Vol. 24 No. 4(Special Issue), pp. 748~757 (2004)

Characteristics of Science Teachers for the Gifted: A Study of Metaphor about Teaching

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ABSTRACT

When teachers for the gifted express metaphors about their teaching, they may develop better understanding and conceptualizing of teaching and enable to choose appropriate teaching strategies for optimizing individualized learning of the gifted. Therefore, the purpose of this study includes to explore metaphors about science teachers' teaching for the gifted in middle schools and classify into types of metaphors. The survey was administered and completed survey instruments by 66 science teachers for the gifted at gifted educational institutions affiliated with local offices of education and 18 science teachers at middle schools were analyzed. It was revealed that science teachers for the gifted described seven types of metaphors about their teaching with characteristics of student-centered (counsel, helper, etc.), teacher-centered (judge, captain, etc.), or student-teacher-interacted (painter, nurse, etc.) types. More than 60% of teachers described their teaching as either student-centered or student-teacher-interacted types. However, percentage of teachers for the teacher-centered and power-oriented type was higher for science teachers for the gifted (33%) than science teachers for regular students (22%). It was also found that female science teachers for the gifted showed higher percentage for teacher-centered and power-oriented (35%) than male teachers (28%) and teachers with BS degree showed higher percentage for student-centered and service-oriented type (33%) than teachers with MS degree (27%). In addition biology teachers for the gifted also were appeared to be more teacher-centered and power-oriented type (60%) than physics (21%), chemistry (6%), and earth science (33%).

Key words: metaphor about teaching, science teachers for the gifted, gifted education in science

I. Introduction

Gifted education in academic areas including science has emphasized differentiated curriculum and individualized teaching and learning in consideration with each student's different ability and potential for maximized development of giftedness (Maker & Neilson, 1995, 1996; Kaplan, 1991; Renzulli, 1976; Van-Tassel Baska, 2000, 2003). Therefore, success of gifted education may depend on what extent learner-centered teaching and learning is provided (Hansen & Feldhusen, 1994). Consequently, effective teachers for the gifted can be determined by their abilities and

*Received on 04 May 2004
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skills to create learner-centered teaching and learning environment.

Studies focusing on characteristics of teachers for the gifted have revealed that more successful teachers for the gifted tend to strengthen student-centered teaching, select differentiated teaching strategies for lesson topics, and conduct teaching behaviors based on theories of gifted education compared to less successful teachers (Hanninen, 1988; Tomlinson *et al.*, 1994). Furthermore, it has been found that competencies of successful teachers for the gifted include skills in teaching thinking skills, problem solving skills, and creativity; in interacting with students; in using appropriate motivational techniques; in conducting student-directed activities; and in facilitating independent research (Chan, 2001; Starko & Schack, 1989; Story, 1985). Such teachers' competencies in teaching for the gifted can be developed by elaboration and clarification of teaching through the use of metaphors (Bullough & Stokes, 1994; Tobin, 1990).

Until 1990s, research on teaching and teacher behavior has focused mainly on how teachers behave in the classroom and how well students learn. However, recently, the emphasis has shifted to an exploration of the internal world of teachers, including their thoughts, perspectives, knowledge, ideas and values (Ornstein, 1999). Some studies of metaphor about teaching have revealed that teachers develop better understanding and conceptualizing of teaching when they describe metaphorically about their roles in teaching (Carlson, 2001; Chen, 2003; Munby & Russell, 1990; Tobin, 1990). Tobin and LaMaster (1995) pointed out that science teachers use metaphors in search for best teaching strategies and according to Tobin and Tippins (1996), metaphors serve as a link between what is known and what is unknown and provide connection between abstract understanding of teaching and concrete teaching behaviors. Due to these reasons, metaphors about teaching have been used as means of learners' reflective thinking for preservice and inservice teacher education programs and stimuli for constructing analytic relationships and conceptual change about teaching (Bullough & Stokes, 1994; Duit, 1991).

Findings related to the use of metaphors about teaching showed that teachers develop better understanding and conceptualizing of teaching and teachers' role and can be grown by switching their metaphors from teacher-centered types to student-centered types (Bruner, 1986; Bullough & Stokes, 1994; Carlson, 2001; Chen 2003). Bullough and Stokes (1994) pointed out that metaphors simplify and clarify meaning in midst of complexity and serve as bridges between images and narratives. Such findings provide growing interests in teacher educators because metaphors may play a role in the process of teacher self-formation and self-exploration, and further teachers enable to seek ways to improve their teaching strategies as well as their role in teaching (Bullough, 1991; Chen, 2003). Therefore, the use of metaphors about teaching can be effectively utilized for analysis of teaching as well as teachers' belief and perception about teaching.

Gifted education in Korea has been rapidly expanded within two years since the enactment of the Law of Gifted Education in 2002 and little research in teacher education and science teachers for gifted has been done. Only one research had conducted to propose the national policies of qualification, employment, pre- and in-service education program of teachers for the gifted in general (Kim *et al.*, 2000). Therefore, this study focuses on examining the metaphors about teaching by science teachers for the gifted in middle school levels and classifying them into types of metaphors. It is expected that the results are used as fundamental data to make sound policies and develop effective teacher education programs for the gifted.

Ⅱ. Research Method

The study employed a survey research method and sample, instrumentation, and data collection procedure for the study were as follows.

Sample: The sample consisted of two groups: (a) science teachers for the gifted at gifted educational institutions affiliated with local offices of education and (b) science teachers for regular classrooms in middle schools to make a comparison of characteristics of science teachers for the gifted. The group of science teachers for the gifted was gathered from 41 gifted educational institutions affiliated with local offices. In Korea, there are different types of gifted educational institutions including special classes, gifted educational institutions affiliated with local offices of education, gifted educational institutions affiliated with universities, and special high school, and the gifted educational institutions affiliated with local offices of education were selected. As of June 2003, 41% of total students (9,097 out of 22,217) in gifted education attended the gifted educational institutions affiliated with local offices of education and there are 4,923 middle school students who participated in total of 91 institutions (Seo, *et al.*, 2003). Amongst 91, there are 80 institutions providing with science education for the gifted and 41 institutions (about 52%) were selected for the study.

The survey was administered by mail for five weeks from June 30 (sending out) to July 31, 2003 (returning due). Four teachers in physics, chemistry, biology, and earth science, respectively, at each institution were asked to respond to the survey. One hundred sixty-four survey questionnaires were distributed to 41 institutions and 106 questionnaires (64.6%) returned. Only 66 questionnaires were identified as ones with metaphors about teaching as job, therefore the returning rate appeared to be 40.2%. In the same manner for science teachers at regular classrooms, 16 middle schools were sampled nationwide and 44 questionnaires (68.8%) were returned out of 64. Again, only 18 questionnaires were with metaphors and thereby, the returning rate was turned out as 28.1% for science teachers for regular students.

Sixty-six of science teachers for the gifted who provided metaphors about their teaching consisted of 30% (20 out of 66) of female and 92% at age between 30s and 40s (see Table 1) while eighteen science teachers for regular students with 56% (10 persons) of female and 56% (10 persons) at age between 30s and 40s. For differences in highest degree earned, 67% of science teachers for the gifted held master degree while 28% of science teachers for regular students with master degree. Years of teaching experiences at regular schools also differ that 59% of science teachers for the gifted had 11-20 years while 28% of science teachers for regular students.

Instrumentation: The survey consisted of two open-ended questions, '(a) please describe a name of job as metaphor which is the most similar to your teaching and (b) briefly explain the most representative behavior related to your chosen job. Respondents were asked to provide information related to demographic data including gender, age, highest degree earned, years of teaching experiences, and subject areas of teaching in science.

Data collection and procedure: Various jobs as metaphors described by respondents were classified according to a standard job classification system in Korea (Ministry of Labor, 2003), and then representative behaviors were utilized to classify jobs into different types grouping similar activities. The standard job classification system in Korea was employed for data

Table 1. Frequency and percentage for categorical variables that describe characteristics of science teachers for the gifted and regular students in middle schools

Variable	Level	Number of science teachers for the gifted (n=66)	Number of science teachers for regular students (n=18)
Gender	female	20 (30.3%)	10 (55.6%)
	male	46 (69.7)	8 (44.4)
Age	20s	3 (4.5)	6 (33.3)
	30s	21 (31.8)	5 (27.8)
	40s	40 (60.6)	5 (27.8)
	50s and over	2 (3.0)	2 (11.1)
Highest degree earned	BS	18 (27.3)	12 (66.7)
	MS	44 (66.7)	5 (27.8)
	Dr	4 (6.0)	1 (5.6)
Years of teaching experiences	1-5 years	9 (13.6)	7 (38.9)
	6-10 years	5 (7.6)	3 (16.7)
	11-15 years	18 (27.3)	3 (16.7)
	16-20 years	21 (31.8)	2 (11.1)
	21-25 years	11 (16.7)	3 (61.7)
	26-30 years	2 (3.0)	0
Science areas teaching	physics	14 (21.2)	0
	chemistry	11 (16.7)	0
	biology	15 (22.7)	0
	earth science	18 (27.3)	0
	two or more	8 (12.1)	general science 18 (100.0)

processing due to general perceptions of teachers to different jobs in common. For categorizing similar activities, what type of activity in a given job provided was analyzed in consideration with students' autonomy, initiation and active role. It means how students are treated when a particular job activity is performed. Therefore, types of jobs were spread between two extreme sides of student-centered and teacher-centered types. It turned out that metaphors about teaching were classified into seven types:

Type 1: student-centered and service-oriented metaphors focus on teachers' role of counseling, guiding, assisting and collaborating with students, therefore, this type may consider students' initiation at maximum.

Type 2: student-teacher interacted and creativity-oriented metaphors focus on teachers' role of creating a product with judgment, insight, sensitivity to students' needs, and spontaneity in responses to students' demands and questions.

Type 3: student-teacher-interacted and labor-oriented metaphors include teachers' role of taking care of students in all aspects, therefore, student initiation, demands, and active roles may be less guaranteed than categories 1 and 2.

Type 4: Teacher-centered and business-oriented metaphors emphasize teachers' role of marketing and delivering knowledge and information, and marketing strategies for attracting students' attention may be emphasized and students' initiation and interest may not be

considered.

Type 5: Teacher-centered and diagnosis-oriented metaphors include teachers' role of diagnosing students' illness and treating to cure, therefore, teachers make decision on teaching processes based on their professionalism and students' opinions may be considered.

Type 6: Teacher-centered and lecture-oriented metaphors focus on teachers' role of persuading students and influencing on students' value and belief, therefore, teachers may make own decision on what students need to know.

Type 7: Teacher-centered and power-oriented metaphors emphasize on teachers' role of making decisions based on their professionalism as well as commanding students with their authority, therefore this category may present an extreme side of teacher-centered.

All responses of metaphors were classified into the above seven types and frequency and percentage of each type were produced. Three independent categorical variables of gender, highest degree earned and subject areas of teaching within science teachers for the gifted were utilized for further comparative analysis.

Ⅲ. Results and Discussion

1. Differences in Metaphors about Teaching between Science Teachers for the Gifted and Regular Students

For science teachers at gifted educational institutions affiliated with local offices of education, the highest percentage was appeared as 30% for teacher-centered and power-oriented type and followed in turn 29% for student-centered and service-oriented type and 23% for student-teacher- interacted and creativity-oriented (see Table 2). On the other hand, the highest percentage for science teachers at regular middle schools was 39% for the student-centered and service-oriented type and followed 28% for teacher-centered and diagnosis-oriented type and then 22% for teacher-centered and power-oriented type. However, differences were found within student-center and service-oriented type between science teachers for the gifted and regular students. Science teachers for the gifted described job metaphors related to consumer-service workers while science teachers for regular students expressed ones related to counsel and psychotherapist. Interestingly enough, the percentage of science teachers for the gifted (30%) was higher in teacher-centered and power-oriented type than science teachers for regular students (22%), and six science teachers for the gifted (9%) described themselves as police, trainer, inspector, and soldier.

2. Differences of Metaphors about Teaching by Science Teachers for the Gifted within Gender, Highest Degree Earned, and Subject Area of Teaching

Difference was found between male and female science teachers for the gifted. The percentage of male teachers was higher (33%; 15 out of 46) than female teachers (20%; 4 out of 20) for student-centered and service-oriented type while percentage of female teachers was higher (35%, 7 out of 20) than male teachers (28%; 13 out of 46) for teacher-centered and power-oriented type (see Table. 3). In terms of teachers' highest degree earned, teachers with BS degree appeared with higher percentage of 33% (6 out of 18) for student-centered and service-

Table 2. Differences in types of metaphors about teaching by science teachers for the gifted and regular students

Type	Job metaphor about teaching	Science teachers for gifted (%)		Science teachers for regular students (%)	
Type 1 Student-centered and service-oriented	(consumer-service worker) guider, helper	10(15.2)		2(11.1)	
	(professional) counsel, psychotherapist	7(10.6)		5(27.8)	
	(professional) co-researcher	2 (3.0)		0	
	Sub total		19 (28.8)		7(38.9)
Type 2 Student-teacher -interacted and creativity-oriented	(performance) director	2 (3.0)		2(11.1)	
	(arts) painter, designer, potter, architect	9(13.6)		0	
	(professional) inventor, programmer, breeder	4 (6.1)		0	
	Sub total		15 (22.7)		2(11.1)
Type 3 Student-teacher interacted and labor-oriented	(worker) farmer, gardener, laborer	2 (3.0)		0	
	(personal care and service) nurse, housewife	4 (6.1)		0	
	Subtotal		6 (9.1)		0
Type 4 Teacher-centered and business-oriented	(sales) seller, store clerk	1 (1.5)		0	
	Subtotal		1(1.5)		0
Type 5 Teacher-centered and diagnosis-oriented	(health care practitioner) medical doctor	3 (4.5)		5(27.8)	
	Subtotal		3(4.5)		5(27.8)
Type 6 Teacher-centered lecture-oriented	(religion related) pastor, missionary	2 (3.0)		0	
	Subtotal		2(3.0)		0
Type 7 Teacher-centered and power-oriented	(senior officers and manager) president, director-general	0		1 (5.6)	
	(education and legal professional) professor, judge	13(19.7)		3(16.7)	
	(transportation worker) aircraft pilot, ship captain	1 (1.5)		0	
	(protective service and inspecting worker) police, worker-supervisor, trainer, soldier	6 (9.1)		0	
	Subtotal		20(30.3)		4(22.2)
Total			66(99.9)		18 (100)

oriented type compared to 27% (12 out of 44) of teachers with MS degree. On the other hand, opposite is true for the type of teacher-centered and power-oriented as there are 28% (5 out of 18) of teachers with BS degree and 34% (15 out of 44) of teachers with MS degree. Noticeably, teachers teaching biology showed the highest percentage of 60% (6 out of 10) for teacher-centered and power-oriented type and followed by earth science (33%), physics (21%), and chemistry (9%) teachers.

Ⅳ. Discussion and Conclusion

Based on the findings from the study, more than 60% of science teachers for the gifted and regular students in middle schools in Korea appeared to have perceptions of themselves to implement student-centered or student-teacher-interacted type teaching strategies. On the other hand, science teachers for the gifted (23%) seemed to emphasize student-centered and

Table 3. Differences in types of metaphors about teaching by science teachers for the gifted within gender, highest degree earned, and subject area of teaching

Type	Frequency (%)	gender		Highest degree earned			Subject areas of teaching				
		male	Female	BS	MS	Dr	physics	chemistry	biology	Earth science	two or more
Type 1 Student-centered and service-oriented	19 (28.8)	15 (32.6)	4 (20.0)	6 (33.3)	12 (27.3)	1 (25.0)	4 (28.6)	4 (36.4)	3 (20.0)	5 (27.8)	3 (37.5)
Type 2 Student-teacher interacted and creativity-oriented	15 (22.7)	10 (21.7)	5 (25.0)	5 (27.8)	9 (20.4)	1 (25.0)	4 (28.6)	1 (9.1)	3 (20.0)	4 (22.2)	3 (37.5)
Type 3 Student-teacher interacted and labor-oriented	6 (9.1)	4 (8.7)	2 (10.0)	1 (5.6)	4 (9.1)	1 (25.0)	0	4 (36.4)	0	1 (5.6)	1 (12.5)
Type 4 Teacher-centered and business-oriented	1 (1.5)	0	1 (5.0)	0	0	1 (25.0)	0	1 (9.1)	0	0	0
Type 5 Teacher-centered and diagnosis-oriented	3 (4.5)	3 (6.5)	0	0	3 (6.8)	0	2 (14.3)	0	0	1 (5.6)	0
Type 6 Teacher-centered and lecture-oriented	2 (3.0)	1 (2.2)	1 (5.0)	1 (5.6)	1 (2.3)	0	1 (7.1)	0	0	1 (5.6)	0
Type 7 Teacher-centered and power-oriented	20 (30.3)	13 (28.3)	7 (35.0)	5 (27.8)	15 (34.1)	0	3 (21.4)	1 (9.1)	9 (60.0)	6 (33.3)	1 (12.5)
Total	66 (100)	46 (100)	20 (100)	18 (100)	44 (100)	4 (100)	14 (100)	11 (100)	15 (100)	18 (100)	8 (100)

creativity-oriented type more than science teachers for regular students (11%) (See Table 2.). Thereby, it implies that science teachers for the gifted with imagination and enthusiasm can create a learning experience for students that will be never repeated. Further, ironically, science teachers for the gifted (30%) also showed higher percentage than science teachers for regular students (22%) for teacher-centered and power-oriented type. These teachers see themselves as controlling force. For example, the metaphor of a teacher as the captain of a ship suggests that teachers are likely to create a teacher-centered and teacher-paced environment and tend to employ direct instruction of lecturing and less interaction between teacher and student (Tobin, 1990). From the results of the study, it can be summarized that science teachers for gifted are

more characterized by either student-centered or teacher-centered than science teachers for regular students, and those teachers of teacher-centered and power-oriented type are not likely to develop understandings of gifted education.

Differences in metaphors by science teachers for the gifted in gender, highest degree earned, and subject areas of teaching were observed. More female teachers (35%) explained their teaching as teacher-centered and power-oriented type than male teachers (28%) (See Table 3.), while more male teachers (33%) are for student-centered and service-oriented type than female teachers (20%). It may be interpreted that female science teachers for the gifted have a tendency to power over students than male teachers and it can be resulted in their teaching that little autonomy is given to students. Science teachers with MS degrees (34%) are likely to be more teacher-centered and power-oriented type than science teachers with BS degrees (28%). Based on the research findings, it may be true that the teachers with MS degree are more teacher-centered and power-oriented type than teachers with BS degree. However, it is generally perceived that the higher their degrees are, the more effective they become and teachers are encouraged to accomplish higher degrees, if possible. Biology teachers appeared to be the highest percentage for teacher-centered and power-oriented type among all science teachers in four areas. Characteristics of body of knowledge in biology may explain part of this finding as most of contents in biology are descriptive and more information and facts for teaching biology are pertained than other subject areas of science. In summary, for characteristics of science teachers for the gifted, female teachers, teachers with MS degrees and maybe biology teachers are likely to be teacher-centered and power-oriented type.

Certainly, it can be argued that classification of metaphors from this sample and interpretation made are influenced by the author's own personal conceptions and experience although attempts existed to be objective and generalized by adopting a standard job classification system. To make meanings out of metaphors about teaching, Gurney (1995) used three words of effort, affect and control while Chen (2003) employed five types according to their orientation, art-, business-, science-, power-, and personal dynamics-oriented types. The criteria or words to classify into different types can differ depending on what to analyze, for example, teacher' change and growth over the time or teacher perception to their teaching at a given time. The research focuses on examining how science teachers for the gifted perceive their teaching through the use of metaphorical expression and where science teachers are located in a spectrum of teaching between student-centered to teacher-centered. Due to this intention, the research did not consider of importance in qualitative aspects much. Elaboration and discussion on metaphors about teaching by individual samples were not given much attention and it will be meaningful for the follow-up studies.

For this study, the sampling population was limited to the gifted educational institutions affiliated with local offices of education. In fact, as of June 2003, there are 95 special classes in science for 1,271 students and 18 science education center for the gifted affiliated with universities for 1,520 students at middle school levels. It may be discovered that science teachers for the gifted in Korea express different metaphors about their teaching.

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