

Key Competencies of Teachers' Professional Development in China

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Abstract

Through case studies and Rasch analysis, this study puts forward 12 indicators of key competencies of Chinese teachers' professional development. There are four indicators about key competencies of teachers' professional ethics: ideals, dedication, diligence and grit. There are also four about professional teaching: nature of discipline, nature of leaning, traditional culture, information and technology. The last four are related to professional learning, i.e., professional autonomy, reflective inquiry, cooperation and innovation, humanistic literacy. Requirements for key competencies are defined in the context of daily instructions, and are categorized into three different levels. These competencies can guide teachers to pursue school-based professional development and lifelong learning, so as to improve the justice, equity, and opportunity of education for all students.

Key words: professional competencies of teachers, professional ethics, professional teaching, professional learning

Introduction

Since the beginning of the 21st century, the new paradigm of talents for the new century has been proposed. Although there are differences among the details of different talents models, such as the OECD competency framework [1], the European framework for key competences for lifelong learning [2], America's 21st century skills [3], and the key competencies of Chinese students' development [4], the new paradigm of talents focuses on the key competencies which need high-quality basic education to construct a solid foundation for students' life-long learning and sustainable development. Hence, teachers' understanding of the new paradigm of talents as well as teachers' professional ability to cultivate students' key competencies have become the increasingly importance in the basic education [5].

However, all countries including China still define the professional standards of teachers in a quite general manner [6]; it remains a challenge to operationalize them [7]. Therefore, when promoting teachers' professional development, countries need to give more specific guidance by clearly specifying levels of the standards from the prospective of professional practices, and by providing assessment based on the standards so as to improve teachers' professional

competencies [8][9].

Based on China's professional standards for teachers, teachers' responsibility in cultivating students' key competencies, and the latest professional standards for teachers in other countries, this study focuses on teachers' professional competencies to facilitate students' full-development. The research questions of this study are: (1) What are the key indicators and professional requirements of practice-oriented professional competencies of teachers in China's primary and middle schools? (2) How to develop a reliable and valid questionnaire to investigate professional competencies of teachers?

Theoretical Framework

To assist teachers towards accomplishing their professional missions in the new periods, many countries (e.g., United States, France, United Kingdom, Australia, Canada, China) have implemented a new round of reforms in improving teachers' professional standards. From these reforms, some new trends for teachers' professional competencies have emerged. First, the new standard uses the key competencies running through the whole careers of teachers to help them pursue sustainable development, not just as part of the requirements for new teachers or excellent teachers. In the United States, the motion has been put forward that all teachers should be equipped with four common core competencies, i.e., the learner and learning, content knowledge and its application, instructional practice, and professional responsibility [10]. Second, the roles of teachers' professional ethics and professional learning in their professional development are stressed in the new standards. For instance, the China's professional standards for teachers stress the importance of teachers' professional ethics [11]. The ethical standards for the teaching profession in Canada are care, respect, trust and integrity [12]. Besides, five professional learning standards are also proposed in Canada. Third, some countries use learning progressions for teachers' professional development based on the increasing complexity and sophistication of efficient teaching practices. The United States' InTASC crafts learning progressions for each core standard across three developmental levels for teachers [10]. In Australia, progressions are divided into different stages: graduate teachers, proficient teachers, highly accomplished teachers, and lead teachers [13].

Analyzing the latest professional standards of teachers in the world, we draw the outline of "what excellent teachers ought to be" and establish the theoretical perspective of this study.

Take responsibility for the development of each student

Professional standards of each country, including China (2012), the US (InTASC, 2013), Britain (2013), Canada (2016) and Australia (2012), all emphasize student orientation. The first duty of teachers is to "encourage students to learn with high expectations" [14]. Hence, teachers should "take professional responsibilities for the development of learners" [10], "engage in the development and learning of students" [12][13], and understand students and help all students realize their personal achievements [15]. As professional practitioners, teachers should undertake the role of public service providers in education and transfer national values [15].

The US InTASC's definition to "take professional responsibilities for the development of learners" is that teachers know how learners grow and develop, recognize a variety of patterns of learners' learning and development. Hence, teachers should design and implement appropriate learning experiences for each student to challenge and develop them. InTASC further lists three levels of teaching practices in standards (see Table 1), indicating that the novice teachers should meet the requirements of level 1, the qualified teachers should meet the requirements of level 2, and the excellent teachers should meet the requirements of level 3. As is seen from Table 1, excellent teachers should be able to fulfill the responsibility of promoting every student's comprehensive development.

Table 1

Three levels of teaching practices for InTASC standards #1

1	2	3
<p><input type="checkbox"/> Drawing on their understanding of child and adolescent development, teachers observe learners, noting changes and patterns in learners' all aspects of development. Seek resources, including from families and colleagues, to adjust teaching.</p> <p><input type="checkbox"/> Teachers actively gather information about learners' interests, so as to engage learners in developmentally appropriate learning experiences.</p>	<p><input type="checkbox"/> Teachers build various mental models for learners' development to adjust instructions based on experience with each learner.</p> <p><input type="checkbox"/> Teachers incorporate the perspectives of learners and their families/communities to integrate different resources and strategies for cultivating learners.</p> <p><input type="checkbox"/> Teachers collect and utilize all resources, inside or outside school, to support and accelerate each student's learning and development.</p> <p><input type="checkbox"/> Teachers identify individual experiences of learners in learning</p>	<p><input type="checkbox"/> Teachers understand the interconnections among learners' development in different aspects, including cognition, emotion, values, skills and socialization. Teachers know the appropriate entry points to support learners' development.</p> <p><input type="checkbox"/> Teachers communicate regularly with learners' families to get a consensus understanding in learners' development. Teachers also help learners to recognize,</p>

<p><input type="checkbox"/> Teachers engage learners in a variety of learning experiences to improve learners' weakness and fully development.</p>	<p>and development, and improve all learners through an appropriate balance of support and challenge.</p>	<p>analyze, and communicate their needs in learning.</p> <p><input type="checkbox"/> Teachers regularly analyze and reflect on learners' performances, provide individualize instructions and take responsibility for each learner.</p>
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High level of professional teaching

Teachers' abilities in professional teaching are highly valued in professional standards of teachers in each country. In InTASC (2013), six out of ten standards are related to teachers' professional teaching. InTASC asks teachers (1) to construct suitable environment to facilitate students' learning and development, (2) to master and utilize the relevant content knowledge to cultivate learners' critical thinking, creativity, and abilities of collaborative problem solving related to local and global issues, (3) to take different methods of assessment to engage learners in their own growth, (4) to design effective instruction and to practice a variety of instructional strategies to develop learners [10].

Four out of seven professional standards in Australia are about teachers' professional teaching. Australia also emphasizes that teachers should master the content knowledge and know how to teach them, plan and implement effective instruction, create and maintain effective learning environments, and provide effective evaluation and feedback for students' learning [13].

Excellent teachers are required to promote students' learning and development with high-level and high-quality professional practices in these professional standards talked about above and below [10][13].

Professional ethics of teachers

One of the challenges in teachers' professional development has always been teachers' professional ethics [16][17] [18]. Research on teachers' professional ethics used to focus on teachers' dispositions [19] [20]. In recent years, research in this area has started to focus on teachers' ethical behavior [21][22][23]. Researchers now pay more attention to improving teachers' capacity for thinking and solving problems when they encounter ethics problems, conflicts, and dilemmas in professional practices [24][25][26]. There are some referential perspectives for the study, such as "client-centered" principle, which helps teachers to better serve and develop students [8]; another is that teachers' professional ethics standards should be made based on ethical relationships between teachers, students, parents, colleagues, schools, and relevant people in the community [27].

Under the circumstance of practice orientation of professional ethics, professional standards of teachers in each country, including China, put forward professional

requirements of teachers' professional ethics, which used to be tacit requirements [19][28]. These professional ethics described in professional standards of teachers convert demanding of teachers' moral from self-discipline into common professional requirements [21][29][30].

The ethical conducts, such as care, respect, trust, and fair are emphasized in each professional standard of teachers (e.g., China, 2012; Britain, 2013; Canada, 2016; InTASC, 2013; Australia, 2012). Teachers are required to perform ethical conducts in their daily practices according to related ethical codes. Details about these ethical codes, for instance, are that teachers should treat pupils with dignity, and build relationships rooted in mutual respect in their daily practices [14]. Teachers should safeguard pupils' wellbeing in accordance with statutory provisions, showing tolerance of and respecting for the rights of others [14][15]. Teachers also should demonstrate good behaviors in the public, and are forbidden to affect pupils negatively or mislead pupils' thought (e.g., China, 2012; Britain, 2013). In addition, it is specifically illustrated in British standards that teachers should not undermine British fundamental values, including democracy, the rule of law, individual liberty and mutual respect, and tolerance of different faiths and beliefs [14].

Professional autonomy and lifelong learner

To foster students to become lifelong learners of the 21st century, teachers should become lifelong learners themselves firstly [31]. Professional standards of teachers in China and in other countries put forward unanimously that teachers should be able to plan their own sustainable professional development independently. They should cooperate with colleagues, school leaders, students, and parents, to carry out reflective professional practices, and to enhance the ability of professional practices through reflection and cooperation.

For example, the five professional learning principles for teachers in Canada (2016) include cooperation, self-direction, critical exploration, professional autonomy, and practice transformation. Canada also points out that teachers' professional learning should be directly correlated to students' learning, be planned for and be guided by themselves, and can get feedbacks from the learning community. Principals' reflections on teachers' professional learning affect teachers' learning opportunities [32]. Cooperation and inquiry practices can enhance the effectiveness of teachers' professional learning [31][33].

Based on the above analyses and summaries of professional standards of teachers, this study takes three perspectives to inquiry teachers' professional competencies. The three are teachers' professional ethics, teachers' professional teaching and teachers' professional learning. We firstly research the professional requirements of teachers' professional competencies through case study according to the three perspectives.

Methods

Case Study. From the list of special-ranked teachers, an official honorary title for the exceptionally good teachers in China, recommended by the Ministry of Education, subject experts, and teaching and research staff from the local education bureaus, we chose 32 special-ranked teachers aged 54 on average from primary and middle schools across China

as the sample of case study. They were in-service or retired and engaging actively in the research and instruction of discipline education across the country. None of them serves as school administrator. In other words, they are representatives of current excellent teachers in China.

The research team of case study consisted of 12 secondary school teachers and 16 graduate students majoring journalism and communication. We organized 32 groups of three for 32 cases. Each graduate student joined 2 cases and each teacher joined 2 or 3 cases. The corresponding author took part in every group. Case study lasted for seven months.

Considering the personal experiences and teaching styles of each special-ranked teacher, we firstly designed interview outlines for them according to the three perspectives. Each interview outline contained eight to ten open-ended items, such as:

- (1) How or why did you become a teacher? Are there any special experiences in your career?
- (2) What are the basic conditions for being a qualified teacher? What are the unique characteristics of special-ranked teachers?
- (3) What are you doing now? Which kind of tasks do you favor to engage?
- (4) What kinds of factors will you take into account when you are preparing the lessons? And how do you prepare the lessons?
- (5) How do you carry out your professional learning?
- (6) What do you think about the situations of the discipline's curriculum, instruction and assessment?
- (7) What is the most benefit you offer your students?
- (8) When/What was the hardness in your career?

Secondly, we clinically interviewed samples one-to-one for two to three hours respectively. In addition, we observed their classroom instructions, and interviewed two or three of their colleagues or local teaching and research staff. Thirdly, we made character reports for each sample in details according to the interview recordings, classroom observations and other related materials. Finally, everyone of the research team listed the characteristics of each sample after reading the character reports. Eighteen skills of special-ranked teachers were extracted.

All 32 teachers were invited to complete a rating exercise prior to sorting the importance of 18 skills according to cultivating student key competencies in the 21st century. All ratings were summarized. We chose the top 12 skills from the three perspectives to develop 12 indicators as key competencies of teacher development (see Figure 1).

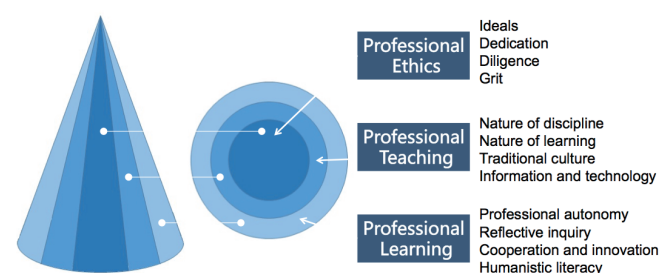


Figure 1. Key competencies of teachers' development

Measurement Instrument Development. Through school and classroom observations, we categorized teachers'

professional practices in each indicator into three different levels: understanding, practicing, and characterizing. Understanding represents a lower level, which means that teachers can conceptual understand the professional requirements of the indicators. Practicing represents a basic level, meaning that teachers can fulfill the professional requirements of the indicators in their professional practices. Characterizing represents a higher level, meaning that teachers have developed coherent value system and put them into professional practices steadily in concern of the professional requirements of the indicators.

Indicator of ideals is about teachers' professional ideals. The requirements concerning key competencies of ideals are that teachers understand their professional responsibilities (understanding), achieve educational aims and carry out national policies during their professional practices (practicing), and pursue their own professional ideals through their daily instructions (characterizing). Indicator of dedication is about how teachers devote themselves to their daily instructions. The requirements relating to dedication are that teachers have a sense of responsibility (understanding), work hard, respect and care for their students (practicing), and consider students' development as their own duty in their daily instructions (characterizing). Diligence is about teachers' hard work to fulfill their professional duties. The requirements of diligence are that teachers focus on the research of national education standards, curriculums and students (understanding), strive for continually improving the quality of instruction (practicing), and inquire the rules of instruction to develop students' key competencies in their daily instructions (characterizing). Grit is concerned with teachers' passion for and perseverance with their professional ideals. The requirements for grit are that teachers understand the long-term efforts to develop students' key competencies (understanding), try their best to create better conditions and opportunities for their students' development (practicing), and cultivate their students' grit by setting good examples in their daily instructions (characterizing).

We developed a questionnaire with 130 items according to the 12 indicators. Thirty-eight experts and special-ranked teachers analyzed the items to evaluate the content validity. There were 113 items left for the pilot-testing. The item format was rating scale. The scale points were 3 for strong agreement, 2 for agreement, and 1 for disagreement.

Data Source and Analysis. We gave the initial instrument to 401 teachers of diverse backgrounds. Firstly, we chose 3 primary schools and 3 middle schools from urban, rural, and private schools through the recommendation of teaching and research staff and school principals. Secondly, we randomly chose teachers from those schools for online administration of the questionnaire. Moreover, we randomly chose one school from each type. Table 2 presents the sample characteristics. After teachers finished the online questionnaire, we randomly interviewed 12 teachers from each school, 36 teachers in total, to establish evidence related to response processes. Teacher quantitative response data were then submitted to Rasch analysis to establish preliminary evidence for construct validity and reliability.

Table 2

Schools	Sample Characteristics			Sum
	High school teacher	Middle school teacher	Primary school teacher	
Urban school	47	36	36	119
Rural school	44	47	50	141
Private school	37	38	66	141
Sum	128	121	152	401

Results and Analysis

Using Winsteps to do Rasch analysis, items fit statistics were reviewed. Appendix 1 shows that INFIT MNSQs, INFIT ZSTDs, and OUTFIT ZSTDs for most items (96%) were within the acceptable range, indicating that these items had a good model-data-fit. Considering item response category structure as shown in Figure 2, there were three categories and each of them had their unique zones of responses, which means the three categories form a clear progression. The category structures of each indicator shown in the Appendix 2 were also good. Table 3 presents the summary of Rasch modeling for the instrument based on 401 respondents. We can see the separation indices for persons and items were good, equivalent to the Cronbach's alpha of 0.96 and 0.97.

Although items fit statistics showed adequate fit between data and the rating scale Rasch model, the range of item difficulties and person abilities shown in Figure 3 indicates a noticeable gap. The respondents, on average, were performing at a higher level than the typical test item. Interviews of the 36 teachers found that teachers were inclined to choose options that speak favorably of them when filling the questionnaire. The instrument needs improvement by including additional items of high levels, reducing items of the same levels.

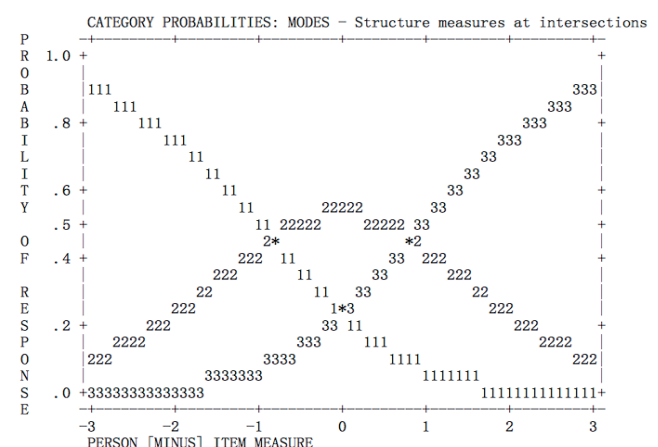


Figure 2. Categories probability curve

Table 3
 Item and person separation and reliability

SUMMARY OF 401 MEASURED (EXTREME AND NON-EXTREME) PERSON									
	TOTAL SCORE	COUNT	MEASURE	MODEL ERROR	INFIT		OUTFIT		
					MNSQ	ZSTD	MNSQ	ZSTD	
MEAN	290.7	112.7	1.83	.23					
S. D.	38.6	1.0	1.35	.13					
MAX.	337.0	113.0	5.06	1.82					
MIN.	113.0	101.0	-6.91	.14	.22	-9.9	.25	-9.9	
REAL RMSE	.28	TRUE SD	1.32	SEPARATION	4.73	PERSON RELIABILITY	.96		
MODEL RMSE	.26	TRUE SD	1.32	SEPARATION	5.06	PERSON RELIABILITY	.96		
S. E. OF PERSON MEAN = .07									
SUMMARY OF 113 MEASURED (NON-EXTREME) ITEM									
	TOTAL SCORE	COUNT	MEASURE	MODEL ERROR	INFIT		OUTFIT		
					MNSQ	ZSTD	MNSQ	ZSTD	
MEAN	1031.6	400.0	.00	.10	.99	-.1	.98	.0	
S. D.	67.5	1.1	.62	.01	.20	2.5	.28	2.5	
MAX.	1129.0	401.0	1.98	.13	1.87	9.9	2.05	9.9	
MIN.	778.0	396.0	-1.13	.08	.76	-3.0	.58	-3.3	
REAL RMSE	.11	TRUE SD	.61	SEPARATION	5.76	ITEM RELIABILITY	.97		
MODEL RMSE	.10	TRUE SD	.61	SEPARATION	5.91	ITEM RELIABILITY	.97		
S. E. OF ITEM MEAN = .06									

Conclusions and Implications

Based on case studies of special-ranked teachers and Rasch analysis of data collected from selective teachers, this study proposes 12 indicators and takes professional ethics as the “core” and professional learning as the “driver” to construct a model named key competencies of teachers’ professional development, in order to guide teachers to cultivate students’ key competencies by pursuing lifelong learning and sustainable professional development.

According to data analysis, the 12 indicators and their three levels of professional requirements are reasonable for key competencies of teachers’ professional development. From the outcomes of online survey, we can conclude the questionnaire is valid and reliable. The validity and the reliability of the study are realized from the following aspects. First, indicators relevant to key competencies of teacher development are drawn from case studies on real special-ranked teachers. Second, requirements for professional practices of different levels are defined in the context of daily instructions, to provide school-based professional guidance to teachers. Third, it contributes a measurement instrument validated by Rasch analysis to guide teacher professional development. The practice-oriented work of this study strengthens the reliability and validity of the key competencies of teachers’ professional development, also improves the effectiveness for guiding teachers’ school-based professional development.

However, there are some limitations in the study. First, the indicators are constructed based on example cases, in the real contexts, but not related to the students’ achievements. Hence, further studies need to be conducted to correlate the performance of students’ achievements with these indicators. Second, the professional requirements of three levels of each indicator may be too general to suit different discipline teachers in different areas of China. There are obvious differences between the different schools located in big cities, suburban areas, and poor countries in China. Thus, further studies are needed to specify the professional requirements of each level of each indicator for different teachers in different areas.

As an initial research of key competencies of teachers’ professional development, the outcomes of the study are informative in terms of defining the areas in need for improvement within teachers’ professional competencies. The findings from this study can help China’s education bureaus and schools design and implement professional development in order to improve teachers’ professional competencies. In addition, this study describes and investigates teachers’ key competencies from a practice-oriented perspective offering a case for research on teacher development of other issues, as well as to further teacher education research. The validated measurement instrument and findings from this study can

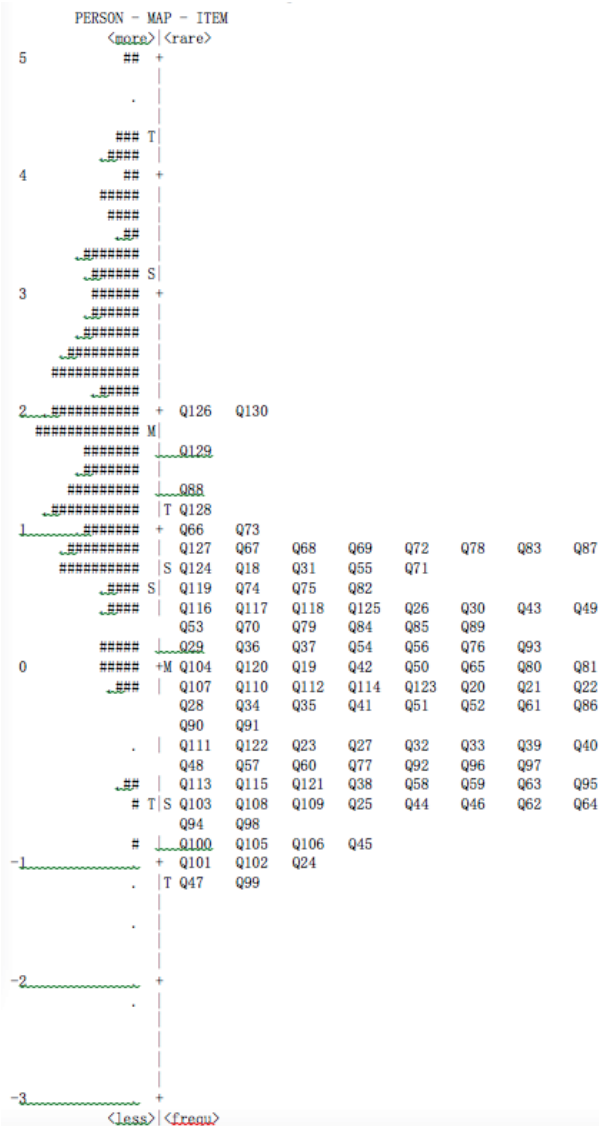


Figure 3. Wright map

facilitate the researchers and teachers to improve key competencies for development of every student in the world.

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Appendix 1. ITEM STATISTICS: MEASURE ORDER

INPUT: 401 PERSON 113 ITEM REPORTED: 401 PERSON 113 ITEM 3 CATS WINSTEPS 3.72.0
 PERSON: REAL SEP.: 4.73 REL.: .96 ... ITEM: REAL SEP.: 5.76 REL.: .97

ENTRY	TOTAL	TOTAL	MODEL		INFIT		OUTFIT		PT-MEASURE	EXACT MATCH			
NUMBER	SCORE	COUNT	MEASURE	S.E.	MNSQ	ZSTD	MNSQ	ZSTD	CORR.	EXP.	OBS%	EXP%	ITEM
113	778	399	1.98	.08	1.60	8.2	1.72	8.4	.34	.60	44.5	57.0	Q130
109	783	398	1.94	.08	1.87	9.9	2.05	9.9	.33	.60	39.8	56.8	Q126
112	823	398	1.65	.08	1.49	6.9	1.49	6.0	.45	.60	44.3	56.7	Q129
71	877	399	1.29	.08	1.62	8.3	1.67	7.4	.44	.60	44.2	58.3	Q88
111	891	398	1.18	.08	1.59	7.9	1.75	7.9	.40	.59	49.9	58.8	Q128
49	915	401	1.05	.09	1.25	3.6	1.25	2.9	.52	.59	53.8	59.7	Q66
56	926	401	.97	.09	1.21	3.0	1.24	2.7	.49	.59	58.5	60.3	Q73
66	935	400	.88	.09	1.21	3.0	1.35	3.7	.51	.58	59.1	60.9	Q83
51	937	399	.86	.09	1.06	.9	1.03	.4	.53	.58	59.3	60.9	Q68
50	941	401	.86	.09	1.14	2.0	1.08	.9	.55	.58	55.5	61.0	Q67
55	943	401	.84	.09	.98	-.4	.96	-.4	.59	.58	60.5	61.3	Q72
110	934	396	.82	.09	1.26	3.6	1.21	2.3	.53	.58	58.0	61.3	Q127
70	946	400	.80	.09	1.23	3.2	1.20	2.2	.52	.58	57.4	61.9	Q87
61	951	401	.78	.09	1.12	1.7	1.18	2.0	.51	.58	57.3	62.0	Q78
52	948	399	.77	.09	1.11	1.6	1.15	1.7	.52	.58	59.0	62.2	Q69
1	958	401	.73	.09	1.36	4.8	1.78	7.1	.46	.58	61.0	62.6	Q18
14	961	401	.70	.09	1.10	1.4	1.14	1.5	.55	.58	62.3	62.8	Q31
107	957	397	.67	.09	1.21	2.9	1.22	2.3	.50	.57	59.8	63.0	Q124
54	964	400	.66	.09	.90	-1.4	.94	-.6	.60	.57	64.7	63.2	Q71
38	971	401	.62	.09	1.17	2.4	1.14	1.5	.52	.57	64.0	63.8	Q55
58	981	400	.53	.09	.95	-.6	.90	-1.0	.58	.56	67.4	64.7	Q75
102	982	400	.51	.09	1.03	.4	.91	-.9	.60	.57	65.9	64.9	Q119
65	983	400	.51	.09	.85	-2.3	.80	-2.2	.61	.57	66.2	64.9	Q82
57	985	399	.47	.09	.81	-2.9	.71	-3.1	.66	.56	72.1	65.3	Q74
53	989	397	.40	.09	.97	-.4	1.02	.2	.56	.56	69.7	66.1	Q70
68	1000	401	.38	.09	1.03	.5	.95	-.5	.59	.56	67.8	66.2	Q85
100	1000	401	.38	.09	.94	-.9	.85	-1.4	.60	.56	67.8	66.2	Q117
101	1005	401	.34	.09	.92	-1.0	.77	-2.3	.62	.56	68.3	66.7	Q118
72	1006	401	.33	.09	.94	-.8	.91	-.8	.59	.56	69.5	66.8	Q89
13	999	397	.31	.09	1.07	.9	1.10	1.0	.51	.56	62.4	67.1	Q30
99	1008	401	.31	.09	.95	-.6	.81	-1.9	.62	.56	70.0	67.0	Q116
67	1007	400	.30	.09	1.00	.0	1.00	.1	.56	.55	68.7	67.1	Q84
26	1006	399	.29	.09	1.11	1.4	1.22	2.0	.49	.55	64.8	67.2	Q43
108	1002	397	.29	.10	1.22	2.8	1.29	2.4	.47	.55	62.9	67.2	Q125
62	1011	401	.29	.09	.88	-1.7	.78	-2.2	.62	.55	71.5	67.1	Q79
9	1011	400	.26	.10	1.02	.3	1.03	.3	.54	.55	70.4	67.4	Q26
32	1014	401	.26	.10	1.02	.3	1.24	2.1	.51	.55	68.0	67.4	Q49
36	1014	401	.26	.10	.91	-1.2	1.05	.5	.55	.55	69.8	67.4	Q53
37	1015	401	.25	.10	1.03	.4	1.11	1.0	.51	.55	65.3	67.5	Q54
39	1015	399	.21	.10	1.02	.3	.95	-.4	.56	.55	69.6	67.9	Q56
12	1015	399	.21	.10	.96	-.4	.90	-.9	.55	.55	68.3	68.0	Q29
76	1018	400	.20	.10	1.09	1.1	1.01	.1	.53	.55	72.2	68.0	Q93
19	1020	400	.18	.10	1.17	2.1	1.30	2.5	.46	.55	63.9	68.1	Q36
59	1023	401	.18	.10	.87	-1.8	.75	-2.4	.62	.55	71.0	68.1	Q76
20	1031	401	.10	.10	1.44	5.1	1.97	6.5	.39	.54	67.0	69.1	Q37
64	1032	400	.07	.10	.82	-2.5	.88	-1.0	.59	.54	75.9	69.4	Q81
33	1034	400	.05	.10	.79	-2.9	.86	-1.2	.60	.54	74.2	69.7	Q50
63	1039	401	.02	.10	.79	-2.9	.73	-2.4	.61	.54	74.8	70.0	Q80
87	1042	401	-.01	.10	1.14	1.8	1.12	1.0	.48	.53	69.3	70.4	Q104
103	1039	399	-.03	.10	.79	-2.9	.63	-3.3	.65	.53	75.4	70.8	Q120
48	1047	401	-.06	.10	.84	-2.1	.92	-.6	.56	.53	74.8	71.2	Q65
2	1048	401	-.07	.10	1.01	.2	1.06	.5	.52	.53	72.8	71.3	Q19
25	1048	401	-.07	.10	.78	-3.0	.72	-2.4	.59	.53	75.8	71.3	Q42
90	1051	401	-.10	.10	1.18	2.1	1.22	1.6	.47	.53	69.0	71.6	Q107
95	1051	401	-.10	.10	.99	-.2	.91	-.7	.55	.53	73.3	71.6	Q112
73	1048	399	-.11	.10	.82	-2.3	.70	-2.5	.60	.53	72.6	71.8	Q90
18	1050	400	-.12	.10	.79	-2.8	.75	-2.1	.60	.53	78.2	71.7	Q35
17	1048	399	-.12	.10	.82	-2.3	.75	-2.0	.60	.53	79.9	72.0	Q34
24	1052	399	-.17	.10	.99	-.1	1.17	1.2	.51	.52	73.1	72.4	Q41
4	1050	398	-.17	.10	.83	-2.2	.78	-1.7	.60	.52	77.6	72.4	Q21
5	1056	400	-.18	.10	.79	-2.7	.76	-1.9	.61	.52	78.7	72.6	Q22

11	1053	398	-20	.10	.77	-3.0	.76	-1.9	.60	.52	77.8	72.7	Q28
97	1061	401	-20	.10	.86	-1.7	.68	-2.6	.60	.52	74.8	72.7	Q114
93	1056	399	-21	.10	1.00	.1	1.19	1.3	.51	.51	74.1	72.8	Q110
69	1058	399	-22	.10	.83	-2.1	.69	-2.5	.60	.51	76.9	72.8	Q86
74	1060	400	-22	.10	.84	-1.9	.70	-2.4	.60	.52	74.2	72.9	Q91
34	1063	401	-23	.10	.82	-2.3	.74	-2.0	.59	.52	78.0	72.9	Q51
35	1063	401	-23	.10	.88	-1.5	.89	-.8	.54	.52	74.3	72.9	Q52
106	1056	398	-23	.11	.92	-1.0	.96	-.2	.56	.51	76.3	72.9	Q123
3	1058	399	-23	.11	.91	-1.0	.88	-.8	.56	.52	73.9	73.0	Q20
44	1064	401	-24	.11	.95	-.6	1.20	1.4	.50	.52	74.3	73.1	Q61
79	1064	400	-26	.11	.99	.0	1.09	.7	.49	.52	73.4	73.6	Q96
80	1062	399	-28	.11	1.00	.0	.91	-.6	.53	.52	76.6	73.6	Q97
22	1066	400	-29	.11	.93	-.9	.83	-1.2	.55	.52	74.7	73.8	Q39
60	1070	401	-30	.11	.82	-2.3	.91	-.6	.59	.51	77.0	74.0	Q77
94	1065	399	-31	.11	.90	-1.1	.82	-1.3	.55	.51	74.9	74.0	Q111
15	1068	400	-31	.11	1.01	.2	.91	-.6	.51	.51	72.7	74.2	Q32
40	1069	400	-32	.11	.85	-1.8	.76	-1.8	.57	.51	78.9	74.3	Q57
43	1071	400	-35	.11	1.12	1.4	1.24	1.6	.46	.51	73.9	74.5	Q60
16	1074	401	-35	.11	.85	-1.8	.86	-.9	.54	.51	77.0	74.6	Q33
6	1072	400	-36	.11	.87	-1.5	.96	-.3	.53	.51	76.4	74.7	Q23
105	1071	399	-37	.11	1.03	.4	.99	.0	.51	.50	75.6	74.8	Q122
10	1076	401	-37	.11	.87	-1.6	.85	-1.0	.56	.51	77.0	74.9	Q27
75	1075	400	-39	.11	.76	-3.0	.63	-2.8	.61	.51	78.7	75.1	Q92
23	1077	401	-39	.11	.96	-.4	.93	-.4	.52	.51	76.3	75.1	Q40
31	1077	400	-42	.11	.81	-2.2	.87	-.8	.56	.51	76.4	75.5	Q48
98	1077	400	-42	.11	.81	-2.2	.72	-2.0	.59	.50	79.7	75.4	Q115
46	1080	400	-46	.11	.83	-2.0	.73	-1.8	.57	.50	78.2	75.8	Q63
21	1085	401	-48	.11	.94	-.6	.91	-.5	.53	.50	74.8	76.2	Q38
96	1087	401	-51	.11	.81	-2.2	.77	-1.5	.57	.50	78.8	76.5	Q113
41	1087	400	-54	.11	.82	-2.1	.58	-3.0	.61	.50	83.0	77.1	Q58
104	1087	400	-54	.11	1.06	.7	1.07	.5	.49	.50	79.2	77.1	Q121
78	1090	401	-55	.11	.98	-.1	1.04	.3	.48	.50	78.3	77.1	Q95
42	1088	400	-56	.11	.82	-2.0	.68	-2.2	.57	.49	80.5	77.3	Q59
92	1094	401	-60	.11	.93	-.8	.88	-.7	.53	.49	80.0	78.0	Q109
77	1093	400	-62	.12	.79	-2.4	.64	-2.4	.58	.49	83.0	78.2	Q94
27	1095	400	-64	.12	1.20	2.0	1.48	2.5	.40	.49	76.7	78.5	Q44
86	1097	400	-68	.12	.87	-1.4	.71	-1.8	.56	.49	81.0	78.8	Q103
45	1100	401	-68	.12	.81	-2.2	.81	-1.1	.55	.49	83.5	78.8	Q62
47	1098	400	-69	.12	.77	-2.6	.66	-2.2	.57	.48	82.2	78.9	Q64
8	1099	400	-70	.12	.84	-1.8	.96	-.1	.54	.48	83.2	79.1	Q25
81	1099	400	-71	.12	.94	-.6	.85	-.9	.51	.48	81.0	79.0	Q98
29	1102	401	-71	.12	.96	-.4	.90	-.6	.51	.48	80.5	79.1	Q46
91	1102	400	-75	.12	.98	-.1	.69	-1.9	.54	.48	81.7	79.6	Q108
28	1106	401	-76	.12	.92	-.8	.89	-.5	.49	.48	80.5	79.9	Q45
83	1105	400	-78	.12	.84	-1.7	.69	-1.8	.55	.47	82.7	80.1	Q100
88	1109	400	-84	.12	.84	-1.7	.91	-.4	.54	.47	84.5	80.8	Q105
89	1114	401	-88	.12	.88	-1.2	.94	-.3	.50	.47	83.0	81.2	Q106
85	1118	400	-99	.13	.92	-.8	.70	-1.6	.53	.46	84.7	82.2	Q102
84	1122	401	-1.01	.13	.88	-1.1	.73	-1.4	.52	.46	86.0	82.5	Q101
7	1118	398	-1.07	.13	1.05	.5	.91	-.4	.44	.45	81.6	83.3	Q24
30	1128	401	-1.11	.13	.94	-.5	1.05	.3	.48	.45	84.0	83.6	Q47
82	1129	401	-1.13	.13	.89	-1.0	.63	-1.9	.52	.45	84.8	83.8	Q99
-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----													
MEAN	1031.6	400.0	.00	.10	.99	-.1	.98	.0			71.7	70.9	
S.D.	67.5	1.1	.62	.01	.20	2.5	.28	2.5			9.5	6.5	
-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----													

Appendix 2. Figure of Category structures of each indicator

