

Identifying the Course Role of In-service Learning via the Social Network Structure

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Abstract: -The purpose of this study focused on the social network structure of in-service development for the English 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 4,317 sample resources. The expected result should be able to understand English literature teacher in-service refresher training expertise in the overall network of centrality, 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, English 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 we can see in-service advancement education for high school teachers are worth to study. In addition, English is the international language and is one of the most important subjects in Taiwan especially we focus more on writing and reading skills for students in recent years. Thus, English literature teachers in high school are the research subjects in this study.

Furthermore, the in-service advancement 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 education training 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 English 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 English literature teacher in in-service advancement education.
- To understand the relation on study course categories which attended by English 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 1st layer are "teaching", "administration" and "other"; the 2nd layer is divided from 1st layer, it has 83 categories; the 3rd layer is divided from 2nd 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]

Table1. Number of high school English literature teachers attending in-service advancement education activities by location and school type

Location	No. of teachers by school type		Totals
	Public Schools	Private Schools	
Taipei city	547	127	674
Kaohsiung City	249	54	303
Taipei County	438	177	615
Yilan County	49	20	69
Taoyuan County	194	167	361
Hsinchu County	62	22	84
Miaoli County	78	36	114
Taichung County	133	162	295
Changhua County	98	43	141
Nantou County	77	6	83
Yunlin County	69	45	114
Chiayi County	26	19	45
Tainan County	136	81	217
Kaohsiung County	187	15	202
Pingtung County	95	26	121
Taitung County	26	0	26
Hualien County	34	27	61
Penghu County	13	0	13
Keelung City	66	18	84
Hsinchu City	81	49	130
Taichung City	160	111	271
Chiayi City	42	39	81
Tainan City	94	104	198
Kinmen County	12	0	12
Lienchiang County	3	0	3
Totals	2969	1348	4317

- **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]

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

Age group	Sex		Totals
	Female	Male	
22-29	239	52	291
30-34	549	93	642
35-39	579	76	655
40-44	541	96	637
45-49	355	81	436
50-54	166	50	216
55-59	43	27	70
60above	7	15	22
Totals	2479	490	2969

1.1 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]

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

Age group	Sex		Totals
	Female	Male	
22-29	267	30	297
30-34	240	59	299
35-39	146	41	187
40-44	179	27	206
45-49	101	25	126
50-54	79	27	106
55-59	55	47	102
60 above	15	10	25
Totals	1082	266	1348

2 Study Design

2.1 Research subjects

In this study the subjects are the high school English 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 4317 sample resources. The basic data analysis is shown in Table 1, Table 2. and Table 3.

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

1st	Layers		Attendance totals
	2nd	3rd	
Teaching	Language Arts	English	6354
Teaching	Other	other	6235
Administration	Educational Affairs	other	4973
Administration	School discipline and guidance	other	3837
Teaching	Language Arts	other	3834
Teaching	Information Technology Education	other	2213
Administration	Other	other	2022
Other	Language Arts	English	1586
Other	Other	other	995
Other	School discipline and guidance	other	771
Administration	General Affairs	other	459
Teaching	Integrative Activity	other	427
Other	Educational Affairs	other	367
Teaching	General Curriculum in Special Education	Apply Special Education	354
Teaching	School discipline and guidance	other	334
Teaching	Language Arts	Mandarin	312
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Teaching	Home Economics	Dept. of Early Childhood Care	1
Teaching	Home Economics	Home Economics	1
Teaching	Home Economics	other	1
Teaching	Industrial	Dept. of Electronics	1
Teaching	Industrial	Machinery Cluster	1
Teaching	Integrative Activity	Scout Education	1
Teaching	Language Arts	Department of Japanese	1
Teaching	Language Arts	Local Language	1
Teaching	Physically and Mentally Disabled	visual impairment	1
Teaching	Science and Social Study	other	1
Teaching	Science and Technology	Earth Science	1
Total			40464

Table 5. The Degree centrality of course categories

Course Categories	Degree	NrmDegree	Share
Teaching_Other_other	186	85.321	0.022
Teaching_Language Arts_English	184	84.404	0.022
Administration_Educational Affairs_other	179	82.11	0.022
Administration_School discipline and guidance_other	177	81.193	0.021
Other_Other_other	171	78.44	0.021
Administration_Other_other	169	77.523	0.02
Teaching_Language Arts_other	165	75.688	0.02
Teaching_Information Technology Education_other	151	69.266	0.018
Other_School discipline and guidance_other	150	68.807	0.018
Other_Language Arts_English	132	60.55	0.016
Teaching_General Curriculum in Special Education_Apply Special Education	115	52.752	0.014
Other_Educational Affairs_other	111	50.917	0.013
Teaching_Language Arts_Mandarin	104	47.706	0.013
Other_Information Technology Education_other	103	47.248	0.012
Teaching_Integrative Activity_other	100	45.872	0.012
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Other_severe emotional disturbance_other	2	0.917	0
Teaching_Industrial_Dept. of Electronics	2	0.917	0
Teaching_Industrial_Machinery Cluster	2	0.917	0
Other_Area of Math_other	2	0.917	0
Other_Job Practice_practice	2	0.917	0
Other_physical handicaps_other	2	0.917	0
Teaching_Home Economics_Dept. of Early Childhood Care	2	0.917	0
Other_Other_Civics and Social Study	2	0.917	0
Other_Area of Science_Physics	2	0.917	0

DESCRIPTIVE STATISTICS

	1	2	3	
	Degree	NrmDegree	Share	
----- Network Centralization = 68.52%				
1 Mean	37.991	17.427	0.005	Heterogeneity = 0.91%. Normalized = 0.45%
2 Std Dev	37.832	17.354	0.005	
3 Sum	8320.000	3816.514	1.000	
4 Variance	1431.251	301.164	0.000	
5 SSQ	629528.000	132465.281	0.009	
6 MCSSQ	313443.969	65954.883	0.005	
7 Euc Norm	793.428	363.958	0.095	
8 Minimum	2.000	0.917	0.000	
9 Maximum	186.000	85.321	0.022	

1.1 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.

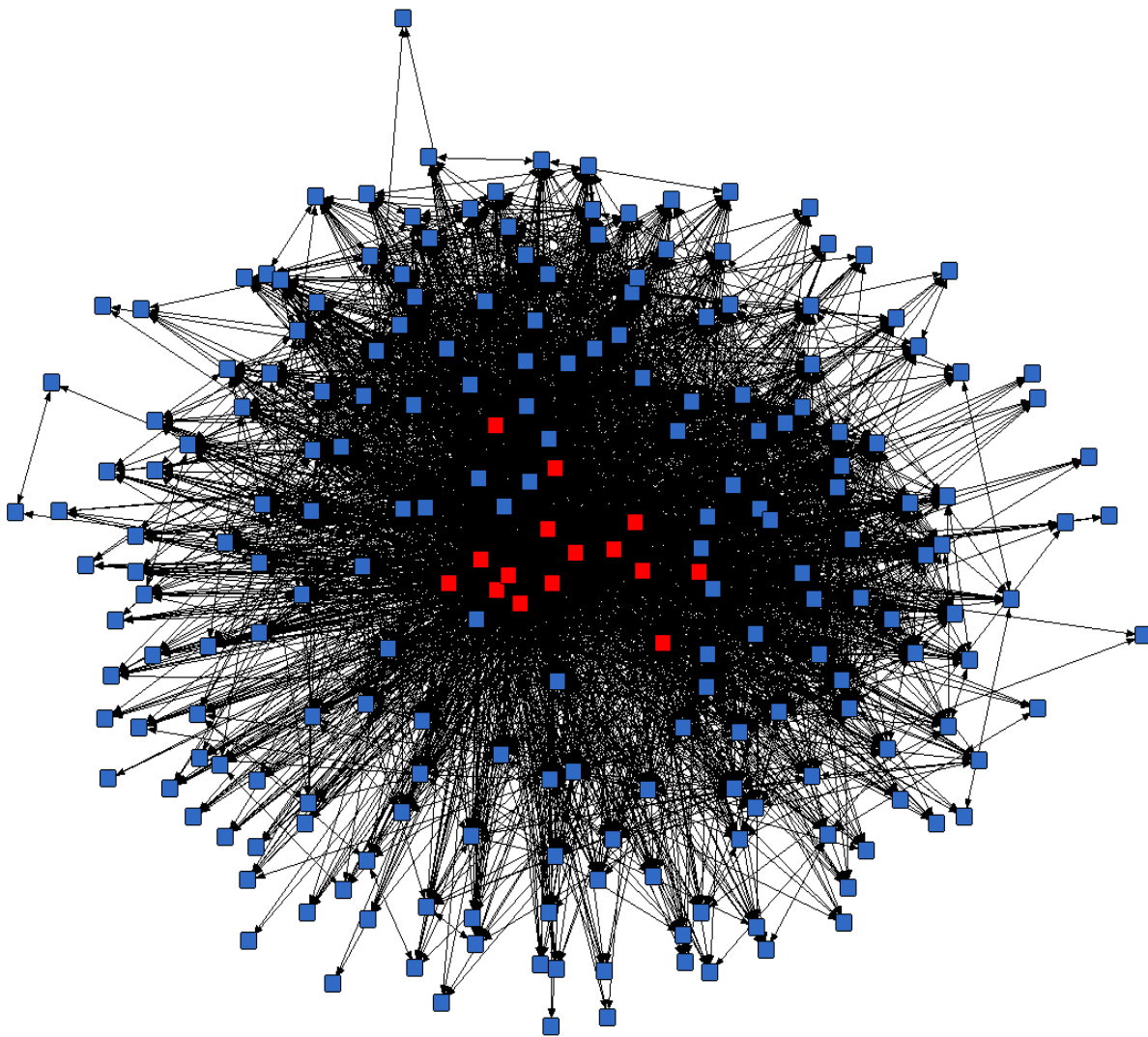


Fig. 1. the whole network graph

2 Results

This study aims to focus on the social network

structure of in-service advancement education for the high school English literature teachers. Table 4 is the course category frequency table for high school English literature teachers attending in-service advancement education.

The table shows course category “Teaching_language Arts_English” has the highest frequency followed by “Teaching_Other_other”, “Administration_Education Affairs_other”, “Administration_School discipline and guidance_other” and “Teaching_Language Arts_other”.

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 5. shows the mean of the degree centrality on course categories is 37.991; The mean of normalized degree centralities on course categories is 17.427 %.

“Teaching_Other_other”, “Teaching_Language Arts_English”, and “Administration_Educational Affairs_other” have the highest degree centrality followed by “Administration_School discipline and guidance_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 English literature teachers. The whole network centralization is 68.52%, which indicate there is a medium high centrality in this network. Figure 1. is the whole network graph which shows the relationship between the course categories. The red square nodes are the top 15 strongest degree centrality. Figure 2. simplify the whole network graph which shows the top 15 strongest degree centrality of course categories.

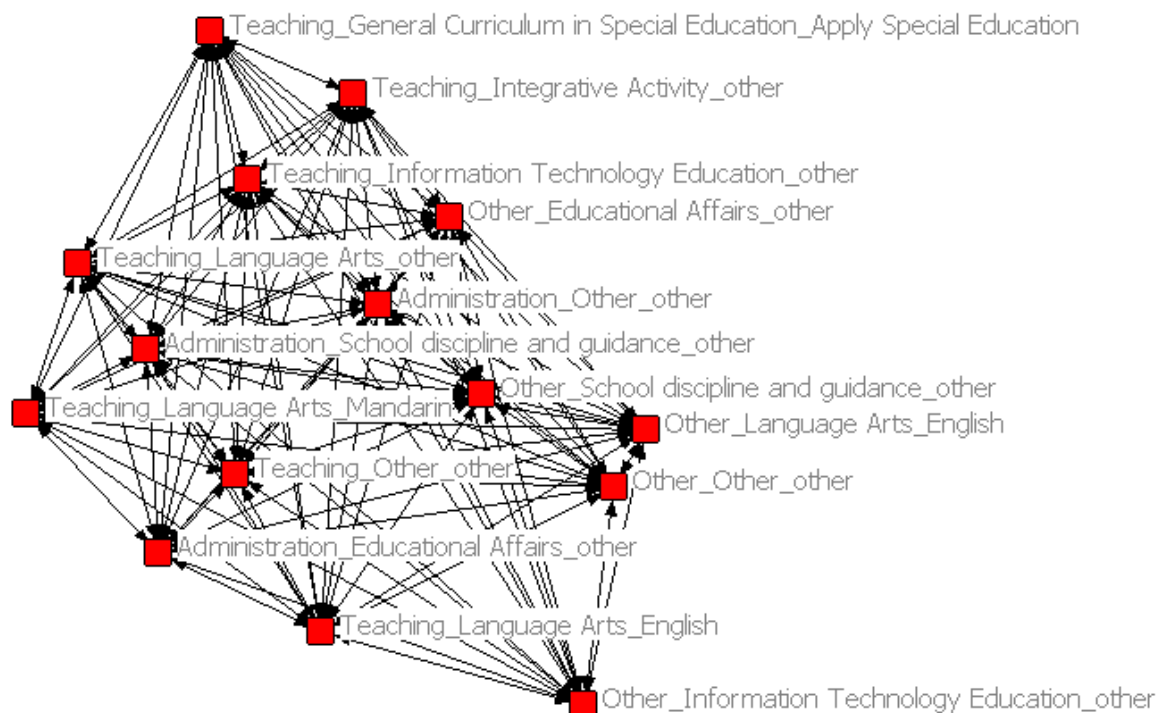


Fig.2. the top 15 strongest degree centrality of course categories.

Blocks & cutpoints

Figure 3. and Figure 4. are the graphs shows the blocks and cutpoint in this network. There are two

blocks and one cutpoint found. “Administration_School discipline and guidance_other” is the cutpoint. Block one is the cutpoint (“Administration_School discipline and guidance_other”) links to “Teaching_Industrial_Dept. of Electronics”, “Teaching_Industrial_Machinery

Cluster” and vice versa; block two is the cutpoint (“Administration_School discipline and guidance_other”) and other course categories except “Teaching_Industrial_Dept. of Electronics” and “Teaching_Industrial_Machinery Cluster” forms a network.

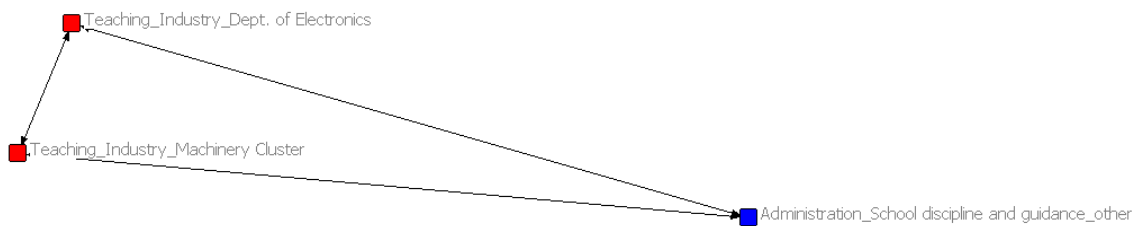


Fig.3 Block 1

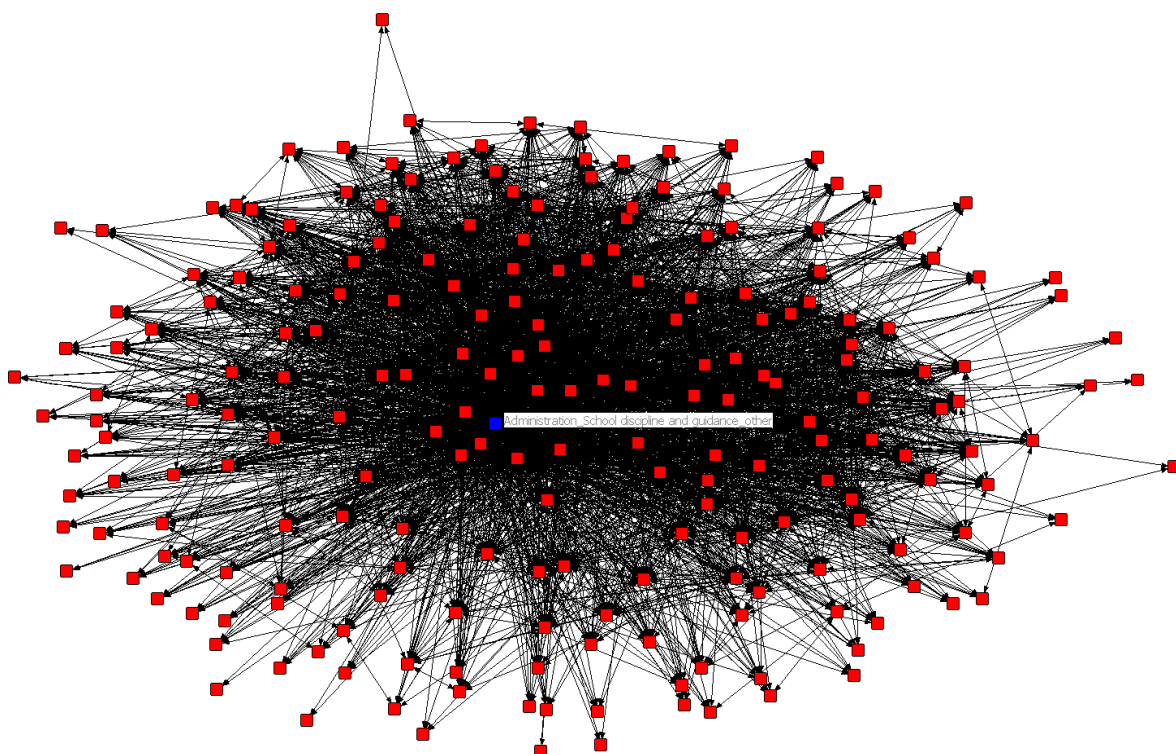


Figure 4. Block 2

Table 6. Clusters of Course categories by Markov clustering algorithm

Course Categories	Cluster
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Course Categories	Cluster
Administration_Arts and Humanities_other	1
Administration_Environmental Education_other	1
Administration_General Affairs_other	1
Administration_Job Practice_career	1
Administration_Job Practice_other	1
Administration_Library Management_other	1
Administration_Personnel&Accounting_other	1
Other_Agriculture_Dept. of Landscape Gardening	1
Other_Area of Arts and Humanities_Arts and Life	1
Other_Area of Arts and Humanities_Fine Arts	1
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Teaching_hearing impairments_other	1
Teaching_language disorders_other	1
Teaching_learning disabilities_Curriculum for Learning impaired Education	1
Teaching_learning disabilities_other	1
Teaching_mental retardation_Curriculum for Mental Retardation Education	1
Teaching_mental retardation_other	1
Teaching_severe emotional disturbance_Curriculum for Emotional and Behavioral Disorders Education	1
Teaching_severe emotional disturbance_other	1
Teaching_the gifted_Curriculums for Gifted Students	1
Teaching_visual impairment_other	1
Administration_Educational Affairs_other	2
Administration_School discipline and guidance_other	2
Other_Arts_Dept. of Film & Drama	2
Other_Health_Health and Nursing	2
Other_Hospitality_Dept. of Restaurant Management	2
Other_Job Practice_practice	2
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Teaching_Industrial_Dept. of Electronics	2
Teaching_Industrial_Machinery Cluster	2
Teaching_Music_other	2
Teaching_Science_Chemistry	2
Teaching_physical handicaps_other	2
Teaching_the gifted_Apply Assessment	2
Teaching_the gifted_other	2
Teaching_visual impairment_Curriculum for Visually Impaired Education	2
Administration_Job Practice_practice	3
Administration_Other_other	3
Other_Area of Social Study_History	3
Other_Area of Social Study_other	3
Other_Language Arts_Department of Japanese	3
Other_Other_Civics and Social Study	3
Other_Science_Chemistry	3
Other_Area of Foreign Language_other	4
Other_Area of Math_other	4
Other_Area of Science_Physics	4
Other_physical handicaps_other	4

Table 6. shows clusters of course categories by Markov clustering algorithm. There are 4 subgroups found. Cluster 1 has 186 course

Subgroups

categories members, cluster 2 has 22 course categories members, cluster 3 has 7 course categories members and cluster 4 has 4 course categories members.

3 Conclusions

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

- The high school English literature teachers attending “Teaching_language Arts_English” related courses most frequently. That indicates high school English literature teachers continue to study their major field of teaching.
- “Teaching_Other_other”, “Teaching_Language Arts_English”, and “Administration_Educational Affairs_other” have the highest degree centrality followed by “Administration_School discipline and guidance_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 English 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 “Administration_School discipline and guidance_other”. If this course category is removed or damaged, the network will quickly fragment into unconnected sub-networks. In this case “Teaching_Industrial_Dept. of Electronics” and “Teaching_Industrial_Machinery Cluster” will be the sub-network and has no connection to the main network.
- 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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