# Identifying the Course Network Structures Based upon Records of In-service Learning Database

Lung-Hsing Kuo
National Kaohsiung Normal University
No.116, Heping 1 st Rd., Lingya District, Kaohsiung City 802, TAIWAN(R.0.C.)
admi@nknucc.nknu.edu.tw

&

Hsieh-Hua Yang

Oriental Institute of Technology

No.58, Sec. 2, Sichuan Rd., Banqiao City, Taipei County 220, Taiwan

Republic of China

yansnow@gmail.com

&

Jui-Chen Yu

National Science And Technology Museum #720 Ju-Ru 1<sup>st</sup> Rd., Kaohsiung

Taiwan

raisin@mail.nstm.gov.tw

&

Hung-Jen Yang
Department of Industrial Technology Education
National Kaohsiung Normal University
No.116, Heping 1 st Rd., Lingya District, Kaohsiung City 802, TAIWAN(R.0.C.)
hjyang@nknucc.nknu.edu.tw

&

Lydia Lin
National Kaohsiung Normal University
No.116, Heping 1 st Rd., Lingya District, Kaohsiung City 802, TAIWAN(R.0.C.)
<a href="mailto:baubaubo@hotmail.com">baubaubo@hotmail.com</a>

Abstract: -The purpose of this study focused on the social network structure of in-service development for the Chinese literature expertise teachers in Taiwan High school. Social network analysis methods include the core measures, identification of groups to analyze the role, figure based on the statistical analysis and so on. In this study we use 2009 National Teacher in-service Education Information Network (http://inservice.edu.tw/) database to obtain 5,417 sample resources. The expected result should be able to understand Chinese literature teacher in-service refresher training expertise in the overall network of centricity, teachers participate in studies course subject categories and countries connected, education seminar for subgroups generated number, subgroups on overall network impact, etc.

*Key-Words:* In-service development, Social network structure, High school, UCINET, Chinese literature teacher

#### 1 Introduction

In recent years, our environments are driven by changes in society, fast growth by science, technology and knowledge development. Teachers as an educational provider should change with the environment, enhance their professional abilities and to give students a better quality of education. In order to enhance teacher quality, Teacher Education Act and Teacher-Law are provided legal basis of in-service advancement education for teachers. Therefore to participate in in-service advancement education can be seen as a duty and responsibility for them. Teachers can spent their time to study variety of in-service advancement education courses at schools. In-service teacher advancement education agencies. Universities with teacher education. Universities without the department of teacher education or Life-long learning organizations. That is providing opportunities for professional growth, the possibility of continuing study and improving teaching knowledge of teachers.

There are more in-service advancement education studies focus on junior high, elementary school teachers. According to the Electronic Theses and Dissertations System, from year 1976 to year 2009 there are 110 topics of in-service advancement education for teachers searched by keywords; Study subjects are elementary school teachers are 59 topics; junior high school teachers are 13 topics; elementary and junior high school teachers are 3 topics [1]. However, there are only one topic study high school teachers. Therefore can see in-service we advancement education for high school teachers are worth to study. In addition, Chinese, the official national language in Taiwan is the most important subjects especially we focus more on writing and reading skills for students in recent years. Thus, Chinese literature teachers in high school are the research subjects in this study.

Furthermore. advancement the in-service education studies are more focused on the job training status, factors (including psychological needs and motivations, policy implications, willingness and ...etc), teaching effectiveness, perception and conflict of role, carry out the strategies and methods of in-service advancement education, discussion on in-service advancement education time and in-service advancement training education system for international comparison. Although some studies of in-service advancement education are related to teachers who

teaching in a single major field (subject), but they have the main issues which we mentioned before. There are less relevant studies on in-service advancement education courses and contents for teachers' teaching subjects. Therefore this study aims to focus on the social network structure of in-service advancement education for the high school Chinese literature teachers by course categories.

#### 1.1 Aim of the study

The research goals in this study are:

- To understand the overall network centrality of Chinese literature teacher in in-service advancement education.
- To understand the relation on study course categories which attended by Chinese literature teachers.
- To find subgroup(s) of similarity and how does the subgroup(s) impact on overall network.

#### 1.2 Key Concepts and Terms

- Course Categories: in this study we focus on the course categories rather than subjects. The course categories have 3 layers; the 1<sup>st</sup> layer are "teaching", "administration" and "other"; the 2<sup>nd</sup> layer is divided from 1<sup>st</sup> layer, it has 83 categories; the 3<sup>rd</sup> layer is divided from 2<sup>nd</sup> layer it contents 249 course categories.
- Nodes and edges: Nodes are the objects or interest (e.g. subjects, people, groups, organizations, and other connected information/knowledge entities.) and the edges are the relations among the nodes. [2]
- **Degree centrality:** Degree is the number of direct relations to other nodes. Degree centrality is the measurement to measure the relative importance on direct connections of nodes in a network.[3][4]
- Components: are sets of nodes connected by edges but components are not connected to each other. [2]
- **Isolates:** nodes are isolate when the nodes have no relations with any other node. [2]
- Cutpoint(s): It would increase the number of components if we removed a node and we called this node is the cutpoint.[2]
- Markov Cluster Algorithm: This is one of the methods to find subgroups. Markov Cluster algorithm partitions a graph into

non-overlapping clusters. The algorithm determines the appropriate number of clusters deduced from the structural properties of the graph.[3][5]

## 1.3 Assumption

Social network analysis is concerned with social relations between nodes and it can be presented in the graph drawing. We assume this social network graph is a dependence graph in which edges are independent if they do not share a node. This means in this study the social behavior of an individual teacher in-service advancement education courses should be influenced only by

its courses, not by individuals to which it does not have any kind of relation.[5]

# 2 Study Design

## 2.1 Research subjects

In this study the subjects are the high school Chinese literature teachers attending in-service advancement education activities in Taiwan. We use 2009 National Teacher in-service Advancement Education Information Network (http://inservice.edu.tw/) database to obtain 5417 sample resources. The basic data analysis are shown in Table 1, Table 2. and Table 3.

Table 1. Number of high school Chinese literature teachers attending in-service advancement education activities by location and school type

	No. of teachers l		
Location	Public Schools	Private Schools	Totals
Taipei city	660	180	840
Kaohsiung City	305	69	374
Taipei County	583	245	828
Yilan County	57	22	79
Taoyuan County	239	214	453
Hsinchu County	79	40	119
Miaoli County	102	43	145
Taichung County	171	227	398
Changhua County	116	52	168
Nantou County	80	12	92
Yunlin County	89	52	141
Chiayi County	37	20	57
Tainan County	172	84	256
Kaohsiung County	231	21	252
Pingtung County	112	30	142
Taitung County	34	1	35
Hualien County	38	32	70
Penghu County	15	0	15
Keelung City	84	33	117
Hsinchu City	109	62	171
Taichung City	178	135	313
Chiayi City	45	53	98
Tainan City	113	123	236
Kinmen County	15	0	15
Lienchiang County	3	0	3
Totals	3667	1750	5417

Table 2. Number of high school Chinese literature teachers attending in-service advancement education activities in public school by age group and sex

	Se	ex		
Age group	Female	Male	Totals	
22-29	295	43	338	
30-34	508	80	588	
35-39	629	102	731	
40-44	685	128	813	
45-49	529	131	660	
50-54	294	78	372	
55-59	83	50	133	
60above	12	20	32	
Totals	3035	632	3667	

Table 3. Number of high school Chinese literature teachers attending in-service advancement education activities in private school by age group and sex

	Se	ex	
Age group	Female	Male	Totals
22-29	274	25	299
30-34	249	68	317
35-39	230	55	285
40-44	261	72	333
45-49	147	54	201
50-54	102	40	142
55-59	78	50	128
60 above	16	29	45
Totals	1357	393	1750

#### 2.2 Data Analysis

In this study the software University of California Irvine of Network Programs (UCINET 6.281) is used to analyze the relationship of network matrix to define the network position. The methods include centrality measures, blocks & cutpoints, subgroups identification and we use NetDraw 2.092 function to perform the relationship between matrix and Social Network graph drawing. Finally analysis report is given.

#### 3 Results

This study aims to focus on the social network structure of in-service advancement education for the high school Chinese literature teachers. Table 4. is the course category frequency table for high school Chinese literature teachers attending in-service advancement education.

The table shows course category "teaching language

\_Mandarin" has the highest frequency followed by "administration\_ Education Affairs\_ other", "administration\_ School discipline and guidance",

"teaching\_other" and "teaching\_other\_other".

Table 4.The course category frequency table for high school Chinese literature teachers attending in-service advancement

	Layers		Attendance		Layers		Attendance		Layers		Atteno
t :	2nd	3rd	totals	1st	2nd	3rd	totals	1st	2nd	3rd	tota
ching	Language	Mandarin	13041	Teaching	Life Education	Personality	46	Teaching	Game	Other	7
inistration	Educational Affairs	Other	7167	Teaching	Science and Technology	Integrated and Other	45	Teaching	Business	Dept. of	6
inistration	School discipline and	Other	6105	Other	Other	Other	42	Teaching	Hearing impairments	International Trade Curriculum for	(
	guidance							=		Hearing-impaired	
-	Other	Other	5709	Teaching	Health and Medical Technology	Dept. of Nursing	39	Administration	Environmental Education	Other	
	Information Technology Education	Other	3894	Teaching	Physically and Mentally Disabled	learning disabilities	38	Teaching	Health & Leisure	Other	
	Language	Other	2515	Teaching	Home Economic and Life	Life Technology	35	Teaching	Health and Medical	Other	
ministration	Other	Other	1806	Teaching	Technology Introduction to Special	Introduction to	35	Teaching	Technology hearing impairments	Other	
ching	Integrative Activity	Other	706	Teaching	Education Business	Special Education Other	34	Teaching	mental retardation	Other	
-		Other		_				-			
	General Affairs		622	Teaching	Life Culture	Food Making and Culture	34	Teaching	Physically and Mentally Disabled	developmental retardation	
nching	Gender Equality Education	Other	567	Teaching	Life Culture	Other	34	Teaching	Physically and Mentally Disabled	hearing impairments	
ching	Arts and Humanities	Other	522	Teaching	Science and Technology	Biology	33	Administration	Arts and Humanities	Other	
	General Curriculum in	Apply Special	460	Teaching	Arts and Humanities	Mandarin	32	Teaching	Area of Health and Physical	Physical Education	
	Special Education School discipline and	Education Other	377	Teaching	severe emotional	Curriculum for	32	Teaching	Education Area of Social Study	Civics and Social	
	guidance			_	disturbance	Emotional and		_	-	Study	
	Language	English	369	Teaching	Educational Affairs	Other	31	Teaching	Business	Dept. of Advertisement	4
ninistration	Personnel & Accounting	Other	362	Teaching	Home Economics	Other	30	Teaching	Gifted	scholastic aptitude	4
ching	Social Study	Other	353	Teaching	Education Arts and Humanities	Visual Arts	29	Teaching	Industrial	Dept. of Auto	4
ching	Life Education	Introduction to Life	315	Teaching	Business	Dept. of Clerical	29	Teaching	Industrial	Mechanics Other	1
-	Moral Education	Education		_		Affairs		-			_
_		Other	308	Teaching	Physically and Mentally Disabled	severe emotional disturbance	29	Teaching	visual impairment	Other	
	Health and Physical Education	Health	292	Teaching	Life Education	Sex and Marriage	28	Administration	Health	Other	3
	Math	Other	287	Teaching	Introduction to Special	Morality Advanced	27	Teaching	Area of Life	Home Economics	:
ching	Arts and Humanities	Arts and Life	283	Teaching	Education Life Education	Curriculum for Religion and Life	27	Teaching	Arts	Dept. of Dance	
-	Environmental Education	Other	254	_		Other	27	-		-	
-				Teaching	the gifted			Teaching	Arts	Dept. of Drama	
ministration	Library Management	Other	246	Teaching	Area of Health and Physical Education	Health and Nursing	25	Teaching	Business	Dept. of Tourism Service	
ching	Language Arts	Mandarin	231	Teaching	Language Arts	Other	25	Teaching	Science and Social Study	Other	
ching	Health and Physical	Other	227	Teaching	Language Arts	Department of	24	Teaching	Science and Technology	Earth Science	
	Education Human Rights Education	Other	224	Teaching	Life Culture	English Image	24	Teaching	Arts	Dept. of Film &	
				_		Management and		_		Television	
-	Social Study	History	207	Administration	Information Technology Education	Other	23	Teaching	Arts and Humanities	History	
aching	Language	Local Language	196	Teaching	Arts	Other	23	Teaching	Health	Health and Nursing	
ching	Science	Other	176	Teaching	Home Economic and Life	Other	23	Teaching	Health and Medical	Dept. of Childhood	
ching	Career Development	Other	167	Teaching	Technology Area of Arts and	Music	22	Teaching	Technology Hospitality	Education Dept. of Restaurant	
	Education	Health and Nursing		_	Humanities			-		Management	
	Health and Physical Education	-	161	Teaching	Physically and Mentally Disabled	autism	22	Teaching	Industrial	Dept. of Computer Science	
aching	Social Study	Civics and Social Study	155	Teaching	Life Education	Life and Death Care	21	Teaching	Information Technology Education	Dept. of Data Processing	2
ching	Health & Leisure	Health and Self	153	Teaching	Science	Earth Science	21	Teaching	Language Arts	Department of	2
aching	Arts and Humanities	Management Fine Arts	147	Teaching	Life Education	Philosophy and	19	Teaching	language disorders	Japanese Other	2
ching	Arts and Humanities	Music	136	_	mental retardation	Life	17				
-				Teaching		Curriculum for Mental Retardation		Teaching	Physically and Mentally Disabled	health impairments	
	General Curriculum in Special Education	Other	111	Teaching	Area of Science	Biology	16	Teaching	Physically and Mentally Disabled	physical handicaps	- 2
	Integrative Activity	Counseling	109	Teaching	Gender Equality Education	Local Language	16	Teaching	Physically and Mentally	visual impairment	
ching	General Curriculum in	Activity Special Education	108	Teaching	Language	second foreign	14	Teaching	Disabled the gifted	Apply Assessment	
-	Special Education Career Planning	Concepts Other	104	Teaching	learning disabilities	language Curriculum for	14	Administration		practice	
-	_			_	ē.	Learning impaired				-	
	Health and Physical Education	Physical Education	100	Teaching	the gifted	Curriculums for	14	Administration	School discipline and	learning disabilities	
ching	Education Life Education	Other	99	Teaching	Area of Social Study	Gifted Students Other	13	Teaching	guidance Agriculture	Dept. of Food	
ching .	Arts and Humanities	Performing Arts	93	Teaching	Physically and Mentally	multiple	13	Teaching	Area of Arts and	Processing Fine Arts	
	severe emotional	Other	87	Teaching	Disabled Physically and Mentally	impairments Other	13	Teaching	Humanities Area of Arts and	Other	
	disturbance			_	Disabled			· ·	Humanities		
	Job Practice	Other	85	Teaching	severe emotional disturbance	Discussion and Analysis of	13	Teaching	Arts	Dept. of Chinese Music	
ching	Health	Other	82	Administration	Job Practice	career	10	Teaching	Arts	Dept. of	
	Home Economic and Life	Home Economics	80	Teaching	Area of Life	Other	10	Teaching	Electronics & Electrical	Refrigerator & Dept. of Computer	
	Technology autism	Curriculum for	77	Teaching	Gifted	general intelligence	10	Teaching	Engineering General Military Defense	Science Other	
_		Autism Education		=							
	Physically and Mentally Disabled	other significant handicaps	71	Teaching	Science	Chemistry	10	Teaching	Gifted	artistic talent	
	Science	Biology	71	Teaching	Business	Dept. of Data	9	Teaching	Home Economics	Dept. of Beautification	
ching	autism	Other	68	Teaching	Life Education	Processing Moral Thinking	9	Teaching	Home Economics	Dept. of Clothing	
ching	Introduction to Special	Other	66	Administration	Child Care	and Decision Other	8	Teaching	Home Economics	Making Home Economics	
	Education							_			
_	Social Study	Geography	65	Teaching	Area of Social Study	History	8	Teaching	Home Economics	Other	
ching	Science	Physics	62	Teaching	Home Economics	Dept. of Early	8	Teaching	Hospitality	Other	
ching	learning disabilities	Other	61	Teaching	Home Economics	Childhood Care Food Science	8	Teaching	Music	Performing Arts	
	Health & Leisure	Health and	60	Teaching	Integrative Activity	Cluster Home Economics	8	Teaching	Power Machinery Cluster	Other	
ching		Emotion	50	- cacining	grunte runtity			_	-		
-	C:0-1	Od	67								
	Gifted	Other	57	Teaching	Integrative Activity	Scout Education	8	Teaching	visual impairment	Curriculum for Visually Impaired	
ching	Gifted General Education in National Defense	Other Other	57 55	Teaching Teaching	Integrative Activity Music	Other	8	Total	visual impairment	Visually Impaired	52

Table 5. The Degree centrality of course categories

Seminary Chartery   1981   1982   1	Course Categories Administration_Educational Affairs_Other	Degree 159	NrmDegree 91.908	<b>Share</b> 0.021	Course Categories Teaching_autism_Curriculum for Autism Education	Degree 52	NrmDegree 30.058	Share 0.007	Course Categories Teaching Physically and Mentally Disabled_health impairments	Degree 18	NrmDegree 10.405	Shar 0.00
Administration Success designer and   18   9,139   0,291   1	Feaching_Other_Other	159	91.908	0.021		51	29.48	0.007	Administration_Job Practice_practice	18	10.405	0.00
1	Feaching_Language_Mandarin	158	91.329	0.021	Teaching_Life Culture_Other	47	27.168	0.006	Teaching_Health and Medical	17	9.827	0.00
1968   1968   1968   1968   1968   1968   1968   1968   1968   1968   1969		158	91.329	0.021	Teaching_Home Economic and Life	47	27.168	0.006	Teaching_Area of Health and	17	9.827	0.00
Security   Company   Com	eaching_Information Technology	150	86.705	0.02	Teaching_Life Education_Philosophy and	46	26.59	0.006	Teaching_Area of Arts and Humanities_Fine	17	9.827	0.00
1	ducation_Other .dministration Other Other	139	80.347	0.018		46	26.59	0.006		16	9.249	0.00
Second   1	eaching Language Other Humanities Other	136	78 613	0.018		46	26.59	0.006		16	9 249	0.00
suchase, General Curiculation in Special 14												0.00
Second Content					-				Disabled developmental retardation			
Second   Content   Paper   P	ducation Apply Special Education								Education Other			0.00
Administration   Personal Accordancy   Personal   Per		105	60 694	0.014	Disabled Learning disabilities	44	25 434	0.006		16	9 249	0.00
International Concert Affairs, Other   95   56.74   0.01   Taching, Language, Paglish   95   54.91   0.01   Taching, Scanser, Projects   41   24.85   0.00   Taching, Scanser, Paglish   1.0					Technology Other				<u>-</u>			0.00
and La Language, English claims. List Absoration. Horistopic 1. See 5.91 colling. List Absoration. Horistopic 1. See 5.91 colling. Seed Study, Other 69 5.5491 50 201 Caching. Seed Study, Other 69 5.5491 50 202 Caching. Seed Study, History 69 5.7491 50 202 Ca									guidance Learning disabilities			
selling Edic Boesimi, Enroducion o Liu 9					and Life				Education_Advanced Curriculum for Special			0.0
Technic Scord Study Once   15   15   15   15   15   15   15   1	aching_Language_English								Japanese			0.00
selling Scold Suby-Other  selling Activa of Humanities, Fine Ass. 9  4 5435 001; Techning Tixon Of Amand Planuminies, 42  selling Scold Microfiles, Fine Ass. 9  5 2437 002  colling Scold Microfiles (Microfiles) (M	aching_Life Education_Introduction to Life	96	55.491	0.013	Teaching_Health and Medical Technology Dept of Nursing	43	24.855	0.006	Teaching_Home Economics_Other	13	7.514	0.00
selling Assend Hamanites, Fine Arts 94   9,5135   0015   Techning Arts of Arts and Hamanites, Anti-Arts of Maring Arts of Arts and Hamanites, Anti-Arts of Maring Arts of Arts and Hamanites, Anti-Arts of Maring Arts of Arts and Hamanites, Arts and Lindon, School canding School disclinations, Other 86   49,711   0011   Teaching, Lindon Garden, School disclination, Other 86   49,711   0011   Teaching, Lindon Garden, Arts of Hamanites, Arts and Hamanites, Arts and Lindon Garden, Arts of Hamanites, Arts and Lindon Garden, Arts of Hamanites, Arts and Hamanites, Arts and Lindon Garden, Arts of Hamanites, Arts and Lindo	eaching_Social Study_Other	95	54.913	0.012	Teaching mental retardation Curriculum for	43	24.855	0.006		13	7.514	0.00
scheing, Social Study, 15000000000000000000000000000000000000	eaching_Arts and Humanities_Fine Arts	94	54.335	0.012	Teaching Area of Arts and Humanities Arts	42	24.277	0.006	Teaching_Area of Social Study_History	13	7.514	0.00
subming Schold Suchger State Subg-History   57   5296   0.011   Teaching_ Life Education, See and Marring   41   23.699   0.005   Teaching_ Resines Floorenines   12   6.358	aching_Environmental Education_Other	90	52.023	0.012	Teaching_Life Culture_Food Making and	42	24.277	0.006	Administration_Health_Other	13	7.514	0.00
authung School discipline and discharge with the control of the co	aching_Social Study_History	87	50.289	0.011	Teaching_Life Education_Sex and Marriage	41	23.699	0.005		12	6.936	0.0
Indiang   Maria   Enhance   Maria					Morality				Cluster			0.0
scheng, Harbith and Physical Intention Menthus (More)  Aching, Markin, Other (More)  Aching, Markin, Other (More)  Aching, Markin, Other (More)  Aching, Markin, Other (More)  Aching, Harbith and Physical Intention Coher (More)  Aching, Markin, Ma	idance Other											0.0
Intention Health and National Physical colors   54   49,711   0.01   Teaching Arts and Humannities, Visual Arts   37   21,387   0.05   Teaching, Huma Enconneis, Dags, of Early   11   6,358   138												
aching, Human Rights Education other  85 49.133 0.011 Teaching, Grover I Delication in National  86 49.133 0.011 Teaching, Physically and Mentally  87 49.777 0.011 Teaching, Physically and Mentally  88 49.133 0.011 Teaching, Physically and Mentally  89 49.134 0.011 Teaching, Physically and Mentally  89 49.134 0	lucation Health				English							0.0
sching, Harbum Applysical change (General Education in National 36 20,80 0,00 Techning, Science and Technology, Earth 11 6,358 change, Harbum Applysical change, Harbum Applysical part of the Management of the Applysical part of the Management A		86	49.711	0.011	Teaching_Arts and Humanities_Visual Arts	37	21.387	0.005	Childhood Care	11	6.358	0.0
selong, Estendh and Physical and Mentally and Mentally 35 20,231 0,005 Administration Information Technology 10 5.78 between Control of the Control of State Co	aching_Human Rights Education_other	85	49.133	0.011	Teaching_General Education in National Defense other	36	20.809	0.005	Teaching_Science and Technology_Earth	11	6.358	0.0
scheing Arts and Humannites, Mass and Life  81 49.13 0.011 Teaching, Flestink Leisure, Other  82 49.13 0.011 Teaching, Physically and Materially  10 5.78  Desabled, Arts and Humannites, Ants and Life  83 49.07 0.011 Teaching, Physically and Materially  10 5.78  Desabled, Justine  10 5.78  Desabled, Stephen Physical  10 5.78  Desabled, Justine  10 5.78  Desabled, J	aching_Health and Physical	85	49.133	0.011	Teaching_Physically and Mentally	35	20.231	0.005	Administration_Information Technology	10	5.78	0.0
Disabled_autisms   Disabled_au		85	49.133	0.011	Teaching_Health & Leisure_Other	33	19.075	0.004	Teaching_Arts_Dept. of Drama	10	5.78	0.0
scheing. Career Development author. Other au	aching_Arts and Humanities_Arts and Life	83	47.977	0.011	Teaching_Physically and Mentally	33	19.075	0.004	Teaching_Physically and Mentally	10	5.78	0.0
maching   Health and Physical training   Health and Physical	aching Career Development	81	46.821	0.011	Disabled_autism Teaching Life Education Moral Thinking	33	19.075	0.004	Disabled_physical handicaps Teaching_visual impairment Other	10	5.78	0.0
Humanifies Missis   Huma	ucation_Other aching_Health and Physical	80	46 243	0.01	and Decision Making	33	19 075	0 004		10	5.78	0.0
Learning inspection   Learning inspect   Learning inspect   Learning inspect   Learning inspect   Learning inspect   Learning   Le	ucation_Health and Nurseing				Humanities Music				Social Study			0.0
aching Science Other 77 44.509 0.01 Teaching Physically and Mentally shall disturbance of the control of the co	anagement				Learning impaired Education							
Disabled severe emotional disturbance   231   17.91   0.004   Tachting Electronic & Electrical Engineering Days of Computer Science Earth Sc									Technology_Dept. of Childhood Education			0.0
aching Language Local Language 75 43.353 0.01 Teaching Life Culture Image Management 31 17.919 0.004 Teaching Lenguage Area Management 31 17.919 0.004 Teaching Management 31 17.919 0.004 Teaching Lenguage Area Management 31 17.919 0.004 Teaching	aching_Science_Other				Disabled severe emotional disturbance							0.0
aching_Language_Local Language aching_Career Planning_Other 75	aching_learning disabilities_Other	75	43.353	0.01	Teaching_Science_Earth Science	31	17.919	0.004		8	4.624	0.0
aching_acting_Other	aching_Language_Local Language	75	43.353	0.01	Teaching_Life Culture_Image Management	31	17.919	0.004	Teaching_Health_Health and Nursing	8	4.624	0.0
aching Science, Biology 74 42.775 0.01 Teaching, Science and Technology_Life Teaching Science All Study_Crivis and Social Adv All Science All Study_Crivis and Social Teaching Science All Study_Crivis and Scien	aching_Career Planning_Other	75	43.353	0.01	Teaching_Physically and Mentally	31	17.919	0.004		8	4.624	0.0
Technology aching Social Study_Civies and Social adving Language Arts_Mandarin 72 41.618 0.009 Teaching_Basiness_Other 73 42.197 0.01 Teaching_Basiness_Other 74 40.46 Teaching_Basiness_Other 75 4.046 Teaching_Basiness_Other 76 4.046 Teaching_Basiness_Other 77 4.046 Teaching_Basiness_Other 78 4.046 Teaching_Social Study_Geography 79 4.046 Teaching_Language Arts_Mandarin 70 4.046 Teaching_Language Arts_Mandarin 70 4.046 Teaching_Language Arts_Other 71 4.046 Teaching_Language Arts_Other 72 4.046 Teaching_Language Arts_Other 73 4.046 Teaching_Language Arts_Other 74 4.046 Teaching_Language Arts_Other 75 4.046 Teaching_Language Arts_Other 76 4.046 Teaching_Language Arts_Other 77 4.046 Teaching_Language disorders_Other 78 4.046 Teaching_Language disorders_Other 89 4.046 Teaching_Language disorders_Other 80 4.046 Teaching_Lan	eaching_autism_Other	75	43.353	0.01	Teaching_Area of Social Study_Other	30	17.341	0.004	Teaching Making Teaching_Industrial_Other	8	4.624	0.0
aching Social Study_Civics and Social 73	aching Science Biology	74	42.775	0.01	Teaching Science and Technology Life	30	17.341	0.004	Teaching Arts Dept. of Drama Refrigerator	7	4.046	0.0
aching Language Arts_Mandarin 72					Technology				& Air-conditioning			0.0
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aching General Curriculum in Special curricu	aching Health and Physical	68	39.306	0.009	Teaching_hearing impairments_Other	25	14.451	0.003	Teaching_the gifted_Other	6	3.468	0.0
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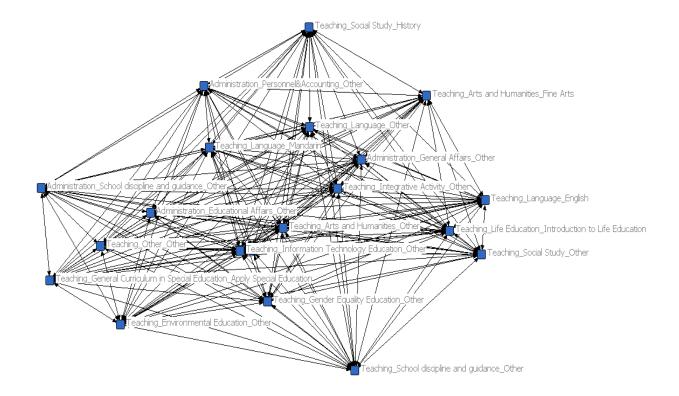
Table 6. descriptive statistics

		Degree	NrmDegree	Share
1	Mean	43.874	25.360	0.006
2	Std Dev	36.485	21.090	0.005
3	Sum	7634.000	4412.717	1.000
4 ۱	Variance	1331.179	444.779	0.000
5	SSQ	566556.000	189300.016	0.010
6	MCSSQ	231625.219	77391.570	0.004
7 I	Euc Norm	752.699	435.086	0.099
8	Minimum	1.000	0.578	0.000
9	Maximum	159.000	91.908	0.021

Network Centralization = 67.32%

Heterogeneity = 0.97%. Normalized = 0.40%

Fig.1. the top 20 strongest degree centrality of course categories.



#### Centrality- degree

The Degree centrality of the relative importance on direct connections of course categories in this network is shown in Table 5. The Table 6 shows the mean of the degree centrality on course categories is 43.874; The mean of normalized degree centralities on course categories is 25.360 %. "Administration\_ Educational Affairs\_ Other", "Teaching\_Other\_Other", "Teaching\_ Language\_ Mandarin" and "Administration\_School discipline and guidance\_Other" has the highest degree

# **Blocks & cutpoints**

Figure 2. and Figure 3. are the graphs shows the blocks and cutpoint in this network. There are two blocks and one cutpoint found. "teaching\_language\_Mandarin" is the cutpoint. Block one is the cutpoint

centrality followed by "Teaching\_ Information Technology Education\_ Other". This means these in-service advancement education course categories has the most maximum possible number of direct connections to other course categories for the high school Chinese literature teachers. The whole network centralization is 67.32%, which indicate there is a medium high centrality in this newtwork. Figure 1. simplify the whole network graph which shows the top 20 strongest degree centrality of course categories.

("teaching\_language\_ Mandarin") links to "Teaching\_Home Economics\_ Home Economics" and vice versa; block two is the cutpoint ("teaching\_language\_Mandarin") and other course categories except "Teaching\_Home Economics\_ Home Economics" forms a network.

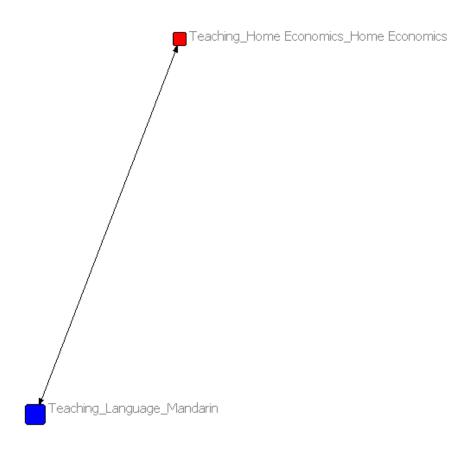


Fig.2 Block 1

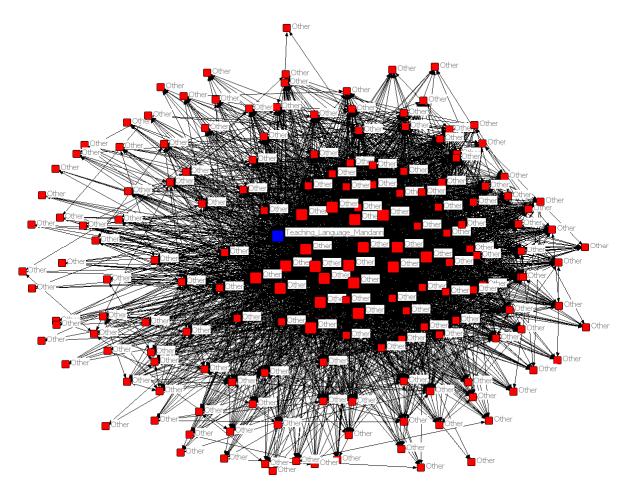


Figure.3. Block 2

#### **Subgroups**

By using Markov clustering algorithm there are 4 subgroups found. Cluster 1 has 149 course categories members, cluster 2 has 16 course categories members, cluster 3 has 6 course categories members and cluster 4 has 3 course categories members.

#### 4 Conclusions

This study aims to focus on the social network structure of in-service advancement education for the high school Chinese literature teachers by course categories. The conclusions are made as the following:

- The high school Chinese literature teachers attending "teaching\_ language\_ Mandarin" related courses most frequently. That indicates high school Chinese literature teachers continue to study their major field of teaching.
- "Administration\_Educational Affairs\_ Other", "Teaching Other Other", "Teaching

Language Mandarin" and "Administration School discipline and guidance Other" has the highest degree centrality followed "Teaching Information Technology Education Other". This means these in-service advancement education course categories has the most maximum possible number of direct connections to other course categories for the high school Chinese literature teachers. That because there are some promotion policies from the Ministry of Education or local Education Departments that needs teachers to promote, such as anti-drug propaganda, sexual assaults preventions...etc.

This network is dominated by "Teaching\_ Language\_ Mandarin". If this course category is removed or damaged, the network will quickly fragment into unconnected sub-networks. In this case "Teaching\_ Home Economics\_ Home Economics" will be isolate in this network.

Table 7. Clusters of Course categories by Markov clustering algorithm

Course Categories Administration Arts and Humanities Other	Cluster 1	Course Categories  Education_Apply Special Education	Cluster	Course Categories Teaching_Language_second foreign language	Cluster 1	Course Categories Teaching autism Other	Cluster 1
Administration_Child Care_Other	1	Teaching General Curriculum in Special	1	Teaching_Life Culture_Food Making and	1	Teaching_aussin_Outer  Teaching_hearing impairments_Curriculum for Hearing-impaired Education	1
Administration_Environmental Education_Other	1	Education_Other Teaching_General Curriculum in Special		Culture Teaching_Life Culture_Image Management		for Hearing-impaired Education  Teaching_hearing impairments_Other	1
Administration_General Affairs_Other	1	Education_Special Education Concepts	1	and Fashion	1	Teaching_learning disabilities_Curriculum for	
Administration Health Other	1	Teaching_General Education in National Defense Other	1	Teaching_Life Culture_Other	1	Learning impaired Education	1
Administration_Information Technology	1	Teaching_Gifted_Other	1	Teaching_Life Education_Introduction to Life Education	1	Teaching_learning disabilities_Other  Teaching_mental_retardation_Curriculum for	1
Education_Other Administration_Job Practice_Other	1	Teaching_Gifted_general intelligence	1	Teaching_Life Education_Life and Death Care	1	Mental Retardation Education	1
Administration_Job Practice_career	1	Teaching_Gifted_scholastic aptitude	1	Teaching_Life Education_Moral Thinking		Teaching_mental retardation_Other	1
Administration_Job Practice_practice	1	Teaching_Health & Leisure_Health and Emotion Management	1	and Decision Making	1	Teaching_severe emotional disturbance_Curriculum for Emotional and	1
Administration_Library Management_Other	1	Teaching_Health & Leisure_Health and Self	,	Teaching_Life Education_Other	1	Behavioral Disorders Education	
Administration Personnel&Accounting Other	1	Management	1	Teaching_Life Education_Personality Integrated and Spiritual Development	1	Teaching_severe emotional disturbance_Discussion and Analysis of	1
Administration School discipline and	,	Teaching_Health & Leisure_Other	1	Teaching_Life Education_Philosophy and	1	Emotional and Behavioral Disorders for Individual Students	1
guidance_learning disabilities	1	Teaching_Health and Medical Technology_Dept. of Childhood Education	1	Life		Teaching_severe emotional disturbance_Other	1
Other_Other_Other	1	Teaching_Health and Medical	1	Teaching_Life Education_Religion and Life	1	Teaching_the gifted_Apply Assessment	1
Feaching_Area of Arts and Humanities_Arts and Life	1	Technology_Dept. of Nursing		Teaching_Life Education_Sex and Marriage Morality	1	Teaching_the gifted_Curriculums for Gifted	1
Teaching_Area of Arts and Humanities_Fine	1	Teaching_Health and Medical Technology_Other	1	Teaching_Math_Other	1	Students Tracking a local invariance of Coming to a Co	•
Arts		Teaching_Health and Physical	1	Teaching_Moral Education_Other	1	Teaching_visual impairment_Curriculum for Visually Impaired Education	1
Teaching_Area of Arts and Humanities_Music	1	Education_Health	-	Teaching_Music_Other	1	Teaching_visual impairment_Other	1
Feaching Area of Health and Physical	1	Teaching_Health and Physical Education_Health and Nursing	1	Teaching_Other_Other	1	Administration_Educational Affairs_Other	2
Education_Health and Nursing Teaching_Area of Health and Physical	1	Teaching_Health and Physical Education_Other	1	Teaching_Physically and Mentally Disabled_Other	1	Administration_School discipline and guidance_Other	2
Education_Physical Education Teaching_Area of Life_Home Economics	1	Teaching_Health and Physical Education_Physical Education	1	Teaching_Physically and Mentally Disabled_autism	1	Teaching_Agriculture_Dept. of Food Processing	2
Teaching Area of Life Other	1	Teaching_Health_Health and Nursing	1	Teaching_Physically and Mentally	1	Teaching_Arts_Dept. of Chinese Music	2
Teaching_Area of Science_Biology	1	Teaching_Health_Other	1	Disabled_developmental retardation	•	Teaching_Arts_Dept. of Film & Television	2
Teaching_Area of Social Study_Civics and	1	Teaching_Home Economic and Life	1	Teaching_Physically and Mentally Disabled_health impairments	1	Teaching_Business_Dept. of Data Processing	2
Social Study Feaching_Area of Social Study_History	1	Technology_Home Economics Teaching_Home Economic and Life	1	Teaching_Physically and Mentally Disabled_hearing impairments	1	Teaching_Business_Dept. of International Trade	2
Feaching_Area of Social Study_Other	1	Technology_Life Technology Teaching_Home Economic and Life	•	Teaching Physically and Mentally Disabled learning disabilities	1	Teaching_Home Economics_Food Science Cluster	2
Teaching_Arts and Humanities_Arts and Life	1	Technology_Other	1	Teaching Physically and Mentally		Teaching_Hospitality_Dept. of Restaurant	
Teaching_Arts and Humanities_Fine Arts	1	Teaching_Home Economics Education_Other	1	Disabled_mental retardation	1	Management	2
Teaching_Arts and Humanities_History	1	Teaching Home Economics_Dept. of Early Childhood Care	1	Teaching_Physically and Mentally Disabled_multiple impairments	1	Teaching_Industrial_Dept. of Auto Mechanics	2
Teaching_Arts and Humanities_Mandarin	1	Teaching_Home Economics_Other	1	Teaching_Physically and Mentally Disabled other significant handicaps	1	Teaching_Industrial_Dept. of Computer Science	2
Teaching_Arts and Humanities_Music	1	Teaching_Human Rights Education_Other	1	Teaching_Physically and Mentally		Teaching_Information Technology Education_Dept. of Data Processing	2
Teaching_Arts and Humanities_Other	1	Teaching_Industrial_Other	1	Disabled_severe emotional disturbance	1	Teaching_Music_Performing Arts	2
Teaching_Arts and Humanities_Performing Arts	1	Teaching_Information Technology Education_Other	1	Teaching_Physically and Mentally Disabled_visual impairment	1	Teaching Physically and Mentally	2
Teaching_Arts and Humanities_Visual Arts	1	Teaching_Integrative Activity_Counseling	1	Teaching_School discipline and guidance Other	1	Disabled_physical handicaps  Teaching language disorders Other	2
Feaching_Arts_Dept. of Dance	1	Activity  Teaching Interesting Activity Home		Teaching_Science and Social Study_Other	1		2
Teaching_Arts_Dept. of Drama	1	Teaching_Integrative Activity_Home Economics	1	Teaching_Science and Technology_Biology	1	Teaching_the gifted_Other  Administration Other Other	3
Teaching_Arts_Dept. of Refrigerator & Air-conditioning	1	Teaching_Integrative Activity_Other	1	Teaching_Science and Technology_Earth		Teaching General Military Defense Other	3
Teaching_Arts_Other	1	Teaching_Integrative Activity_Scout Education	1	Science Science	1	Teaching_Gifted_artistic talent	3
Teaching_Business_Dept. of Advertisement	1	Teaching_Introduction to Special		Teaching_Science and Technology_Life Technology	1	Teaching_Home Economics_Dept. of	
Teaching_Business_Dept. of Clerical Affairs	1	Education Advanced Curriculum for Special Education	1	Teaching Science and Technology Other	1	Clothing Making	3
Teaching_Business_Dept. of Tourism Service	1	Teaching Introduction to Special	1	Teaching_Science and Technology_Physics	1	Teaching_Hospitality_Other	3
Teaching_Business_Other	1	Education_Introduction to Special Education	1	Teaching_Science_Biology	1	Teaching_Power Machinery Cluster_Other	3
Teaching_Career Development Education_Other	1	Teaching_Introduction to Special Education_Other	1	Teaching_Science_Chemistry	1	Teaching_Area of Arts and Humanities_Other	4
Feaching_Career Planning_Other	1	Teaching_Language Arts_Department of English	1	Teaching_Science_Earth Science	1	Teaching_Home Economics_Dept. of Beautification	4
Γeaching_Educational Affairs_Other	1	Teaching Language Arts Department of		Teaching_Science_Other	1	Teaching_Home Economics_Home Economics	4
Teaching Electronics & Electrical	1	Japanese	1	Teaching_Science_Physics	1		
Engineering_Dept. of Computer Science Teaching_Environmental Education_Other	1	Teaching_Language Arts_Mandarin	1	Teaching_Social Study_Civics and Social Study	1		
	1	Teaching_Language Arts_Other	1	Teaching Social Study Geography	1		
Teaching_Game_Other Teaching_Gender Equality Education_Local		Teaching_Language_English	1	Teaching Social Study History	1		
Language	1	Teaching_Language_Local Language	1	Teaching_Social Study_Other	1		
Teaching_Gender Equality Education_Other	1	Teaching_Language_Mandarin	1	Teaching_autism_Curriculum for Autism	1		
Teaching General Curriculum in Special	1	Teaching_Language_Other	1	Education	1		

There are 4 subgroups found in this network. The cluster 1 course categories is the major subgroup in this network; it is the largest and has the most power to impact on this network, followed by cluster 2, 3 and 4. If the cluster 1 course categories is removed or damaged, the network will quickly collapse.

Correspondingly, we sought to elucidate whether social network could be applied to identify relationships and roles. Other on-line activities might be also becoming impact to learners, such on-line PBL, mobile device for learning and integrated information providing. [6, 7, 8] It is suggested that further study could be conducted.

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