I.J. Education and Management Engineering **2012, 8, 6-12**
Published Online August 2012 in MECS (http://www.mecs-press.net)
DOI: 10.5815/ijeme.2012.08.02

***Available online at* http://www.mecs-press.net/ijeme**

Statistical Analysis on Curriculum of the National Model School of Software Engineering

[a]Zhang Gang, [b]Wang Xiaolin

[a, b] *School of Computer Science and Technology Tianjin University Tianjin, China*

Abstract

This paper analyzes the curriculum referred to the software engineering undergraduate programs of 31 software schools in the 36 national model schools of software engineering (NMSSE) and analyzes the distribution of the courses. The result shows that the core courses offered by NMSSE cover the core courses released by the teaching guidance committee of computer science and technology of higher school under the Ministry of Education (TGC) and the optional courses are not consistent in the programs of NMSSE. The analysis result can be severed as a resource for improving programs and changing the curriculum in software engineering at the undergraduate level. Also it can provide the references for revising the professional norms.

Index Terms: software engineering; program; professional norms; core courses

1. Introduction

The knowledge area, knowledge point and reference teaching system of software engineering at undergraduate level are introduced in the professional norms released by the teaching guidance committee of computer science and technology of higher school under the Ministry of Education (TGC) in 2006 (hereafter calling professional norms)[1] and SE2004[2]. In order to have a more comprehensive understanding on the courses offered by each school and the difference of the courses between the schools, A comprehensive statistical analysis and a distribution analysis on the courses referred to software engineering undergraduate the programs of the 31 schools of software engineering (due to some reasons of data collection, the programs of 5 schools are lack) in the 36 national model schools of software engineering (NMSSE) were done. The analysis result is severed as a resource for improving programs and changing the curriculum in software engineering at the undergraduate level. Also it can provide the references for revising the professional norms.

2. Course and Offering Statistics

The analysis is on the basis of the collected programs of the 31 NMSSE and listing the entire core professional

Corresponding author:
E-mail address: [a] gzhang@tju.edu.cn

courses (including required courses, optional courses and distributional elective courses, not including the mathematics, English, humanities course and specific professional courses offered in some individual school of software engineering). There are differences between the course names in the programs of the school of software engineering when analyzing the curriculum of the 31 NMSSE. In order to make the statistical result reflects the overall situation of the curriculum of NMSSE and also to facilitate the statistics curriculum, some courses whose names are similar to each other are classed to analyze in the paper. The 91 courses has been worked out form the programs of the 31 NMSSE after merging and processing the courses involved in the programs as Table 1.

It should be noted that the statistics work is based on the programs of the 31 NMSSE or the listed names in the programs instead of the contents. So the work merging the courses is merging the names of the courses actually.

The column, "The number" in the Table 1, represents the number of schools offering the corresponding course in NMSSE and the column called "proportion" shows the percent of the software schools which offer the corresponding course in all this 31 schools. The courses are listed as the descending order of "the number"

3. Offered Courses Analysis

3. 1 The Most Concentrated Offered Core Courses

As seen from the Table 1 the 18 courses numbered from 1 to 18 are offered in 20 schools (about two-thirds), so the 18 courses are supposed the most concentrated offered core courses. Further analysis about the types of the courses finds that the Foundation of Information Security, Embedded System, Graphics, and Electronic Commerce are basically distributional elective courses and optional courses. If the professional distributional elective and optional courses are not considered, the rests are the most concentrated and important core courses offered in NMSSE. Comparing the most concentrated core courses offered in NMSSE with the core courses released by TGC[3], the conclusion can be got from table 2 as follow:

- The former completely covers the latter which indicates the core courses in NMSSE meet with the need of the requirement to ensure the students have good discipline.

TABLE I. THE STATISTICS TABLE OF THE COURSES OF NMSSE

Number	Course Name	the Number	Proportion
1	Operating System	31	1.00
2	Computer Network	31	1.00
3	Data Structures	31	1.00
4	Database Concepts	31	1.00
5	Discrete Mathematics	30	0.97
6	Advanced Programming Language	30	0.97
7	Computer Organization	28	0.90
8	Introduction to Software Engineering	28	0.90
9	Foundation of Information Security	26	0.84
10	Embedded system	25	0.81
11	Software Testing	25	0.81
12	Introduction to Computers	24	0.77
13	Principle of Compilers	23	0.74

14	Software Project Management	23	0.74
15	Graphics	23	0.74
16	Principles of Electronic Commerce	22	0.71
17	Object-Oriented Programming	21	0.68
18	Software Architecture	20	0.65
19	Software Process Improvement （CMMI）	19	0.61
20	Java Programming	18	0.58
21	UNIX /Linux Operating System	18	0.58
22	ERP	18	0.58
23	Design and Analysis of Algorithm	18	0.58
24	Network Multimedia	18	0.58
25	System Analysis and Design	18	0.58
26	Web Project	17	0.55
27	User Interface Design	17	0.55
28	Database Application	16	0.52
29	J2EE	15	0.48
30	Digital Image Processing	15	0.48
31	.NET Programming	14	0.45
32	UML Modeling	14	0.45
33	Digital Logic	14	0.45
34	Game Programming	13	0.42
35	Artificial Intelligent	12	0.39
36	Software Component Technology	12	0.39
37	Assembly Language for Computers	11	0.35
38	Software Requirement Analysis	11	0.35
39	Data Warehouse and Data Mining	11	0.35
40	Principle & Interface Technology of Micro-Computer	10	0.32
41	Distributed Object Technology	9	0.29
42	Computer Architecture	9	0.29
43	XML Design Technique	8	0.26
44	Group and Cooperation Communication	8	0.26
45	Network Programming	8	0.26
46	Complier Technique	7	0.23
47	Introduce to the Personal and Group Process	7	0.23

48	Software Configuration Management	7	0.23
49	C# Programming	6	0.19
50	Computer Ethics	6	0.19
51	Economic for Software Engineering	6	0.19
52	Environment and Tools for Software Developing	6	0.19
53	Digital Technique and Application	5	0.16
54	System Programming	5	0.16
55	Cryptography	4	0.13
56	Network Management	4	0.13
57	Introduction to Formal Language and Automata	4	0.13
58	Windows Programming	3	0.10
59	Fundamentals of Workflow Technique	3	0.10
60	Computational Methods	3	0.10
61	Managing Customers Relationship	3	0.10
62	Pattern Reorganization	3	0.10
63	Software Documentation Writing	3	0.10
64	Fundamentals of Network Database	3	0.10
65	Interactive Software Development	2	0.06
66	Formal Methods in Software Engineering	2	0.06
67	Examples Analysis of Software Design	2	0.06
68	Software Metrology	2	0.06
69	Design and Analysis of Real-time System	2	0.06
70	Information Retrieval	2	0.06
71	B Method	1	0.03
72	Z Language	1	0.03
73	Supply Chain Management System and Application	1	0.03
74	Function-based Programming	1	0.03
75	computer aided software engineering	1	0.03
76	Theory of Computability and Complexity	1	0.03
77	Fundamentals for Rapid Application and Development Technique	1	0.03
78	Logic Programming	1	0.03
79	Enterprise Knowledge Management	1	0.03
80	Human Resource Management	1	0.03
81	An Introduction to Cognition	1	0.03
82	Intrusion and Intrusion Detection Technology	1	0.03
83	Software Modeling and Analysis	1	0.03
84	Software Reliability	1	0.03

85	Software Design Pattern	1	0.03
86	Software Detailed Design	1	0.03
87	Software Reconstruction Technology	1	0.03
88	Security of Internet Information and Content	1	0.03
89	System Simulation and Virtual Reality	1	0.03
90	Project Bidding and System Design	1	0.03
91	Chinese Language Processing	1	0.03

- The Principle of Compilers is considered to be the important software engineering basic course in the most of NMSSE.
- Most of NMSSE consider that the contents of Software Testing, Software Project Management, and Software Architecture are the core contents what must be understood and mastered by the students of software engineering.

3. 2 The Most Concentrated Offered Optional Courses

As seen from the Table 1, the Foundation of Information Security, Embedded System, Graphics, and Principles of Electronic Commerce are offered in the 20 schools (about two-thirds). But the 4 courses are the distributional elective courses and optional courses in the programs of each school. The 4 courses are supposed to be the most concentrated offered optional courses in NMSSE.

The optional courses most concentrated offered reflect the four directions paid the most attention in NMSSE, Information Security, Embedded, Cartoon Game, and E-Commerce.

3. 3 The More Concentrated Offered Courses

As seen from the Table 1, there are 10 courses, the Software Process Improvement (CMMI), Java Programming, UNIX/Linux Operating System, ERP, Algorithm Design and Analysis, Network Multimedia, System Analysis and Design, Web Project, User Interface Design, and Database Application, offered in NMSSE are the more concentrated offered courses.

Further analysis result shows that with the purpose of improving the level and ability of software engineering, the Software Process Improvement (CMMI) and System Analysis and Design are offered; the Java Programming, Web Project, Network Multimedia, and User Interface Design are to improve the ability of network system and network programming; the Database Application and ERP are to strengthen the basis of the database application, especially in the enterprise management application; the Algorithm Design and Analysis is for improving the ability of programming and UNIX/Linux Operating System can extend the system application platform from the microcomputer to the embedded system.

The 10 courses more concentrated offered reflect the several key points what NMSSE focus on in training students' ability in a way.

3. 4 The Further Attentioned Course

According to the knowledge units in the professional norms and SE2004, the Economic for Software Engineering is an independent knowledge unit (FND.ec) and gives the corresponding descriptions of knowledge points (FND.ec.1, FND.ec.2, FND.ec.3, FND.ec.4). In addition, the IEEE is revising the SWEBOK 2004. The knowledge area of "Engineering Economical Basis" will be increased in the new version of SWEBOK and the related material on the Human-Computer Interface will be increased in the knowledge area of the software

design and software testing [4]. Thus the Engineering Economical Basis and the Human-Computer Interface are important to the students of software engineering. From the analysis result, there are two schools offering Software Engineering Economic, one offering Software Economic, one offering IT Economic, one offering the Economics Foundation (option), and one offering the Modern Economic (option), so that there are defects in the engineering knowledge and economic management knowledge. Although without the reflection in the program because of that the content about the engineering economic may be arranged in the economic management optional courses, it still reflects most of schools pay less attention relatively to the engineering economic.

And most of schools pay less attention to Human-Computer Interface, Software Psychology, and Cognitive Psychology. The study shows 17 schools (55%) offering the User Interface Design, only two schools offering the Software Psychology, and another one offering An Introduction to Cognition. It should be stated that maybe there are general optional courses similar to the Cognition Psychology are offered in some schools or some schools merge the course related to cognitive psychology to the others. And this situation is not reflected in the programs directly. So the statistical result is affected.

3. 5 The Offered Optional Courses are Comparatively Discrete

About 30% courses are offered in above 50% schools and the schools offering about 70% courses is less than 50%. Less than 10 (32%) schools offer the 51(56%) courses, less than 5 (16%) schools offer the 36 (40%) courses and only one (3%) school offers 20 (22%) courses. Above all, the optional courses offered in NMSSE are comparatively discrete.

TABLE II. THE COMPARISON TABLE

Number	**Core Courses of NMSSE**	**Core Courses of TGC**
1	Introduction to Computers	
2	Discrete Mathematics	Discrete Mathematics
3	Data Structures	Data Structures
4	Computer Organization	Computer Organization
5	Operating System	Operating System
6	Computer Network	Computer Network
7	Database Concepts	Database System
8	Advanced Programming Language	Programming
9	Object-Oriented Programming	
10	Principle of Compilers	
11	Introduction to Software Engineering	
12	Software Testing	
13	Software Project Management	
14	Software Architecture	

4. Conclusions

The most concentrated crucial core courses offered in NMSSE cover the 7 core courses released by TGC that indicates the core courses offered in NMSSE meet with the requirement of TGC but need to improve in the aspects of software engineering economic and software psychology. The comparatively discrete between most of the optional courses reflects the bigger difference each college has on the professional knowledge of software engineering and on the direction of the offered software engineering from a perspective. The difference represents the result of reform and innovation in the programs of the school of software engineering according to every college's own distinguishing features and the features of the regional economic.

Acknowledgment

The authors would like to thank the many people who have contributed to the support and help, including the teaching guidance committee of computer science and technology of higher school under the Ministry of Education and the office of the national model school of software engineering under the Ministry of Education.

References

[1] The teaching guidance committee of computer science and technology of higher school under the Ministry of Education, Development strategy report and professional norms of computer science and technology of higher school(trial)[M]. Beijing: Higher Education Press, 2006.(in Chinese).
[2] http://sites.computer.org/ccse/SE2004Volume.pdf, IEEE/ACM Software Engineering 2004, 2004.
[3] The teaching guidance committee of computer science and technology of higher school under the Ministry of Education. Gerneral core knowledge system and curriculum of computer science and technology of higher school[M]. Beijing: Tsinghua University Press, 2007. (in Chinese).
[4] http://www.computer.org/portal/web/swebok, SWEBOK Guide Set for 2010 Refresh, 2010.