UNDERSTANDING THE RELATIONSHIP BETWEEN DOMINATING MULTIPLE INTELLIGENCES AND TEACHING STYLES THROUGH A CANONICAL ANALYSIS

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ABSTRACT

This paper presented a brief analysis of the relationships between dominating multiple intelligences and teaching styles in the teaching and learning processes. This study employed a canonical relation analysis with Gardner's multiple intelligences and Grasha's teaching styles as the dominating factors. The participants were 810 teachers from several high schools located in the region of North Sumatera, Indonesia. The multiple intelligence factors applied were logic-mathematic intelligence, linguistic intelligence, interpersonal intelligence, intrapersonal intelligence and existential intelligence, while the teaching styles involved were expert style, facilitator style, and delegator style. The results showed that there was a significant relationship between the dominating multiple intelligences and the teaching styles during teaching and learning processes, whereas all-dominating intelligence factors were correlated positively along with the expert style and facilitator style. Meanwhile, the existential intelligence did not exhibit any correlation with the expert style. Overall, it conclusively pointed out that the interpersonal intelligence and intrapersonal intelligence had implied the most effective factors in the teaching and learning processes, while the existential intelligence was as the most insignificant factor.

Keywords: Multiple Intelligences, Teaching Styles, Canonical Analysis, High Schools, Indonesia

INTRODUCTION

Teachers play an essential role in determining the education process going progressively. There is always correlative education factors that successfully engage along with the teacher role. A lot of attempts have been carried out either by the governmental bodies or by the private institutions to improve the teacher competency and role in the educational system (Mustofa, 2007). Sardiman (1992) stated that a teacher should be able to act as an informator, organizator, motivator, director, initiator, transmitter, facilitator, mediator, and evaluator in the teaching and learning processes. The teaching quality implies obviously to the competency improvement for the graduates. An interactive and condusive environment for learning activities can be created in a class room as long as the teacher possesses a good knowledge and awareness with the students' diversity (Wood, 1999). The teaching quality can actually be reflected through the teaching style that is usually applied during the learning process (Kamamia et al., 2014).

The teaching styles are mostly referred to the behaviour and attitude demonstrated by an instructor during in the class room in order to create the best situation or condition for a well being learning process (Hasanuddin, 2021). The teaching style is also a complex combination of self-confidence, behaviour, strategy, motivation, personality and control (Wright, 1987). Grasha (1994) defined the teaching style as a representative of self-confidence and behaviour exhibited by a teacher during in the class room, comprising some influencing dimensions such as the ability for the knowledge transferring, interaction with the students, student's homework monitoring and student's projects supervising. These dimensions clearly exhibit that the multiple intelligences play a significant role in the improvement of teaching style which in turn reflecting the learning strategy (Gardner, 2007).

Intelligences can be asserted as the main factor which determines the ability to fruitfulness achievement from a learning process. In Indonesia, many educational institutions are still focusing their teaching and learning frame into a method that so-called as "single intelligence", although there is no actual evidence that the smart students will easily attain a successful grade in the learning process (Howard, 2010). Serin and his co-workers (2009) studied the relationships between teaching strategies and multiple intelligences for the kindergarten teachers. Results exhibited that various dimensions of the multiple intelligences such as visual intelligence, natural intelligence and interpersonal intelligence played a vital role in the teaching and learning strategies. In addition, Sulaiman and his associates (2010) reported that the multiple intelligences apparently implied to the improved teacher profile and role, leading to the attainment of a comprehensive and constructive teaching strategy.

Multiple Intelligences: Theory and Definition

The theory of multiple intelligences was introduced and developed by Howard Gardner, a psychologist and an education professor from the Graduate School of Education, Harvard University in 1983 (Gardner, 2007). Gardner had given a definition for the intelligence as an ability to resolve problems and yielded products in the circumstances and real situations. Therefore, intelligence was not merely devoted to the ability to answer the IQ tests in the class room, in fact, it also contained the ability to alleviate the real problems in the circumstances (Gardner, 2010).

In the theory of multiple intelligences, Gardner stated that the intelligences were comprised of 8 (eight) intelligence dimensions, such as linguistic intelligence, mathematic intelligence, visual intelligence, musical intelligence, kinesthetic intelligence, interpersonal intelligence, intra-personal intelligence, and naturalistic intelligence (Gardner, 2010). This theory was based on the perception that the intellectual ability determined using the IQ tests (single intelligence) was very limited. This was because the IQ tests merely emphasized on the logical (mathematic) and linguistic abilities. The followings are Gardner's multiple intelligences (Gardner, 2010):

1) Linguistic intelligence. The ability in using the words or sentences to express the thinkings.
2) Logic-mathematical intelligence. The intelligence in using the number and logics effectively.
3) Spatial intelligence. The intelligence deals with the ability to recognize matters, and reading a graph precisely.
4) Bodily-kinesthetic intelligence. The intelligence to self-expression with the body gestures.
5) Musical intelligence. The intelligence in developing and expressing music and sound, melody, and ability to play musical instruments.
6) Interpersonal intelligence. The intelligence to relate and communicate with people.
7) Intrapersonal intelligence. The ability to self-recognition and control, and behave appropriately in the society.
8) Natural intelligence. The ability to well understand the environmental ethics.
9) Existential intelligence. The ability in answering the existential problems or the philosophical matters related with the existence of human and so forth.

Teaching Styles: Definition and Perspective

Teaching and learning is a process along with the complicated activities in the uncertainty condition. There is no absolute explanation during the teaching and learning process between a teacher and students (Townsend, 2007). Teaching is a condition where the evaluation and decision are controlled professionally in conducting the learning process appropriately (Schunk, 2012). According to Cohen (1998), teaching is a process carried out by an instructor in the class room. Therefore, he expected that an instructor would undergo a challenging process during the teaching and learning process. Teaching style is then referred to the combined behavior and attitude demonstrated by an instructor to create the best condition and situation for a well being learning process. The teaching style is also corresponded to a complex combination of confidence, attitude, strategy, motivation, personality and control (Wright, 1987). According

to Gayle (1994), teaching style is a systemic structure behaviour, complex, and stable that are associated with the teacher profile, while (Kaplan & Gies, 1995) defined the teaching style as the attitude and media for the knowledge transfer process.

Both analyses exhibit that Gayle, Kaplan and Gies perceived the teaching styles from a wider aspect points of view, which was instructor personality and teaching note. Moreover, Grasha (1994) defined the teaching style as a representative frame, necessity, confidence and instructor behaviour and attitude that are usually shown during in the class room. This teaching style is composed by some dimensions that influence the way to providing information, student interaction, managing homeworks, and monitoring and supervising the student's projects. The teaching style then can be categorized into 5 (five) styles *i.e.*, expert style, formalistic authorization style, personality model style, facilitator style and delegator style. The teaching style is indeed determined by the instructor's confidence, knowledge, and performances during in the class room.

The confidence frame is the fundamental principles by an instructor associating with the students, and learning process. While, knowledge and performances refer to the ability of an instructor to carry out the duty and responsibility effectively (Goodyeara & Dudley, 2015). Peacock (2001) stated that the teaching style could be shown by the naturalistic behaviour of human being in delivering the information and knowledge in the class room. Gage & Berliner (1994) noted that the teaching style as the behaviour demonstrated by an instructor through body gestures, moving during in the class room, intonation and sound, and the eager to holding the teaching and learning process. Fisher & Fisher (1979) thought the teaching style as an approaching method. Galton and his co-workers (1980) defined the teaching style as a complete teaching strategy. Siedentop (1991) perceived the teaching style as a teaching format. Conclusively, those three definitions emphasize the teaching styles depended on the instructor profile and the teaching strategy.

As aforementioned, Grasha (1996) had categorized the teaching styles into five styles. Below is a concise characteristic of each style:

1) Teacher possesses the expert style perceives that the in-depth knowledge and soft skills are primarily needed, giving the students a more detail knowledge.
2) Teacher with a formalistic authorization style uses a standardized model by the institution or school. As a consequence, no flexibility and innovation in the teaching and learning model.
3) Teacher showing personality model style uses the teacher profile as the role model in teaching and learning process. Students are encouraged to follow the teacher's methods in resolving the problems.
4) Teacher with a facilitator style emphasizes an interactive communication and discussion with the students. This style aims to shape a self-confident and innovative students.
5) Teacher with a delegator style promotes the improved student self-performances. Students are encouraged to work in a team with an in-depth discussion. The teacher plays a role as references source and supervisor.

The study presented in this paper is aimed to investigate the relationships between dominating Gardner's multiple intelligences and Grasha's teaching styles through a canonical analysis. So far, no studies have ever been reported elsewhere regarding the use of canonical method to analyze their relationships. All the data were collected from 810 teachers from several high schools in the region of North Sumatera, Indonesia. The results of this study are expected to provide a comprehensive understanding of a constructive educational model for academicians and practitioners.

METHODOLOGY

Research Design

The research design used in this study was a quantitative method that employed a canonical method to analyze data obtained from the data source. There were the quantitative characteristics adopted such as utilizing direct data sources with the researchers as the main instruments, taking into account the result rather than the process, and deductive. The research

design was prioritized into direct data collection, textual details, and the relationship with the psycho-educational perspective. The type of research was a case study and designed according to the obtained data source. Thereby, the use of quantitative research will allow the authors to identify and understand the research findings to construct a teaching and learning model according to the canonical method.

Participants

Participants in this study were teachers from several high schools in the region of North Sumatera, Indonesia. Figure 1 shows the region of North Sumatera whereas the research locus was conducted. 810 participants were comprised 245 male and 565 female. In detail, 691 participants were bachelor degree holder, 114 participants had master degree, and 5 participants were doctoral degree holder. Table 1 exhibits a number of participants and their population. All participants were given a complete inventory according to Gardner's multiple intelligences and Grasha's teaching styles.

FIGURE 1
THE RESEARCH LOCUS

Table 1
A NUMBER OF PARTICIPANTS AND THEIR POPULATION

Participants				
Category		**Sex**		**Total**
		Male	**Female**	
Level of education degree	Bachelor	197	494	691
	Master	45	69	114
	Doctoral	3	2	5
Total		245	565	810

Data Collection

The main method in the data collection used was observation. This method was used to directly observe the teaching styles and their relationships with the multiple intelligences that were reflected by the student knowledge and performances. The teaching and learning activities related to Gardner's multiple intelligences and Grasha's teaching styles were quite difficult to observe directly. Therefore, researchers used a more comprehensive participatory approach using questioners and interviews to indicate the most dominating intelligence and teaching style. Data obtained was analyzed using a canonical method.

Canonical Analysis

The variables used in this study were comprised multiple intelligences (independent variables) and teaching styles (dependent variables). A canonical analysis was employed to examine the relationships between all the independent and dependent variables. While, the regression analysis was carried out to investigate the degree of effective contribution of each variable. Categorization was then conducted to obtain the standard critical mean values that indicated the dominating factors of each intelligence and style. Table 2 and Table 3 show the critical mean values for the multiple intelligences and the critical mean values of the teaching styles, respectively.

Table 2
CRITICAL MEAN VALUES OF THE MULTIPLE INTELLIGENCES

Multiple Intelligences	Value
Logic-mathematical intelligence	3.68
Linguistic intelligence	3.68
Interpersonal intelligence	3.68
Intra personal intelligence	3.68
Spatial intelligence	3.68
Bodily-kinesthetic intelligence	3.68
Musical intelligence	3.68
Natural intelligence	3.68
Existential intelligence	3.68

* The intelligence is dominance if the obtained mean value>critical mean

Table 3
CRITICAL MEAN VALUES OF THE TEACHING STYLES

Teaching Styles	Value
Expert style	3.50
Formalistic authorization style	3.90
Personality model style	4.10
Facilitator style	3.80
Delegator style	3.00

* The teaching style is dominance if the obtained mean value>critical mean

RESULTS

Table 4 exhibits the effects of multiple intelligences on teaching styles. There were five types of multiple intelligences that had given dominating effects into the teaching styles, *i.e.*, logic-mathematical intelligence, linguistic intelligence, interpersonal intelligence, intrapersonal intelligence, and existential intelligence.

Table 4
EFFECTS OF MULTIPLE INTELLIGENCES ON TEACHING STYLES

Intelligence	Critical Mean	Empirical Mean	Remark
Logic-mathematical intelligence	3.68	3.87	Dominant
Linguistic intelligence	3.68	3.82	Dominant
Interpersonal intelligence	3.68	3.87	Dominant
Intra personal intelligence	3.68	4.05	Dominant
Spatial intelligence	3.68	3.53	Not Dominant
Bodily-kinesthetic intelligence	3.68	3.27	Not Dominant

Musical intelligence	3.68	3.10	Not Dominant
Natural intelligence	3.68	3.58	Not Dominant
Existential intelligence	3.68	4.36	Dominant

Table 5 shows the most dominating teaching styles on the multiple intelligences, *i.e.*, expert style, facilitator style and delegator style.

Table 5
EFFECTS OF TEACHING STYLES ON MULTIPLE INTELLIGENCES

Teaching Styles	Critical Mean	Empirical Mean	Remark
Expert style	3.86	3.50	Dominant
Formalistic authorization style	3.76	3.90	Not Dominant
Personality model style	3.99	4.10	Not Dominant
Facilitator style	3.99	3.80	Dominant
Delegator style	3.95	3.00	Dominant

Table 6 tabulates the results of multi variance significant tests. It can be seen that all the values obtained was lower than 0.05 (P<0.05) indicating that the canonical functions were collectively significant. Therefore, the canonical analysis demonstrated a significant correlation between the variables.

Table 6
RESULTS OF MULTI VARIANCE SIGNIFICANT ANALYSIS

Analysis	Value	P
Pillais	0.55815	0.000
Hoteling	1.18396	0.000
Wilks	0.45287	0.000
Roys	0.53775	

Figure 2 exhibits the canonical analysis correlations between all the variables and the model examination**.** It can be seen the three canonical functions according to the root numbers, whereas the first function demonstrated the correlation number of 0.73332, the second function had 0.11032, and the third function was 0.09070. Both the first function and second function showed the value of Sig. of F<0.05, signifying the both functions could be analyzed further. While, the third function had the value higher than 0.05, indicating the insignicant function. According to the correlation values, the first function yielded the highest correlation number that was 0.73332. Thus, it should be further analyzed.

Eigenvalues and Canonical Correlations

Root No.	Eigenvalue	Pct.	Cum. Pct.	Canon Cor.	Sq. Cor
1	1.16335	98.25887	98.25887	.73332	.53775
2	.01232	1.04057	99.29944	.11032	.01217
3	.00829	.70056	100.00000	.09070	.00823

Dimension Reduction Analysis

Roots	Wilks L.	F	Hypoth. DF	Error DF	Sig. of F
1 TO 3	.45287	49.06550	15.00	2214.37	.000
2 TO 3	.97970	2.06875	8.00	1606.00	.036
3 TO 3	.99177	2.22287	3.00	804.00	.084

FIGURE 2
CANONICAL CORRELATIONS AND THE MODEL EXAMINATION

Figure 3 shows the calculation of canonical loadings from all the variables. For the dependent variables, *i.e.*, y1 (expert), y2 (facilitator), y3 (delegator), all the variables exhibited a higher canonical coefficients than 0.5, in which the y2 (facilitator) was the highest one. Meanwhile, the x3 (interpersonal) independent variable was obtained to have the highest value of canonical coefficient.

Figure 4 shows the analysis of canonical correlation values. The four independent variables (logic-mathematic, linguistic, interpersonal, and intrapersonal) gave a significant effect to the dependent variables of expert, facilitator, and delegator (canonical coefficient < 0.05).

Correlations between DEPENDENT and canonical variables
Function No.

Variable	1	2	3
y1	-.84296	.00837	.53792
y2	-.94712	.27016	-.17313
y3	-.92145	-.37174	-.11291

Correlations between COVARIATES and canonical variables
CAN. VAR.

Covariate	1	2	3
x1	-.80109	.37532	-.06927
x2	-.81846	-.48217	.12152
x3	-.88483	-.04972	.36499
x4	-.83828	.04554	-.10929
x5	-.47644	-.14690	-.68610

FIGURE 3
CALCULATION OF CANONICAL LOADINGS FROM ALL THE VARIABLES

Dependent variable .. y1 pakar

COVARIATE	B	Beta	Std. Err.	t-Value	Sig. of t
x1	.1390375277	.1720603435	.02960	4.69738	.000
x2	.0821769273	.1045458179	.03377	2.43352	.015
x3	.2201841444	.2696411755	.03604	6.10902	.000
x4	.1488553230	.1589152696	.03729	3.99219	.000
x5	.0548834556	.0481651119	.03400	1.61430	.107

Dependent variable .. y2 fasilitator

COVARIATE	B	Beta	Std. Err.	t-Value	Sig. of t
x1	.2148067483	.2368009251	.03044	7.05744	.000
x2	.0751112220	.0851232739	.03472	2.16305	.031
x3	.2172914731	.2370443340	.03706	5.86279	.000
x4	.2188127397	.2080944936	.03834	5.70683	.000
x5	.1368817739	.1070097810	.03496	3.91528	.000

Dependent variable .. y3 delegator

Dependent variable .. y3 delegator

COVARIATE	B	Beta	Std. Err.	t-Value	Sig. of t
x1	.1439153533	.1667434511	.02966	4.85276	.000
x2	.1465070609	.1745051429	.03383	4.33013	.000
x3	.1891326773	.2168501110	.03611	5.23733	.000
x4	.1819540767	.1818678609	.03736	4.87042	.000
x5	.1404351581	.1153877971	.03406	4.12264	.000

FIGURE 4
ANALYSIS OF CANONICAL CORRELATION VALUES

Table 7 tabulates the effects of each variable of the multiple intelligences on each variable of the teaching styles in term of effective contribution. It was obtained that the Dependent Variable (DV) of y1 (expert) provided the lowest contribution (38.26%), while the y2 (facilitator) was found as the highest contributor (48.34%). From the table, it can also be seen that the Independent Variable (IV) of x5 (existential) contributed the lowest value.

Table 7
THE EFFECTS OF EACH VARIABLE OF THE MULTIPLE INTELLIGENCES ON EACH VARIABLE OF THE TEACHING STYLES IN TERM OF EFFECTIVE CONTRIBUTION

DV	IV	Beta	Zero Oder	Beta*Zero Order	SE (%)
y1 (Expert)	x1(Logic mathematical)	0.174	0.492	0.086	8.56
	x2(Linguistic)	0.102	0.511	0.052	5.21
	x3(Interpersonal)	0.279	0.565	0.158	15.76
	x4(Intrapersonal)	0.17	0.513	0.087	8.72
Y1 with x1,x2,x3 and x4				0.383	38.26
y2 (Facilitator)	x1(logic mathematic)	0.569	0.237	0.135	13.49
	x2(linguistic)	0.552	0.085	0.047	4.69
	x3(interpersonal)	0.607	0.237	0.144	14.39
	x4(intrapersonal)	0.585	0.208	0.122	12.17
	x5 (existential)	0.337	0.107	0.036	3.61
Y1 with x1,x2,x3,x4 and x5				0.483	48.34
y3 (delegator)	x1(logic mathematic)	0.527	0.167	0.088	8.80
	x2(linguistic)	0.527	0.175	0.092	9.22
	x3(interpersonal)	0.596	0.217	0.129	12.93
	x4(intrapersonal)	0.566	0.182	0.103	10.30
	x5 (existential)	0.335	0.115	0.039	3.85
Y1 with x1,x2,x3,x4 and x5				0.451	45.11

DISCUSSION

Indeed, intelligences influence the teacher's performances. In spite of having good knowledge, the intellectual intelligences also affect the approach, methodology, creation and innovation in solving the problems during the teaching and learning process (Zulfikar, 2009). These kind of intellectual intelligences are required to carry out some mental activities, thinking, assessing, and problems solving (Robin & Judge, 2008). A teacher is a role model to the students in which all the speech and attitudes are always taken into account. Therefore, a teacher shall be smart and possesses a good characters, and it can be seen from the multiple intelligences demonstrated during in the class room. In fact, having the IQ intelligence is not enough to make a professional teacher. Hence, a professional teacher shall be able to demonstrate both multiple intelligences and IQ intelligence during the teaching and learning process.

Gardner has stated that the intelligence is not merely related to the teacher's performances, but it reflects the ability to problems solving in any circumstances. The teaching styles refer to a combined behavior and attitudes that is shown by an instructor in order to create the best situasion and condition for a well-being learning process (Denig, 2004). They are also referred to a complex combination of confidence, attitude, strategy, method, motivation, personality and control (Wright, 1987). This condition exhibits that a teacher's teaching style directly correlates with the multiple intelligences possessed.

The results of this study emphasize to the interpersonal intelligence. From the analysis carried out, it has been shown that this kind of intelligences had the highest correlation values

with the teaching styles (expert style, facilitator style, delegator style). The interpersonal intelligence is related with the ability to well understand and response the stimuli by the students like motivation, behavior, face expression, voice and sign. In other words, this intelligence determines the ability to make the good relations and communication with other peoples. Additionally, it emphasizes to the ability to create a good social relation in terms of emphaty, pro-socializing, self-consciousness, problem solving and effective communication. The interpersonal intelligence is really necessary to improve the teacher's personality and social competencies.

The main component of interpersonal intelligence is the ability to response and accommodate the problems and challenges properly. A teacher with a good interpersonal intelligence is keen to look at the students, and high responsive to voice and gestures. It has been obtained from the study, this kind of intelligences was strongly related with the teaching styles applied such as the expert style, facilitator style and delegator style. Teacher with the expert style always challenged the students with problems and provided a more detail knowledge and discussion. The teacher demonstrating the facilitator style preferred to emphasize an interactive communication and discussion with the students. While, the teacher showing the delegator style encouraged the students to be independent and self-working. The students were allowed to self-working or be apart of a team-work. The teacher merely played a role as the reference source and supervisor.

CONCLUSION

A brief analysis of the relationships between dominating multiple intelligences and teaching styles in the teaching and learning processes was provided. The correlations between Gardner's multiple intelligences and Grasha's teaching styles were analyzed using a canonical method. Thera were 810 participants used that were the teachers from several high schools located in the region of North Sumatera, Indonesia. There was a significant relationship between the dominating intelligences and the teaching styles during teaching and learning processes, whereas all-dominating intelligence factors were correlated positively along with the expert style, facilitator style and delegator style. The result of this study emphasized the interpersonal intelligence according to the highest correlation values obtained in relations with the teaching styles applied. A teacher with expert style always challenged the students with problems and provided a more detail knowledge and discussion. A teacher demonstrating facilitator style preferred to emphasize an interactive communication and discussion with the students. While, a teacher showing delegator style encouraged the students to be independent and self-working. In addition, it also pointed out that the existential intelligence was as the most insignificant factor during teaching and learning process.

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