillan Education.

Becker, K. H., & Maunsaiyat, S. (2002). Thai students' attitudes and concepts of technology. *Journal of Technology Education, 13*(2), 6-20.

Buchanan, R., & Margolin, V. (1995). *Discovering design: Explorations in design studies*. Chicago, IL: The University of Chicago Press.

Bullock, E. W. (1986). Design and the design process. *CEFP Journal, 24*(6), 4-5.

Bunge, M. (1967). *Scientific research (Vol 1: The search for system).* New York, NY: Springer.

Burgess, R. G., & Bryman, A. (1999). *Qualitative research.* London: SAGE.

Chan, M. K., & So, A. Y. (Eds.) (2002). *Crisis and transformation in China's Hong Kong.* Armonk, NY: M. E. Sharpe.

Chand, I., & Runco. M. (1992). Problem finding skills as components in the creative process. *Personality and Individual Differences, 14,* 155-162.

Cohen, L., Manion, L., & Morrison, K. (2007). *Research methods in education* (6th ed.). London: Routledge.

Consultation Paper. (2004). Consultation paper: Promotion of innovation and design: DesignSmart initiative. Hong Kong: Innovation and Technology Commission. Retrieved April 15, 2007, from http://www.info.gov.hk/itc/eng/designsmart/index.shtml

Csikszentmihalyi, M., & Getzels, J. W. (1970). Concern for discovery: An attitudinal component of creative production. *Journal of Personality, 38*(1), 91-105.

Curriculum Development Committee. (1983). *Syllabuses for secondary schools, design and technology (CE level).* Hong Kong: Education Department.

Curriculum Development Council. (1991). *Syllabuses for secondary schools, design and technology (CE level).* Hong Kong: Education Department.

Curriculum Development Council. (1998). *Syllabuses for secondary schools, design and technology (CE level).* Hong Kong: Education Department.

Curriculum Development Council. (2000). *Learning to learn: Key learning area (Technology education).* Hong Kong: Printing Department.

Curriculum Development Council. (2003). *Syllabuses for secondary schools, design and technology (CE level).* Hong Kong: Education Department.

Curriculum Development Council. (2005). *Consultation document for the* *curriculum development of design and technology.* Hong Kong: Curriculum Development Council.

Department for Children, Schools and Families. (2007). Design and technology at key stage 3. Retrieved May 15, 2007, from http://www.standards.dfes.gov.uk /schemes2/secondary_dt/resources?view=get

Department for Education & Employment. (1999). *Design and technology: The National Curriculum for England: Key stages 1-4* (National Curriculum). London: QCA/DfEE.

Department of Education and Science. (1989). *Proposals of design and technology for ages 5 to 16.* London: HMSO.

Department of Education and Science. (1990). *Technology in the National Curriculum.* London: HMSO.

Department of Education and Science (1995). *Design and technology in the National Curriculum.* London: HMSO.

Denscombe, M. (2000). *The good research guide for small scale social research projects.* Buckingham: Open University Press.

Dewey, J. (1929). *The quest for creativity.* New York, NY: Putnam.

Dillon, J. T. (1982). Problem finding and solving. *The Journal of Creative Behavior, 16*(2), 97-111.

Dudek, S. Z., & Côté, R. (1994). Problem finding revisited. In M. A. Runco (Ed.), *Problem finding, problem solving and creativity* (pp. 131-150). Norwood, NJ: Ablex Publishing.

Education Bureau. (2007). Education Reform Highlights. Retrieved July 20, 2007, from http://www.edb.gov.hk/index.aspx?nodeid=1583&langno=1

Eggleston, J. (1996). *Teaching design and technology* (2nd ed.). Buckingham: Open University Press.

Eggleston, J. (2000). *Teaching and learning design and technology: A guide to recent research and its applications*. London: Continuum.

Eggleston, J. (2001). *Teaching design and technology* (3rd ed.). Buckingham: Open University Press.

Einstein, A. (1938). *The evolution of physics*. New York, NY: Simon & Schuster.

Faure, D., & Lee, P. T. (2004). *Economy*. Hong Kong: Hong Kong University Press.

Fischer, D. H. (1970). *Historians' fallacies: Toward a logic of historical thought*. New York, NY: Harper & Row.

Flick, U., Kardorff, E., & Steinke, I. (2004). *A companion to qualitative research*. Thousand Oaks, CA: SAGE.

Friedman, R. C., & Shore, B. M. (Eds.) (2000). *Talents unfolding: Cognition and development*. Washington, DC: American Psychological Association.

Fung, A., Lo, A., & Rao, M. N. (2005). *Creative tools*. Hong Kong: School of Design, The Hong Kong Polytechnic University.

Fung, C. K. E. (1997a). *Newsletters: History and development of design and technology*. Hong Kong: Hong Kong Association for Design and Technology Education.

Fung, C. K. E. (1997b). *A study on the dissemination strategies of the new AS-level design and technology in Hong Kong* (Unpublished thesis). Hong Kong: The University of Hong Kong.

GEMS Education. (2007). The National Curriculum for England. Retrieved May 15, 2007, from http://www.gemseducation.com/server.php?show=nav.001004006001

Getzels, J. W. (1964). Creative thinking, problem solving, and instruction. In R. Hilgard (Ed.), *Theories of learning and instruction (63rd NSSE Yearbook, Part 1)* (pp. 240-267). Chicago, IL: University of Chicago Press.

Getzels, J. W. (1982). The problem of the problem. In R. Hogarth (Ed.), *New directions for methodology of social and behavioral science: Question framing and response consistency* (pp. 37-49). San Francisco, CA: Jossey-Bass.

Getzels, J. W. (1987). Problem finding and creative achievement. *Gifted Students Institute Quarterly, 12*(4), B1-B4.

Glasgow, N. A. (1997). *New curriculum for new times: A guide to student-centred, problem-based learning*. California, CA.: Corwin Press.

Graves, N., & Varma, V. (1997). *Working for a doctorate: A guide for the humanities and social sciences*. London: Routledge.

Hicks, M. J. (2004). *Problem solving and decision making: Hard, soft and creative approaches* (2nd ed.). London: Thomson.

Hinrichs, T. R. (1992). *Problem solving in open worlds: A case study in design.* Hillsdale, NJ: L. Erlbaum Associates.

Ho, L. S., & Ash, R. F. (2006). *China, Hong Kong and the world economy: Studies on globalization*. New York, NY: Palgrave Macmillan.

Hong Kong Annual Report. (1986). Hong Kong: Hong Kong Government Printer.

Hong Kong Annual Report. (1990). Hong Kong: Hong Kong Government Printer.

Hong Kong Annual Report. (1996). Hong Kong: Hong Kong Government Printer.

Hong Kong Examinations Authority. (1987). Regulations and syllabus (Hong Kong Certificate of Education Examination). Hong Kong: Hong Kong Examinations Authority.

Hong Kong Examinations Authority. (1997). Regulations and syllabus (Hong Kong Certificate of Education Examination). Hong Kong: Hong Kong Examinations Authority.

Hong Kong Examinations and Assessment Authority. (2002a). *Design and technology syllabus, CE level (2004-CE-D&T)*. Hong Kong: Hong Kong

Examinations and Assessment Authority.

Hong Kong Examinations and Assessment Authority. (2002b). *Design and technology, CE level, alternative syllabus (2004-CE-D&T (ALT))*. Hong Kong: Hong Kong Examinations and Assessment Authority.

Hong Kong Examinations and Assessment Authority. (2002c). *Syllabus: Design and technology – Advanced supplementary level*. Hong Kong: Hong Kong Examinations and Assessment Authority.

Hong Kong Examinations and Assessment Authority. (2005). *Syllabus: Design and technology – Advanced supplementary level*. Hong Kong: Hong Kong Examinations and Assessment Authority.

Hong Kong Examinations and Assessment Authority. (2006). *Syllabus: Design and technology – Advanced supplementary level*. Hong Kong: Hong Kong Examinations and Assessment Authority.

Hong Kong Examinations Authority. (1993). *Project list of Design and Technology III, Hong Kong Certificate of Education Examination 1993*. Hong Kong: Hong Kong Examinations Authority.

The Hong Kong Polytechnic University. (2003). *Shaping the future: Design for Hong Kong: A strategic review of design education and practice*. Hong Kong: School of Design, The Hong Kong Polytechnic University.

The Hong Kong Polytechnic University. (2005). *Programme syllabus: BEng(Hons) in Product engineering with design*. Hong Kong: Department of Mechanical Engineering, The Hong Kong Polytechnic University.

Hong Kong Trade Development Council. (2000). *Economic development of northwest China: opportunities for Hong Kong*. Hong Kong: Hong Kong Trade Development Council.

Houtz, J. C. (1994). Creative problem solving in the classroom: Contributions of four psychological approaches. In M. A. Runco (Ed.), *Problem finding, problem solving and creativity* (pp. 153-173). Norwood, NJ: Ablex Publishing.

Innovation Technology Centre. (April 8, 2004). *Summary of views from some PolyU members in response to the "DesignSmart" initiative.* Unpublished consultation document. Hong Kong: HKSAR Innovation Technology Centre.

James, K. (2005). Culture and individual and group creativity in organization. *The Korean Journal of Thinking & Problem Solving, 15*(2), 77-96.

Jay, E. S., & Perkins, D. N. (1997). Creativity's compass: A review of problem finding. In M. A. Runco (Ed.), *Creativity research handbook, Vol. 1.* Cresskill, NJ: Hampton.

Johnes, J. C. (1970). *Design methods and technology: Seeds of human future.* London: John Wiley.

Kimbell, R. (1982). *Design education: The foundation years.* London: Routledge & Kagan Paul.

Kimbell, R. (1997). *Assessing technology: International trends in curriculum assessment: UK, Germany, USA, Taiwan, Australia.* Buckingham: Open University Press.

Kimbell, R. (2005). *Assessing design innovation: Final report: A research and development project for the Department for Education and Skills (DfES) and the qualifications and curriculum.* London: Goldsmiths College.

Kimbell, R., Stables, K., & Green, R. (1996). *Understanding practice in design and technology.* Buckingham: Open University Press.

Kwok, Y. C. J. (Ed.) (1997). *(Re)-discovering design: A critical consideration of the Hong Kong culture of design.* Hong Kong: A Better Tomorrow Workshop.

Kwok, Y. C. J., & Siu, K. W. M. (2002). *Participatory research for the designing of children and youth integrated services centres.* Hong Kong: The Hong Kong

Polytechnic University.

Lau, K. T., So, R. M. C., Justice, L., Lee, T. C., & Townson, D. (2005). Design opportunity in Hong Kong and the Pearl River Delta Region. In P. Rodgers, L. Brodhurst & D. Hephburn (Eds.), *Crossing design boundaries: Proceedings of the 3rd Engineering & Product Design Education International Conference* (pp. 71-76). London: Taylor & Francis.

Laurel, B. (Ed.) (2003). *Design research: methods and perspectives.* Cambridge, MA: MIT Press.

Law, W. Y. (1989). *Opening speech of the graduation ceremony of the Hong Kong Technical Teachers' College* (unpublished speech, July 1989). Hong Kong.

Lee, P. K. (2000). *Hong Kong from Britain to China: Political cleavages, electoral dynamics and institutional changes* (Unpublished speech). Aldershot: Ashgate.

Leung, C. F. (1998). Criterion-referenced assessment in design and technology problem solving. In P. Stimpson & P. Morris (Eds.) *Curriculum and assessment for Hong Kong: Two components, one system* (pp. 413-432). Hong Kong: Open University of Hong Kong Press.

Leung, T. P. (Ed.) (2004). *Hong Kong: Better by Design.* Hong Kong: The Hong Kong Polytechnic University.

Liu. C. X. (2005). Presentation and representation: Research data management. *Conference proceedings: 3rd Annual Hawaii International Conference on Arts and Humanities* [CD publication]. Honolulu, HI: Hawaii International Conference on Arts and Humanities.

Lloyd-Jones, R. (1998). *Assessment: From principles to action: Guides to assessment in education* (2nd ed.). London: Macmillan. (Original work published 1986)

Ma, N. (2007). *Political development in Hong Kong: State, political society, and* *civil society*. Hong Kong: Hong Kong University Press.

Mackworth, N. H. (1965). Originality. *American Psychologist, 20*, 51-66.

Marshall, S. P. (1995). *Schemas in problem solving*. New York, NY: Cambridge University Press.

Martin, D. J., Dakers, J., Duvernet, L., Kipperman, D., Kumar, K., Siu, K. W. M., Thorsteinsson, G., & Welch, M. (2003). In search of a sustainable future: An international overview of the contribution from design and technology education. *The Journal of Design and Technology Education, 8*(3), 137-149.

Ministry of Education. (2001). *Design & technology syllabus: Lower secondary.* Singapore: Curriculum Planning & Development Division, Ministry of Education.

Mo, P. H. (2006). *Trade, exchanges and productivity growth*. Hong Kong: Hong Kong Baptist University.

Morris, P. (1990). *Curriculum development in Hong Kong*. Hong Kong: Faculty of Education, The University of Hong Kong.

Morris, P. (1995). *The Hong Kong school curriculum: Development, issues and policies*. Hong Kong: Hong Kong University Press.

National Curriculum Council (1990). *Non-statutory guidance - Design and technology capability.* London: National Curriculum Council, HMSO.

Norman, D. A. (1998). The design of everyday things. Cambridge, MA: MIT Press.

The National Curriculum for 11 to 16 Year Olds. (2007). Retrieved May 5, 2007, from http://www.direct.gov.uk/en/EducationAndLearning/Schools/ExamsTestsAndTheCurriculum/DG_10013877

Nicholson, B. (1989). Assessing design and technology in the National Curriculum. *2nd National Conference Design and Technology Educational Research & Curriculum Development*. Loughborough: Department of Design and Technology, Loughborough University of Technology.

Norman, E., Cubitt, J., Urry, S., & Whittaker, M. (1995). *Advanced design and technology* (2nd ed.). Harlow: Longman.

Okuda, S., Runco, M., & Berger, D. (1991). Creativity and the finding and solving of real-world problems. *Journal of Psychoeducational Assessment, 9*, 45-53.

Osborn, A. F. (1963). *Applied imagination* (3rd ed.). New York, NY: Charles Scribner's Sons.

Papamichael, K. M. (2003). *Design process and knowledge*. Ann Arobor, MI: UMI.

Perloff, H. S. (1985). Urban planning and the quality of the urban environment. In L. S. Burns, & J. Fredmann, (Eds.), *The art of planning: Selected essays of Harvey S. Perloff* (pp. 91-104). London: Plenum Press.

Peto, J. (1999). *Design process, progress, practice*. London: London Museum.

Poulson, L., & Wallace, M. (Eds.) (2004a). *Learning to read critically in teaching and learning*. London: SAGE.

Poulson, L., & Wallace, M. (2004b). Designing and writing about research: Developing a critical frame of mind. In L. Poulson & M. Wallace (Eds.), *Learning to read critically in teaching and learning* (pp. 37-60). London: SAGE.

Priest, S. H. (1996). *Doing media research: An introduction*. Thousand Oaks, CA: SAGE.

Puccio, G. J., Murdock, M. C., & Mance, M. (2005). Current developments in creative problem solving for organizations: A focus on thinking skills and styles. *The Korean Journal of Thinking & Problem Solving, 15*(2), 43-76.

Punch, K. F. (1998). *Introduction to social research: Quantitative & qualitative approaches*. London: SAGE.

Qualifications and Curriculum Authority. (2007). Good practice in design and technology 16-19. Retrieved August 1, 2007, from http://www.qca.org.uk/qca_5357.aspx

Robertson, S. I. (2004). *Problem solving* (Chinese ed.). Beijing: Zhongguo Qing Gong Ye Chu Ban She.

Rowe, P. G. (1999). *Design thinking* (Chinese ed.). Taipei: Jian Zhu Qing Bao Ji Kan Za Zhi She.

Rubinstein, M. F., & Firstenberg, I. R. (1995). *Patterns of problem solving* (2nd ed.). Englewood Cliffs, NJ: Prentice-Hall.

Runco, M. A. (1990). *Theories of creativity*. Newbury Park, CA: SAGE.

Runco, M. A. (Ed.) (1994). *Problem finding, problem solving and creativity*. Norwood, NJ: Ablex Publishing.

Runco, M. A. (1997). *The creativity research handbook*. Cresskill, NJ: Hampton Press.

Runco, M. A. (2003). *Critical creative processes*. Cresskill, NJ: Hampton Press.

Runco, M. A. (2007). *Creativity: theories and themes: research, development, and practice*. Burlington, MA: Elseviers Academic Press.

Schoennauer, A. W. W. (1981). *Problem finding and problem solving*. Chicago, IL: Nelson-Hall.

School Curriculum and Assessment Authority and Curriculum and Assessment Authority for Wales. (1995). *Key stage 3: Design and technology, the new requirements*. London: HMSO.

Silverman, D. (Ed.) (1997). *Qualitative research: Theory, method and practice*. London: SAGE.

Silverman, D. (2000). *Doing qualitative research: A practical handbook*. London: SAGE.

Siu, K. W. M. (1994). *A study of pupils' rationale for the selection of topics in the project section of the HKCEE design and technology*. Unpublished thesis. Hong

Kong: The University of Hong Kong.

Siu, K. W. M. (1997a). Review the past to plan the future: Setting design education direction through a review of education targets from the 1960s to present. In Y. C. J. Kwok (Ed.), *(Re)-Discovering* design (pp. 25-45). Hong Kong: A Better Tomorrow Workshop.

Siu, K. W. M. (1997b). Criticism and theory studies in design and technology teacher education programs. *Curriculum Forum, 7*(1), 49-58.

Siu, K. W. M. (1997c). Rethinking student project identification in Design and Technology. *Science & Technology Education Conference 1996 Proceedings: Bridging science and technology education - innovations and experiences* (pp. 204-211). Hong Kong: The University of Hong Kong.

Siu, K. W. M. (1999a). Improving design and technology education in Hong Kong. *Journal of Art and Design Education, 18*(3), 345-350.

Siu, K. W. M. (1999b). New roles of design teachers. *Education Today, 49*(1), 25-30.

Siu, K. W. M. (2000a). A case study of the difficulties and possibilities for students to initiate their project titles. In K. Volk, W. So, & G. Thomas (Eds.), *Proceedings: Science and Technology Education Conference 2000* (pp. 112-120). Hong Kong: Education Department and The Hong Kong Institute of Education.

Siu, K. W. M. (2000b). Developing the creativity of engineering students: Providing flexibility in design activities. In *1st Biennial International Conference on Technology Education Research 2000 Proceedings: Improving practice through research: Improving research through practice* (pp. 37-46). Brisbane: Faculty of Education, Griffith University.

Siu, K. W. M. (2000c). Re-construction of learning space for design education. *Design and Education, 8*(1), 20-28.

Siu, K. W. M. (2000d). A comparative study of relay thinking activities in degree and secondary level students. *Educational Research Journal, 15*(1), 45-68.

Siu, K. W. M. (2001a). Meeting the knowledge demands of the new economy: From recognising existent problems to discovering emergent ones. In F. Beven, C. Kanes & D. Roebuck (Eds.), *Proceedings of the 9th Annual International Conference on Post-compulsory Education and Training: Knowledge demands for the new economy (Volume Two)* (pp. 223-231). Brisbane: Australian Academic Press.

Siu, K. W. M. (2001b). What should be solved? *The Korean Journal of Thinking and Problem Solving, 11*(2), 9-22.

Siu, K. W. M. (2001c). Reconstructing the learning environment for the new needs in engineering training. *Engineering Science and Education Journal, 10*(3), 120-124.

Siu, K. W. M. (2002a). Impact of new technology on teaching and learning in technology education: Opportunity or threat?. In E. W. L. Norman (Ed.), *DATA International Research Conference 2002* (pp. 29-37). Wellesbourne: The Design and Technology Association.

Siu, K. W. M. (2002b). Meeting the new needs: Curriculum development and assessment of technology subjects. In *25th Anniversary Commemorative Album of the Hong Kong Examinations and Assessment Authority* (pp. 48-54). Hong Kong: Hong Kong Examinations and Assessment Authority.

Siu, K. W. M. (2002c). Nurturing all-round problem solvers: Enabling students to recognise, discover, and invent problems. In H. Middleton, M. Pavlova & D. Roebuck (Eds.), *Learning in technology education: Challenges for the 21st century (Volume 2)* (pp. 211-221). Brisbane: Centre for Technology Education Research, Griffith University.

Siu, K. W. M. (2002d). The quality of need identification in design. In H. Pham & M.

W. Lu (Eds.), *Proceedings of the Eighth ISSAT International Conference on Reliability and Quality in Design 2002* (pp. 211-215). New Brunswick, NJ: International Society of Science and Applied Technologies.

Siu, K. W. M. (2002e). 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 & W. Y. Wu (Eds.), *Thinking Qualities Initiative Conference Proceedings 2000 & 2001* (pp. 215-222). Hong Kong: Centre for Educational Development, Hong Kong Baptist University, and Hong Kong Society for the Advancement of Learning and Teaching of Thinking.

Siu, K. W. M. (2003). Nurturing all-round engineering and product designers. *International Journal of Technology and Design Education, 13*(3), 243-254.

Siu, K. W. M. (2005). Facilitating the development of the design industry. *The Korean Journal of Thinking and Problem Solving, 15*(1), 91-99.

Social Welfare Department. (2007). Retrieved March 22, 2007, from http://www.swd.gov.hk/en/index/site_pubsvc

Starko, A. J. (2000). Finding the problem finders: Problem finding and the identification and development of talent. In R. C. Friedman & B. M. Shore (Eds.), *Talents unfolding: Cognition and development.* Washington, DC: American Psychological Association.

Sternberg, R. J. (1994). *Thinking and problem solving* (2nd ed.). San Diego, CA: Academic Press.

Sternberg, R. J., & Frensch, P. A. (Eds.) (1991). *Complex problem solving: Principles and mechanisms*. Hillsdale, NJ: Lawrence Erlbaum.

Stimpson, P., & Morris, P. (1998). *Curriculum and assessment for Hong Kong: Two components, one system*. Hong Kong: Open University of Hong Kong.

Stoll, S., & Fink, D. (1996). *Changing our schools*. Buckingham: Open University

Press.

Tan, S. C. (1996). *A case study of the teaching of design and technology in a secondary school* (M.Ed. Unpublished Thesis). Singapore: National Institute of Education.

Taylor, I. A. (1972). *A theory of creative transactulization: A systematic approach to creativity with implications for creative leadership* (Occasional Paper, No. 8). Buffalo, NY: Creative Education Foundation.

Territory Development Department. (1993). *Twenty years of new towns development.* Hong Kong: Territory Development Department.

Town Planning Office. (1988). *Town planning in Hong Kong.* Hong Kong: Government Printer.

Trade and Industry Department. (2007). Retrieved March 30, 2007, from http://www.tid.gov.hk/english/smes_industry/smes_industry.html

Treffinger, D. J. (1995). Creative problem solving: Overview and educational implications. *Journal of Educational Psychology, 7*(3), 301-312.

Treffinger, D. J., Isaksen, S. G., & Stead-Dorval, K. B. (2006). *Creative problem solving: An introduction* (4th ed.). Waco, TX: Prufrock Press.

Turner, M. (1989). *History of Hong Kong design.* Hong Kong: Hong Kong Polytechnic.

University Grants Council. (2007). Retrieved August 1, 2007, from http://www.ugc.edu.hk/eng/ugc/index.htm

University Prospectus. (2000-2005). *University prospectus (Section for the programmes of the School of Design).* Hong Kong: The Hong Kong Polytechnic University.

Volk, K. S., & So, W. W. M. (Eds.) (2002). *Meeting the challenges of education reform: Proceedings of Science & Technology Education Conference 2002.* Hong

Kong: Printing Department, HKSAR.

Volk, K. S., Yip, W. M., & Lo, T. K. (2003). Hong Kong pupils' attitudes toward technology: The Impact of design & technology programs. *Journal of Technology Education, 15*(1) 48-63.

Wertheimer, M. (1959). *Productive thinking (Enl. ed.).* London: Travistock.

Whimbey, A., & Lochhead, J. (1991). *Problem solving and comprehension* (5th ed.). Hillsdale, NJ: Lawrence Erlbaum.

Whiteley, N. (1993). *Design for society.* London: Reaktion Books.

Wilson, G. (2000). *Problem solving.* London: Kogan Page.

Wise, D. (1990). *The design process.* East Sussex: Wayland.

Wolcott, H. F. (2001). *Writing up qualitative research.* Thousand Oaks, CA: SAGE.

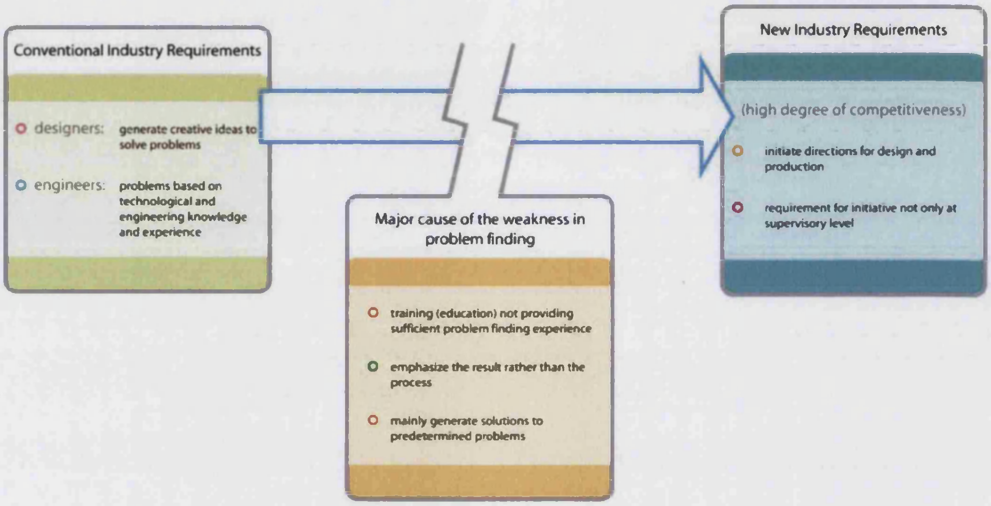
Yau, C. M. (2002b). Portfolio assessment in the subject design and technology (D&T) for secondary one students in Singapore. In K. Volk (Ed.), *Science & Technology Education Conference 2002 Proceedings* (pp. 260-272). Hong Kong: Hong Kong Institute of Education.

Yin, R. K. (1993). *Applications of case study research.* London: SAGE.

Yin, R. K. (1994). *Case study research: Design and methods* (2nd ed.). Thousand Oaks, CA: SAGE.

Appendix I

Changes of Industry Requirements, and Major Causes of the Weakness in Problem Finding



Appendix II

An Early Version of the Questionnaire for the Study

This questionnaire is an early version of the questionnaire planned for the entire study. After a trial run of the questionnaire to some students, this version of the questionnaire was not used. Instead, it was revised and divided as two new sets of tools for this study:

(i) Questionnaires for two levels of students to understand their backgrounds (see Appendix II & III).

(ii) Initial questions for group discussions and in-depth interviews with the students. (For a sample of the questions and record of the interviews, see Appendix IV). The topics of the initial questions included:

- General Understanding
- Willingness/Expectation
- Difficulties, Constraints, Limitations
- Gains, Satisfaction
- Suggestions

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1. Sex: ☐ Female ☐ Male

2. Education level:
☐ Cert/Dip ☐ H-Cert/H-Dip ☐ Other: ___________

3. Educational background:
☐ Design ☐ Engineering ☐ Other: ______________

4. Did you have any experience of problem finding before taking this subject?
☐ Yes ☐ No

If so, when was the first time you had such an experience in school:
☐ pre-primary ☐ primary ☐ secondary ☐ post-secondary ☐ degree
☐ other: _____________

5. Which situation do you prefer in carrying out your design project?
☐ a problem/project title identified by yourself
☐ a problem/project title assigned by your teacher
☐ a set of problems/project titles assigned by your teacher, and you select one of them
☐ other:____

6. With regard to your response to Question 5, why?
____

7. What is the most important factor for you in selecting your project title?
☐ interest ☐ ease of finding a solution ☐ others' suggestions
☐ other: __________

8. Rank the degree of the difficulty of the different stages of a design process provided below. Use "1" to indicate the most difficult, and "6" to indicate the easiest.
( ) identifying problems
( ) confining the problems to a project title
( ) generating ideas
( ) proposing a final solution
( ) realisation of the solution
( ) evaluation

9. Which level is the most appropriate time for students to be introduced to the experience of problem finding?
☐ pre-primary ☐ primary ☐ secondary ☐ post-secondary ☐ degree
☐ no need

10. With regard to your response to Question 9, when is the most suitable time for students to gain experience in problem finding?
☐ as early as possible ☐ final year ☐ other: __________

11. Do you think that experience in problem finding is useful for your current job?
☐ strongly disagree ☐ disagree ☐ neutral ☐ agree ☐ strongly agree

12. Do you think that experience in identifying problems will be useful for your future job?
☐ strongly disagree ☐ disagree ☐ neutral ☐ agree ☐ strongly agree

13. Some people say that problem finding is a conceptual issue. Thus, it is not necessary to have practice in it. Do you agree?
☐ strongly disagree ☐ disagree ☐ neutral ☐ agree ☐ strongly agree

14. Some people say that the experience of problem finding can be obtained in their workplace. Thus, there is no need to acquire this kind of experience in school. Do you agree?
☐ strongly disagree ☐ disagree ☐ neutral ☐ agree ☐ strongly agree

15. In this (14-week) design project, how many weeks did you spend on identifying the problems and fixing your project title?
____________ weeks

16. What was your major difficulty in identifying the problem(s)?
____

17. What was your major difficulty in fixing the project title?
____

18. Any other comments on identifying problems and fixing the project title:
____
____
____

— End —

Appendix III

Questionnaire I: Backgrounds of the Students Participated in the Study (Secondary School)
(Translated copy from Chinese version)[119]

The questionnaire is for a study on problem finding in design curricula. The information of personal particulars provided in this questionnaire will NOT be disclosed to other persons, including your teacher and classmates. Thank you very much for your help in filling this questionnaire.

1. Name: ____________________________

2. Sex: ☐ Male ☐ Female

3. Age: ______ years old

4. School: ____

5. Year of Study: ☐ Secondary Two ☐ Secondary Four

6. How many year(s) you have been studied in this school?

   __________ year(s)

7. How many year(s) you have learned D&T in this school?

   __________ year(s)

8. Do you think that experience in problem finding is important in D&T study?

   ☐ strongly disagree ☐ disagree ☐ neutral ☐ agree ☐ strongly agree

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[119] To be convenient for the students to respond to this questionnaire and to remove the fear of English, this questionnaire was provided in Chinese to the students.

9. Rank the degree of importance of the different stages of a design process provided below. Use "1" to indicate the most important, and "7" to indicate the least important.

( ) identifying problem
( ) confining the problem to a project title
( ) generating idea
( ) proposing a final solution
( ) realisation of the solution
( ) evaluation
( ) presentation

10. Do you think that problem finding is difficult?

☐ strongly disagree ☐ disagree ☐ neutral ☐ agree ☐ strongly agree

11. Rank the degree of difficulty of the different stages of a design process provided below. Use "1" to indicate the most difficult, and "7" to indicate the least difficult.

( ) identifying problem
( ) confining the problem to a project title
( ) generating idea
( ) proposing a final solution
( ) realisation of the solution
( ) evaluation
( ) presentation

12. In D&T lessons, have you identified a problem for an individual project by yourself?

☐ Yes ☐ No

13. In D&T lessons, have you identified a project title for an individual project by yourself?

☐ Yes ☐ No

14. In D&T lessons, have you done any <u>group</u> project(s)?

☐ Yes ☐ No

If yes, have you identified a project title for the project(s)?

☐ Yes ☐ No

15. Except D&T lessons, have you got any experience in problem finding in other design activities in the school, such as other design projects in other subjects?

☐ Yes ☐ No

If yes, what kind of design activities? ________________________________

16. Except design activities, have you got any experience in problem finding in other projects/activities in the school, such as extra-curricula activities?

☐ Yes ☐ No

If yes, what kind of activities? ________________________________

17. Have you got any experience in problem finding in other projects/activities outside this school?

☐ Yes ☐ No

If yes, what kind of activities? ________________________________

— End —

Appendix IV

Questionnaire II: Backgrounds of the Students Participated in the Study (Design School of the University)

The questionnaire is for a study on problem finding in design curricula. The information of personal particulars provided in this questionnaire will NOT be disclosed to other persons, including your teacher and classmates. Thank you very much for your help in filling this questionnaire.

1. Name: ______________________________

2. Sex: ☐ Male ☐ Female

3. Age: ______ years old

4. School and University:

   ____

5. Year of Study: ☐ Year 1 (full-time) ☐ Year 2 (part-time)

6. How many year(s) you have been studied in this design school?

   __________ year(s)

7. Before you study this programme, did you study design or design related subjects (including secondary school)?

   ☐ Yes ☐ No

   If yes, when? ______________________________

   How long? ______________________________

   Where (what programme)? ______________________________

8. Do you think that experience in problem finding is important in design study?

☐ strongly disagree ☐ disagree ☐ neutral ☐ agree ☐ strongly agree

9. Rank the degree of importance of the different stages of a design process provided below. Use "1" to indicate the most important, and "7" to indicate the least important.

( ) identifying problem
( ) confining the problem to a project title
( ) generating idea
( ) proposing a final solution
( ) realisation of the solution
( ) evaluation
( ) presentation

10. Do you think that problem finding is difficult?

☐ strongly disagree ☐ disagree ☐ neutral ☐ agree ☐ strongly agree

11. Rank the degree of difficulty of the different stages of a design process provided below. Use "1" to indicate the most difficult, and "7" to indicate the least difficult.

( ) identifying problem
( ) confining the problem to a project title
( ) generating idea
( ) proposing a final solution
( ) realisation of the solution
( ) evaluation
( ) presentation

12. In the programme you are studying, have you identified a problem for an individual project by yourself?

☐ Yes ☐ No

13. In the programme you are studying, have you identified an individual project title by yourself?

☐ Yes ☐ No

14. In this programme, have you done any <u>group</u> project(s)?

☐ Yes ☐ No

If yes, have you identified a project title for the project(s)?

☐ Yes ☐ No

15. Except in the current programme you are studying, have you got any experience in problem finding in other design projects/activities in other academic programme(s) in the university?

☐ Yes ☐ No

If yes, what kind of design activities? ____________________

16. Except in the current programme you are studying, have you got any experience in problem finding in other projects/activities in the university, such as extra-curricula activities in the university?

☐ Yes ☐ No

If yes, what kind of activities? ____________________

17. Have you got any experience in problem finding in other projects/activities <u>outside</u> the university?

☐ Yes ☐ No

If yes, what kind of activities? ____________________

18. Have you got any design related working experience for a duration longer than 3 months?

☐ Yes ☐ No (If no, the end of this questionnaire)

If yes, when? ______________________________

How long? ______________________________

Where and what is nature of the job(s) (can be more than one job)?

____

____

19. Have you got any experience in problem finding in your job(s)?

☐ Yes ☐ No

Please explain some brief details of the experience:

____

____

____

— End —

Appendix V

Initial Questions and Record of the In-depth Interviews

(A sample of interview/discussion record of the case study in the Design School of the University.)

The topics of the initial questions for the in-depth interviews included:

- General understanding
- Willingness, expectation
- Difficulties, constraints, limitations
- Gains, satisfaction
- Suggestions

I — interviewer (author)
F1, F2 — full-time students (interviewees)
P1, P2 — part-time students (interviewees)

General Understanding

I:	Do you have any experience of finding problem and identifying project titles freely on your course?
F1:	No. Generally, our teachers provide us with the topics or titles of the projects.
I:	What do you mean by "providing topics and titles for you?"
F1	For example, the teachers give us a problem, and we try to find a solution for it.
F2:	Our first year consisted of fundamental study; our projects were only small in scale. Most of the time, we only needed to solve the problems provided by the teachers.

I:	Anything else?
P1:	Sometimes our teachers gave us a set of topics and titles to choose from.

I:	How about in secondary school? Did you get any project experience?
F2:	I got some project experience in the subjects of Geography, History, and Design and Technology [D&T].
I:	You (F2) mentioned that you had learned D&T before. Did your teachers allow you to identify a title by yourself?
F2:	No.
I:	Besides D&T, did you (F2) identify any project title by yourself?
F2:	No.
I:	How about the others? Did you (F1, P1, P2) get any experience in defining project titles in school?
F1, P2	No.
P1:	I conducted a project with some classmates in extra-curricular activities. We identified the topic of the project as being related to environmental concerns.
I:	Besides this experience in extra-curricular activities, any other similar experiences?
F1:	I got a little experience of defining project titles in a Children and Youth Centre. The social workers discussed with us and asked us to initiate a project which could improve the environment of the Centre.
I:	What was the final outcome?
F1:	We decided to re-paint a room which was provided by the Centre for us to play cards in. We used spray-paint to decorate the room.
I:	Can you comment on this activity?
F1:	It was interesting and we enjoyed doing it, since the whole activity was initiated by us. Our motivation was very strong. The task was not assigned by the social workers, and they provided us with a high degree of flexibility.

I:	How about you (P1, P2), before you started this programme? Did you study any other post-secondary courses, and did you get any experience in defining project titles by yourselves?
P1:	Yes, I studied a higher diploma course before. All project titles were assigned by our teachers. For the final project, it was a group project.

Our teachers provided us with a set of project titles. We had to form groups, and each group had to select a title from it.

I: Did you or your classmates ask the teacher to allow you to identify a project title by yourselves?

P1: No.

I: Why?

P1: We knew that it would not be permitted. However, some of us asked to select the same title.

I: Why?

P1: Some of the titles were more difficult.

I: Were your requests granted?

P1: Not really. The teacher expected our selection to cover all of the titles. We had to reach a compromise by ourselves if more than one group of students wanted to select the same title.

I: What was the final outcome? Did different groups select different titles?

P1: Yes. As mentioned previously, the teacher ignored our request, and we had to settle the issue by ourselves.

I: What do you think about this kind of method of selecting project titles?

P1: Not so bad. We did not need to put too much effort into defining the title. I think it would have been difficult to find a project title by ourselves.

I: Why do you say this? How can you know that it would have been difficult for you to find a project title by yourselves if you had not tried before?

P1: We had no experience in this area. As the time schedule was very tight, providing a title for us was much better. However, as I already mentioned, sometimes, when several groups wanted to tackle the same title, it was not allowed. We had to compromise, and some of us had to select another title though unwilling to do so. This was a waste of time.

Willingness, Expectation

I: You (P1) mentioned that you had no experience in identifying a project title, and that it was difficult for you to do so. Now that you are working, do you think that the experience and skill of "identifying a project title" is important in your current job?

P1: I don't really think so, though I think this kind of experience may be useful for me later. Since my current position is not in a high rank and does not involve decision-making, particularly making decisions about the direction of the company's projects, I only follow my supervisor's instructions, though I can give my opinions. However, the nature of the projects is not decided by me. Let me put it like this: even my supervisor cannot make the decision whether a kind of job or a project should be done or not. Most of the time, we only get a project brief from "the top", and we need to finish it. You cannot say "I don't like this project brief or project requirement", and then do something else which you have identified. You know, there is not much emphasis on R&D (research and development) in many "factories" (manufacturing companies) in Hong Kong.

I: How about your (P2) opinions?

P2: I agree with him (P1) that we have very limited opportunities to make decisions in our jobs, particularly regarding the project brief. In spite of this, I think that getting more learning experience in problem finding will be useful for us in the future, since the nature of the manufacturing industry is changing. Most of the factories have moved to the Chinese mainland. People like me need to go back to the Chinese mainland at least three times a week. All the manufacturing processes of my company are carried out on the Chinese mainland. In fact, today, people on the Chinese mainland can do [produce] the same things that Hong Kong people can. We always claim that we can create and manage things better than people on the Chinese mainland. However, I don't think this will be so in the future. I think that this kind of experience and skill can prepare engineers not only to produce a product, but to design a new product.

I: Do the others agree with her (P2)?

F1: Yes. This is also the reason that I chose to study this programme and selected this subject. I expected to learn more about industrial design, more about design. As they (P1, P2) said, if we could not get this kind of experience at school (university), we might not have the same kind of opportunity to try when we go out to work.

I:	What do you think of the requirements of this project?
F2:	It's interesting. However, it was not easy for me, even though the teacher gave us some guidelines.
P1:	I agree. It was particularly difficult at the beginning. I did not know what should be done. Or, rather, it seemed that anything could be done.
F1:	I didn't know how to set the scope of a title. Honestly, it seemed safe for me to set a simple title which had a high feasibility to be tackled.
I:	What do you mean by "a high feasibility to be tackled?"
F1:	Easy to achieve a final solution.
F2:	I agree with him (F1). Some of our colleagues did some simple research and then set easy project titles for themselves. They could solve the problems and propose solutions easily. So, although the teacher suggested us to find problem and identify a title which should be meaningful and related to Hong Kong culture and life, what was always in my mind was a good outcome.
I:	Would you explain more about what you mean by "a good outcome?"
F2:	I mean a final solution which can get high marks. As the requirement of the design project, I always kept in mind that I needed to have a creative solution for the title I identified. Actually, I did not need to identify a creative title, but a creative solution for the title.

I:	Any other comments on the project in which the title can be identified by students?
P2:	I know that some of our classmates only copied projects that their companies were working on, and claimed that they had identified these projects and their proposed solutions. This was unfair to us.
F1:	Some copied from magazines, and claimed that the project titles were identified by them.
I:	I should agree that it's not easy for your teachers to detect these situations. I understand most of you will not report these cases to me.
P2:	Of course. It's also the reason that I think it would be fairer to give the same title to all students, ask them to propose solutions, and compare their ability in design.
I:	This may also raise the same difficulty where a student has tackled the assigned problem before. He/she also can get an advantage from it.
P2:	This probability is not so high.

Difficulties, Constraints, Limitations

I:	You (P1) mentioned that it was difficult for you to find a problem and identify a title at the beginning of this project. Could you explain more about this?
P1:	It was because we had not had this kind of experience before. Moreover, in the programme, the assessment method of most of the subjects is examination. Even when we need to tackle projects, their focus is only on problem solving, not problem finding.
F2:	We don't know what is a good project title. As he (P1) mentioned before, it seemed that anything could be a project title, and anything could be done.
P1:	We also don't know how much time should be spent on problem finding and project title identification.
I:	What do you think?
P1:	I think it should not be too long. I think we should spend more time tackling the identified problem.
I:	Do you mean proposing solutions?
P1:	Yes.
F1:	I don't think so. If you set a very bad project title, no matter how good your outcome is, it will be meaningless.
P1:	However, if your title is identified very well but you cannot propose a good solution, it will also be meaningless.
I:	How about the others?
F2:	I think a balance of time is important. But it is very difficult.
I:	Why? How much time did you (F2) spend on defining the title of this project? I mean as a percentage.
F2:	I spent about one-third of the total project time (4 to 5 weeks), because I changed the title several times after having tutorials with you.

I:	Any other difficulties and constraints in defining your project title?
F1:	As I mentioned before, although the teacher taught us how to confine a project title, I could not handle it well. I still did not know how detailed the title should be, and what the degree of depth should be.
F2:	Like some of my classmates, I always wanted to change the identified

project title.

I: Why did you want to change it? Didn't you feel satisfied with it?

F2: The main reason was the difficulty of the identified title. I think some of the titles I identified were good. However, they were difficult to solve when I started to analyse and propose solutions. So, as the projects were to be assessed according to not only the identification of the project title but also the solution, I preferred to select an easy project title.

I: You teachers told you that some of the marking criteria of the project were based on the problem finding and title identification. Do you think that a difficult project title to let you to gain a higher grade?

F2: No. As students, I would prefer to play safe.

I: Do you think that the requirements of the project — including the problem finding — was too much to you?

P1: I don't think so. As some of them (F1, F2, P2) mentioned before, more hints and requirements helped us to identify a project title more easily.

I: How about the others?

P2: I agreed that a clearer and detailed defined scope gave help to us.

I: Any other difficulties and constraints?

F1: At the beginning, I spent two days to find problems, but I could not find one. I walked on the street, as my teacher suggested. Sometimes I was very happy, since I thought I had found some potential topics for my project. However, when I thought about them more carefully, I abandoned the topic.

I: Why?

F1: Sometimes, I found that it was impossible for me to tackle it, or it seemed that the existing solutions for the problems were good enough. My work seemed meaningless and redundant.

I: Many of you mentioned having changed your project titles. What made you not want to persevere with the problems you initially identified?

P1: Sometimes, when I found a project title and thought it was good, and tried to propose solutions, some of my classmates or my teacher would tell me that the problem had some existing good solutions. Then I would give up the title, particularly when my proposed solution already existed on the market.

F2: Sometimes, when I talked with my classmates about my proposed project title, they would laugh at me. Sometimes, their reasons were quite strong, and I had never thought about them before.

F1: Yes, I agree. Sometimes, my identified problems seemed too "small". And my classmates also seemed to have no difficulty in proposing very good solutions right after I told them my identified problem. It seemed not worthwhile for me to go further. Besides, sometimes my classmates identified the same title as mine and spoke it out first. I didn't want to repeat it again, and say that I also identified the same title.

P1: I had some good problems identified. However, they seemed not to belong to our discipline (that is, design and engineering). I mean that these project titles are difficult to solve by using our learned knowledge and skills.

I: Please explain further. Can you give an example?

P1: Such as social problems. For example, young people like to use foul language. This is not related to our discipline. It's something about culture and attitude.

I: Why didn't you change your ways of seeing this social problem and look at it from a design perspective? Does anybody have any comments?

P2: I think we can relate it to design as well as engineering, such as by designing a machine to publish the names of young people who always speak foul language. Based on this machine, we can change the attitudes of young people who like to use such language.

I: How do you (P1) feel about his (P2's) comments?

P1: Maybe. But it seems very difficult.

I: Yes, I agree. But we are not concerned with the possibility of a social issue being your project title, but the difficulty in proposing a solution for this title.

P1: Yes, I agree. But, as he (F2) said, as students, we need to play safe. In this project, I preferred to identify a problem for which it seemed easy to find a "possible" solution.

I: Please give me an example.

P1: Such as one of my classmates' projects: a small lighting device in a coin-wallet, which can be used in a dark environment.

I: Can I make a tentative conclusion that you were very much concerned with the possibility of an outcome when you identified a project title?

P1: Yes, you could say that, since we faced time constraints. For an assigned 14-week project, we had to finish it on time.

I: What did you feel about the project?

P2: I only took the project as an exercise. It seemed not directly related to our current work.

I: Would you explain?

P2: As (P1) said, in our workplaces, we only follow our supervisors' instructions. Finding problem does not seem so important for my current job. I would prefer to learn some creative methods in engineering and technological matters, rather than "finding" a problem to solve.

Gains, Satisfaction

I: Did you get any new experience from the project?

F1: Before I tried to identify a project title, I always thought it would be easy to do. However, as I mentioned before, I went out and walked on the street and tried to find a good title. I still could not get a good one.

I: Finally, how did you identify your project title?

F1: I got some hints from a magazine.

I: Any other methods?

F2: I learned how to observe and be concerned with Hong Kong people's daily lives.

I: Would you explain?

F2: Since we were required to identify project titles related to the daily life of Hong Kong people, I needed to consider the "goings-on" around me.

P1: I think what (F2) said is that this project could increase our "awareness". For example, one of our classmates identified the existing design of public rubbish bins as his project, and redesigned the device to contain cigarette ends and ash. Although the teacher mentioned this topic during his lectures, I agree that I was seldom aware of this kind of issue in our society.

I: How about the design process? Did you gain any different experience?

P2: I think in the past, we placed all of our attention on "product development". In this project, I first needed to find out "what should be designed and developed". Even in the product development process, I always had to worry about whether it was the right title.

P1: I agree. Given the nature of my current job and some of my previous projects, what I have been concerned with is the final outcome. I have never worried about or questioned the nature and title of the projects. However, in this project, I needed to defend my project title in the project presentation.

I: How about ways of thinking?

P2: It provided more space for us to develop our thinking. Of course, as I mentioned before, this also presented me with difficulties in finding a direction, particularly at the beginning of a project, if I had to identify the project title by myself.

F2: If a project title is determined by teachers, I agree that the space for thinking would be narrower, since many things would have been predetermined and well fixed. However, in this project, since I needed to identify the project title by myself, before I started thinking about the solution, I had to refine the title step by step.

F1: I think there are different objectives for projects whose titles are identified by teachers and those whose titles are chosen by us. For project titles identified by teachers, more attention is paid to the solution. For the project titles identified by us, the attention is on identifying a need.

I: What are your overall comments?

F1: I find it is not an easy job to find a problem and identify a project title.

P1: A good start — I mean a well-identified problem and title — is very important. I observed that some of my classmates got good solutions and they tackled the identified titles very well since they could identify the needs and objectives of their project clearly. Their ability to observe "small items" in our society was very good.

I: Do you think that you also can have this kind of good ability?

P1: I think more practice and more discussion, such as we had at the final project presentation, is very important. What I learned is that simple items or issues can also pose design problems, which is something I have never thought about before.

Suggestions

I: Do you have any suggestions for improving the arrangements for such kinds of problem finding and project title identification?

F1: Since I have not had this kind of experience before, I think it would help if more examples or cases could be provided in class. Moreover, as I mentioned before, how to confine a project title is also important.

P2: Although the teacher gave us a large freedom to set our project timetable and there was no restriction on the duration of problem finding and title identification, I noticed that most of us started late. I think most of us thought that it was an easy job. I would suggest that tighter contact between the teacher and us is important.

I: How?

P2: Maybe we need to have more tutorials with the teacher. An interim presentation for our project title before the final solution might be useful.

I: Some of you mentioned the marking scheme and assessment method; do you have any suggestions regarding these areas?

P2: I think the marking criteria should be only the creativity of the title and the process of defining it, and should not include the solutions. This would provide more freedom for us to identify a project title without considering the feasibility of the outcome.

F1: I don't think so. I agree that the weighting of the solution should be minimised but not totally eliminated. It's unrealistic if a title is identified without considering the possible solution.

P2: I don't think so. I think it totally depends on the project objectives.

I: What do you think about one of the requirements of this project, that your project title should be related to daily life of Hong Kong people? Did this requirement present difficulties?

F1: I don't think so. As she (P2) said, it gave us a good direction.

F2: I agree. Daily life provides plenty of scope, and as you mentioned before, this brief could increase our social awareness. But I would suggest a more specific area, for example, the daily lives of young people or housewives.

I: But you can identify these by yourself.

F2: Yes, I agree. But if all of the students can identify project titles within a specific scope, the outcome (project titles) would be more interesting.

I: But this seems to go back to the situation in which the teacher provides you with the project title.

F2: I agree. However, as it is the first time for us to define titles by ourselves, a more specific scope may make it easier for us to handle.

I: Do you mean more hints should be given?

F2: Yes.

F1: I would expect the teacher to provide us with more examples. It was really difficult for us to start to identify a project title, as we had no prior experience. As he (P1) said, it seemed that anything could be a title.

Appendix VI

The Shift of the Design Teachers' Roles
(Adopted from Siu, 1999b, Figure 3)