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Teacher - Student Interactions: Learning Science in Primary School Teacher Education

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Abstract –This paper reports on student perceptions of elementary school science learning carried out by lecturers in the primary school teacher education study program of four universities in Indonesia. In the context of research, learning activities are focused on teacher interpersonal behavior. The questionnaire used in this study uses the QTI questionnaire that has been developed by Rekha Koul. The questionnaire uses English and has been translated into Indonesian so that it can be used in Indonesia. This research uses survey and interview methods. The results of this study indicate that each of the interpersonal behaviors of elementary school science lecturers has a relationship between Leadership, Helpful / Friendly, Understanding, Student responsibility, Dissatisfied, Admonishing and Strict. The leadership dimension is more prominent than other factors and the dissatisfaction dimension is second to last.

Keywords: Interaction of learning, Science education, Elementary School, QTI

Introduction

In Indonesia, Primary School Teacher Education is a study program that prepares students to become prospective teachers at the elementary school level who are professional and have pedagogical skills. In this study, we examine the interaction of teachers in Elementary School Teacher Education Science classes. According to Appleton, (2003). Learning science in elementary schools is a vehicle to equip students with the knowledge of skills and attitudes needed to continue education and to adapt to the changes around them (Roth, W & Lee, 2004). Science is one of the subjects related to everyday life and is related to the environment (Hofstein, & Lunetta, 2004). Science in elementary schools is used as a way to find out about nature systematically, so that science is not only the mastery of a collection of knowledge in the form of facts, concepts, or principles but also a process of discovery (Carey, 2000; Bell, & Cowie, 2001). Science education is expected to be a vehicle for students to learn about themselves and the natural surroundings, as well as the prospect of further development in applying them in everyday life. The learning process emphasizes providing direct experience to develop competencies in order to understand the natural surroundings naturally (Glasersfeld 1989; Lederman, & Abell, 2014). However, the problems of education in Indonesia are currently increasingly complex. Based on the Trends in Mathematics and Science Study (TIMSS) 2011 study, Indonesia was ranked 36 out of 49 countries in the world. The results of the Program for International Student Assessment (PISA) study also show that Indonesian

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students are ranked 64 out of 65 countries in the world (OECD, 2015). These results occurred in succession for the last ten years. Not much different, the 2015 TIMSS results published in December 2016 showed that the achievement of Indonesian students in mathematics was ranked 46 out of 51 countries with a score of 397 (Mullis, Martin, Foy, Hooper, 2015). Based on these data, it is necessary to strengthen the learning processes and interactions carried out by science lecturers to students who will later become science learning teachers so that they can implement knowledge and approaches about science to their students later (Hofstein, & Lunetta, 2004). The role of lecturers as professional educators is actually very complex, not limited to the interaction of learning in the classroom, which is commonly called the teaching and learning process (Huxley, 1991; Yeo, 2003). The success of the learning process is not only influenced by students but lecturers also play an important role in the success of the learning process (Freeman et al, 2014). Learning that is expected at this time, students can be actively involved in the teaching and learning process. So, the success or failure of the learning process in achieving the goal is always related to the ability of the lecturer to carry out learning interactions (Fatima, 2015). Therefore, to find out how the interaction between teachers and students, it is necessary to conduct research on this by using the right instruments to determine teacher-student interactions based on student perceptions. In previous studies, it was found that the QTI (Questionnaire Teacher Interaction) instrument used was an English language instrument that needed to be translated into Indonesian so that it could be used in Indonesia. There are many studies on teacher interaction using QTI but in Indonesia it is still little researched. Even though this is very important because lecturers have a role in educating and teaching prospective elementary school teachers. This research can also add to the repertoire of knowledge for the development of science, especially regarding learning interactions for other universities.

Learning Environment Research

One of the important factors that can maximize learning opportunities for students is the creation of a conducive learning environment. Over the past four decades, learning environment research has been a good form of research in learning (Fraser 1998; Fraser and Walberg 1991; Haertel et al. 1981). The learning environment plays an important role in the process of learning activities in an optimal learning environment that can affect student achievement (Wolf & Fraser). The learning environment is a source of material and learning aids. The learning environment is one of the factors in the learning process (Fraser, 2015). Environment in a narrow sense is the environment outside the individual or human. The environment includes all materials and stimuli inside and outside the individual, both physiological, psychological, and socio-cultural (Lizzio, Wilson, & Simons, 2002).

Questioner teacher interaction (QTI)

Learning in schools is basically a very complex teaching and learning activity, namely the available time, teacher character, learning resources, and the interaction between students and teachers (Koul & Fisher, 2006; Van Petegem & Blieck, 2006; Wubbels, Th., & Levy, 1993).

The interaction carried out by the teacher is one of the supporters of the quality of education that can create the high and low success of an educational process (Stronge, 2018). In practice, the learning environment, especially in the classroom, is directly

influenced by the teacher's interpersonal attitude or the interaction between teachers and students. (Van, Ritzen, & Pieters, 2014). According to Telli, den Brok, & Cakiroglu, (2017) the teacher interpersonal behavior, namely the behavior of teachers in interacting with students, is an important element in the teaching and learning process and is a major component of the learning environment in particular. The teacher's interpersonal behavior towards the interpersonal behavior carried out by the teacher will be able to maintain optimal conditions for the learning process to occur (Korthagen & Evelein, 2016). Several studies have been conducted regarding student perceptions of teacher interpersonal behavior which are closely related to student achievement and student motivation and the learning environment (Wubbels & Mieke, 2005; Wubbels, P, Veldman, & Tartwijk, 2006). Along with the development of research that discusses teacher interactions and the learning environment. Many instruments have also been developed to provide researchers with the information they need in their research. One of the instruments we discussed above is the Questionnaire on Teacher Interaction (QTI). Questionnaire on Teacher Interaction (QTI) is a form of assessment instrument regarding student and teacher perceptions of teacher interpersonal behavior in teacher-student interactions in the classroom environment (Koul & Fisher, 2003; Rahmawati, Koul & Fisher, 2015). The Questionnaire on Teacher Interaction (QTI) was developed in the early 1980s by a team of Dutch researchers at Utrecht University in the Netherlands to measure teacher behavior and interactions with students (Wubbels., Creton, & Hooymayers, 1985; Rahmawati, Kaoul & Fisher, 2015). Furthermore, QTI was developed in several countries in other languages, such as English, American, Australian English, Turkish and Indonesian (Wubbels and Levy 1991; Wubbels, 1993; Telli et al. 2007). The Questionnaire on Teacher Interaction (QTI) is designed to measure students' interpersonal perceptions of teachers (Sun, Mainhard & Wubbels, 2018). Another opinion suggests that QTI is used to measure students' perceptions of interactions with their teachers, a Questionnaire on Teacher Interaction (QTI) has been developed (Passini, Molinari & Speltini; 2015). Koul (2005) developed 48 questionnaire items covering Leadership, Helpful / friendly, Understanding, Student freedom, Uncertain, Dissatisfied and Admonishing.

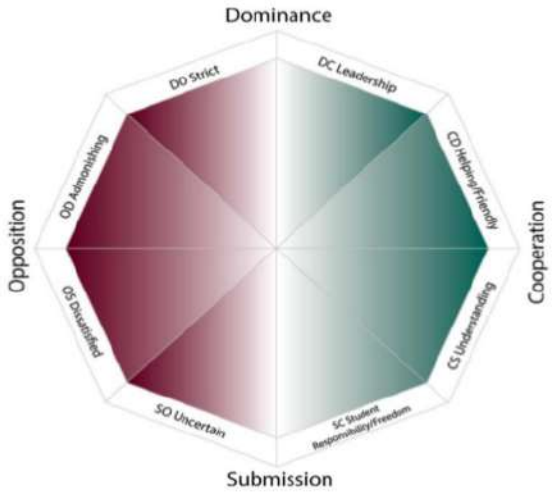
QTI was adapted from Leary's interpersonal behaviour model. Leary's model allows a graphical representation of human interactions with the help of the proximity dimension (Cooperation-Opposition) to measure the level of cooperation or closeness with those involved in the communication process and the influence dimension (Domination-Submission) shows the level of domination or control during the communication process (Wubbels & Levy, 1993). Several studies have validated the Questionnaire on Teacher Interaction (QTI) and investigated its reliability (Goh & Fraser, 1996; Kim, Fisher, & Fraser, 2000; Wubbels et al., 2006). Research has also examined the relationship between the Questionnaire on Teacher Interaction (QTI) sector (Goh and Fraser 1996), the ability of Questionnaire on Teacher Interaction (QTI) to differentiate between classrooms (Goh & Fraser, 1996; Kim et al., 2000; Sivan. & Chan, 2013). and the suitability of its two dimensions (Effect and Distance) for the observed data (Fisher, den Brok, Waldrip, & Dorman, 2011)

Questionnaire on Teacher Interaction (QTI) has been used and validated in several countries such as the Netherlands, America, Australia, Hong Kong. However, Questionnaire on Teacher Interaction (QTI) is still slightly validated and used in Indonesia, especially in the learning environment carried out by lecturers in the primary school teacher education study

program. Whereas by using Questionnaire on Teacher Interaction (QTI) we can identify and identify the profile of interpersonal behaviour of lecturers who teach natural science courses in elementary schools based on student perceptions.

Master's Interpersonal Behaviour Model

In MITB, the relationship between teacher and student is divided into two groups of interrelated behaviors. The teacher's interpersonal behavior group is also called proximity (cooperationopposition, CO) and influence (dominance-submission, DS). Wubble and Levy (1993) state that proximity is a group of teacher interpersonal behaviors that are used to categorize teacher interpersonal behavior and explain the level of cooperation between students and teachers. Influence is a group of teacher interpersonal behavior that is used to categorize teacher interpersonal behavior and explain how or who is in control of communication between students and teachers and the frequency therein (Steele, 2009). The following is Wubble's Model of Teacher Interpersonal Behavior (Fisher & Rickards, 1998).



.Figure 1. Wubble's Model of Teacher Interpersonal Behaviour (Fisher & Rickards, 1998).

Based on the picture above, each teacher's behavior pattern is described as follows.

1) Leadership: Leadership behavior is shown by: paying attention to what is happening in class, leading, organizing, giving orders, assigning tasks, determining procedures, arranging class situations, explaining, and holding attention.
2) Helping / Friendly: Helpful / friendly behavior is shown by: helping, showing interest, joining, behaving friendly or caring, being able to make jokes, inspiring confidence and trust.
3) Understanding: Understanding behavior is shown by: listening to students with great interest, empathy, showing trust and understanding, accepting apologies, looking for ways to resolve differences, being patient, being open to students.
4) Student Responsibility / Freedom: The behavior of giving responsibility / freedom of students is shown by: giving the opportunity to work independently, waiting for the class to be quiet, giving freedom and responsibility to students, agreeing on something.

5) Uncertain: doubtful behavior is shown by: being humble, apologizing, waiting and seeing how the learning process is going, and admitting mistakes.
6) Dissatified: Dissatified behavior is indicated by: waiting for students to be silent, considering pros and cons, being silent, showing dissatisfaction, looking gloomy, questioning / doubtful, and criticizing.
7) Admonishing: The behavior of reprimanding is shown by: getting angry easily, giving students assignments, displaying expressions of annoyance and anger, forbidding students, always wanting to be right, and like to punish.
8) Strict: Discipline behavior is shown by: maintaining tight control, checking, judging, keeping the class silent, maintaining silence, being assertive / disciplined, setting proper rules and norms.

Research Design

This study aims to determine teacher-student interactions based on student perceptions. Data collection in this study used QTI which was developed by Rekha Koul. This research was conducted in three stages. In the first phase, the QTI instruments using English were translated into Indonesian with the aim that they could be used in Indonesia. In the second phase, after being translated the QTI instrument the reliability test. In the third phase, the research was carried out at four universities in Indonesia which have different characteristics.

Respondents in this study were 240 students who were selected from four universities. Students were asked questions about their perceptions of their lecturers' interaction behaviour using the QTI instrument. Then this study complements interviews with students with the aim of extracting qualitative information about students' perceptions of the interaction of lecturers who teach science courses. The characteristics of the target colleges for research are as follows:

1. University 1 - is a higher education institution in the middle of Jakarta, the capital city of the Republic of Indonesia. This college provides education for prospective educational personnel at all levels of education and expertise. At this college, there is an elementary school teacher education study program which has excellent and professional science teaching staff. In this study, researchers collaborated with senior science lecturers who were 54 years old with 25 years of teaching experience teaching science.
2. University 2 - is a high education institution located in Banten Province, Indonesia. This college has a faculty of teacher training and education sciences. In higher education 2, the lecturers are dominated by lecturers from the best university graduates in Indonesia. With the guidance of the existing professors, it is hoped that new innovations in education will emerge. The target of research in higher education 2 is the Primary School Teacher Education study program which has science lecturers with 10 to 20 years of teaching experience.
3. University 3 - is a private higher education institution characterized by religion, namely Islam. College 3 has teaching staff in the field of primary school science who are professional and have up to 20 years of experience.
4. University 4 - is an educational institution characterized by Islamic higher education. This college is one of the best colleges in the city of Tangerang. This college has elementary school science teaching staff who have 5 to 15 years of teaching experience.

Results for first phase of the study

The results and discussion in this phase are divided into three phases. The first discusses the results of the survey and observations of students from the four universities. In the second phase, it discusses the implications of natural science learning in primary school teacher education study programs. For the second phase, QTI is used to determine students' perceptions and as a reflection of the teacher.

Quantitative analysis of QTI data

The questionnaire is given to students and every question listed on the questionnaire must be filled in by the student. The distribution of QTI questionnaires using google documents. The results from QTI were analyzed using SPSS version 22. Table 1 shows an integrated quantitative analysis of the survey results.

Teacher interpersonal behavior

Table 1 describes the mean and standard deviation for each QTI scale and shows that students perceive their lecturers to have Leadership, Understanding and Helpful / friendly behaviours quite often. The determination of the item score uses a Likert scale with a score.

Table 1. *Scale internal consistency (Cronbach alpha reliability), mean and standard deviations for each QTI scale*

Scale	Alpha reliability	Mean
Leadership	0.849	3,72
derstanding	0,78	3.61
Helpful/friendly	0,838	3.70
Student responsibility/freedom	0,81	3,67
Uncertain	0,70	3,57
Admonishing	0.67	3.45
Dissatisfied	0.60	3,39
Strict	0,61	2,99

N = 240, boy = 92 girl = 148

The instrument uses a scale very often (5), often (4), rarely (3), sometimes (2), never (1) with 48 questions. The QTI instrument consists of dimensions of leadership, understanding, helpful / friendly, student responsibility / freedom, uncertain, admonishing, dissatisfied and strict. Participants' perceptions of leadership with a score of 3.72 and strict with a score of 2.99.

Reliability

The QTI is a previously validated learning environment questionnaire. However, the reliability of this instrument was further confirmed in this study by internal consistency based on the correlation between variables using the Cronbach alpha reliability coefficient (Newby & Fisher 1997). Table 2 shows that the alpha reliability of the instrument ranges from 0.61 to 0.849, indicating that the scale is suitable for use in this study with all alpha reliability above 0.50 (De Vellis 1991).

Correlations between scale

Calculation of inter-scale correlation using the Pearson correlation. For example, the Leadership scale is closely and positively correlated with Understanding (0.71) and Helpful / Friendly (0.66). Reliability and the ability to differentiate between classes indicate that QTI

can be used as a valid instrument in research. Interpretation of correlation can be achieved by examining significant values that are p less than 0.05 (Coakes and Steed 2007).

Table 2 Inter-Item Correlation Matrix

	LEA	UND	SRES	UNC	ADM	DISS	STRC
LEA	1.000	-.929	.544	.801	.859	-.881	.660
UND		1.000	-.200	-.800	-.983	.649	-.474
SRES			1.000	.400	.076	-.875	.569
UNC				1.000	.832	-.706	.095
ADM					1.000	-.544	.305
DISS						1.000	-.676
STRC							1.000

Qualitative analysis of students' perceptions of QTI

Qualitative analysis of students' perceptions about QTI in this study was collected through observation and interviews. Observations were made to the four universities on the island of Java, Indonesia. These tertiary institutions have their own characteristics and advantages. The brief profiles of the four colleges are:

First university

The first university is a public higher education institution and teacher training. Observations at state universities were carried out after researchers distributed questionnaires. The selected class is a concentration class in elementary school science. The research involved 70 selected students with different characteristics and academic achievements.

Second university

The second university is a public college. This college has a faculty of teacher training and education. Observations were made when the researcher distributed the questionnaire. The class chosen is a concentration class in the field of science and mathematics in the Elementary School Teacher Education study program. The study involved 65 respondents who took science education courses in elementary schools. This college has elementary school science lecturers who are still teaching assistants. Although the assistant lecturer has the competence and qualifications of a doctor in science as a graduate from a well-known university in Indonesia.

Third university

The third university is a university based on Islam. In this college, all study programs receive additional courses, namely Islamic religious education, including the primary school teacher education study program. Observations at this college were carried out for 5 times. Because the elementary school science learning class is on Monday to Friday. This study involved 50 students. The selected respondents are students who have received practical science learning courses in elementary schools.

Fourth university

The 4th university is a private, faith-based college. This college applies Islamic and Muhammadiyah values. This study involved 55 students. The selected students are students

who have received basic concept courses of natural science in elementary schools and science laboratories.

Results for second phase of the study

Implications of teacher interpersonal behaviour

The profiles of the four lecturers from each participating university were taken based on student perceptions on the eight QTI scales. Researchers provide QTI results to lecturers, based on the results of data analysis as a process of data trangulation. With the QTI result data, it provides information to the lecturer on how the students perceive the lecturers' interpersonal behavior. The following is Figure 1, Figure 2 Figure 3 and Figure 4 regarding the dimensions of lecturer interpersonal behavior as follows:

Figure 1. The first university

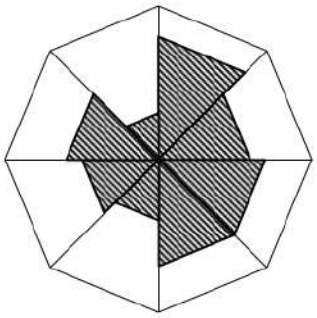


Figure 2. Second university

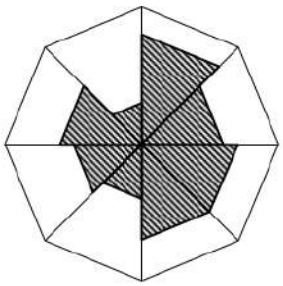


Figure 3. Third university

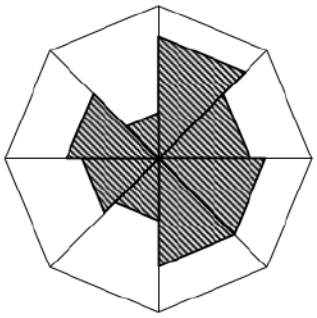
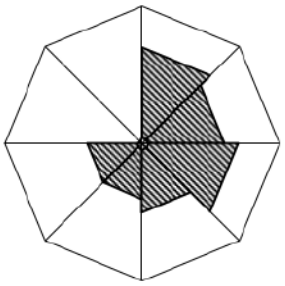


Figure 4. The fourth university



The figure above shows the profile of the interpersonal behavior of each lecturer that is felt by each student. This profile is a description of four lecturers who carry out scien learning in the primary school Teacher Education study program at different universities. Based on the results of the study, it was found that overall students liked the lecturers who had good leadership in the class. Besides that, they also have a good perception when the lecturer has a good understanding and knowledge of science.

The results of interviews conducted at the first university, leadership and Helpful / Friendly, and have a good understanding. For the second university, lecturers have excellent interpersonal behavior, namely leadership and are helpful / friendly, although they still have strict discipline towards students.

"I like the lecturer because he is kind and responds with a smile every time I reprimand"

(Student interview, 16th July 2019)

Lecturers often involve me in designing instructional media needed in learning science in elementary schools

(Student interview, 16th July 2019)

"'"Mrs. X is often the opportunity for all students to have the courage to express their opinion by reprimanding one by one at the beginning of their recovery or giving personal questions related to the material that was studied last week".

(Student interview, 19th July 2019)

For the third university there is no statistically significant difference, especially on the Understanding and Helpful / Friendly scale. This is shown by the results of interviews conducted with students. This is supported by comments from his lecturer who demonstrated that :

"I try to be close or friendly and try to enjoy teaching science so that my students are more interested in science learning."

(Lecturer interview, 16 July 2019)

"I understand that not all students like science lessons, so I try to make science learning easy and fun".

(Lecturer interview, 19th July 2019).

Interviews conducted with lecturers at the fourth university also showed relatively the same statistical score, namely the leadership factor, this was supported by his opinion as follows:

"I try to make students learn in a directed way to master the concept of science so that at each initial lecture session, I show the agreed program, and review whether the students have adjusted to their respective assignments"

(Lecturer interview, 24th July 2019).

Implications for teacher

Based on the research findings, it shows that the leadership factor is very prominent compared to other factors, this illustrates that the lecturers in general have shown the behavior of being able to control the class appropriately but there is an interesting thing is the low student dissatisfaction score, this gives the impression that students feel less satisfied with the condition his learning interactions. This is possible due to the cultural factors of students who are less open in expressing their opinions. Based on these findings, lecturers in teaching science need to take an effective and different communication approach. Another factor is the mastery of the material and the lecturers' self-confidence in science competencies.

Conclusion

The results of the research findings can be concluded that QTI can be used by lecturers as a means of reflection and to identify the interaction attitudes they have and try to develop these interaction attitudes. In this study, lecturers' interpersonal analysis was based on student perceptions of eight lecturer behaviours, namely Leadership (the extent to which the teacher leads, organizes, provides subject matter, determines teaching procedures and controls classroom situations), Helpful / Friendly (the extent to which the lecturer shows and attracts attention, act with consideration, are friendly, confident, and trustworthy), Understanding (the extent to which the teacher understands, provides empathy, gives trust, and is open to students), Student responsibility (the extent to which the lecturer gives the opportunity to students work independently, provides responsibility and freedom to students), Uncertain (the extent to which the lecturer hesitates in acting), Dissatisfied (the extent to which the lecturer expresses dissatisfaction, criticism, looks unhappy, is silent), Admonishing (the extent to which the teacher becomes angry, expresses annoyance and his anger, giving warning and punishment),

and Strict (as far as m ana teacher conducts examinations in class relating to teaching activities, maintaining calm, and enforcing strict rules). The findings of this study are important as part of the lecturers' reflection in class teaching.

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