The importance of teacher Interpersonal Behaviour for Student Attitudes in Brunei Primary Science Classes

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ABSTRACT

This study investigated relationships between students' perceptions of their teachers' interpersonal behaviour and their subject-related attitude in primary science classes in Brunei. Teacher-student interpersonal behaviour was mapped with the Questionnaire on Teacher Interaction (QTI) and reported in terms of two independent dimensions called Influence (teacher dominance vs. submission) and Proximity (teacher cooperation vs. opposition). While prior research using the QTI mainly focussed on secondary education, the present study was one of the first in Brunei and in primary education and one of few studies to use multilevel analysis. Data from 1,305 students from 64 classes were used in this study. Results indicated strong and positive effects of Influence and Proximity on students' enjoyment of their science class and supported findings of earlier work with the QTI.

The importance of teacher Interpersonal Behaviour for Student Attitudes in Brunei Primary Science Classes[1]

1. Rationale

Students' motivation to become scientists, their attitude towards the learning experiences in their science lessons, and their interest in science as a career or for leisure, have long been investigated (Moore & Foy, 1997). In many countries, the promotion of favourable attitudes towards science is viewed as a very important aim of science education (Fraser, 1981; Kelly, 1986). The situation in Brunei Darussalam is no exception. In keeping with this research tradition, associations between students' perceptions of their actual learning environments and their attitudes towards their science class were investigated in this study. There were several reasons for such an investigation.

First of all, in Brunei, science education has been given an important status in school curricula. The Ministry of Education has advocated improvements in the teaching and learning of science and mathematics, aiming to create the foundation of a technologically-oriented workforce in line with the needs of national development (Ministry of Education, 1999). Analyses of past years' external Brunei-Cambridge General Certificate of Education Ordinary-Level Examinations revealed that students in Brunei consistently performed poorly in science subjects despite having experienced highly qualified teachers and reasonably well-equipped science laboratories in secondary schools (Poh, 1996). Accepted methods to overcome poor academic achievement in science have included the creation of more positive attitudes towards the learning of science (Poh, 1996). The present study investigates

how teaching and characteristics of students, classes, and teachers can affect these science-related attitudes.

Second, little comprehensive research of science teaching and learning has been conducted in Brunei Darussalam (Poh, 1996). One reason for this is a lack of suitable instruments to investigate and map these concepts with Malay students and teachers. This study used existing instruments to map students' perceptions of their science teachers' classroom behaviour and their enjoyment of science lessons and adapted these for use with Malay-speaking students. Thus, one reason for the present study was to develop, back translate, validate, and use generally applicable instruments. To achieve this, a Standard Malay translation of the *Questionnaire on Teacher Interaction* (QTI; Wubbels, Créton & Hooymayers, 1985; 1987) was used to provide information about students' and teachers' perceptions of teacher-student interpersonal behaviour.

Several previous *learning environment studies* have investigated the relationships between teacher interpersonal behaviour and students' attitudes toward science (Brekelmans, Wubbels, & den Brok, 2002; den Brok, 2001; Fraser, 1998; 2002). The present study contributes to this line of research in several ways. First, while most of these previous studies focused on secondary science education, the current study assessed effects of interpersonal behaviour in *primary* education. Second, by employing multilevel analyses of variance on students' attitude scores and by correcting the effects of teaching for effects of student, class and teacher covariates, the study aimed to provide a *more precise estimate* of the effect that teachers may have on their students' attitudes toward science than previous work. Third, this study was the first of its kind to investigate such relationships *in Brunei*[2].

The next section of this paper provides a discussion of the framework used in this study to map teacher behaviour: the Model for Interpersonal Teacher Behaviour, the concept of attitude toward science and (a review of) research investigating the relationship between teaching and student attitudes. Then, the research questions and design of the study (instrumentation, sample and analyses) are presented. Finally, results of the analyses are described and discussed in terms of the study's strengths and weaknesses, and implications for science teaching are provided.

2. Theoretical Framework

Our conceptualisation of teacher-student interpersonal behaviour partially evolved from a *systems approach to communication* (Watzlawick, Beavin, & Jackson, 1967), in which classroom groups are conceived as ongoing systems. Systems require a certain stability in order to exist. When students meet a teacher in a new class, they will be open to any impressions, though they may be influenced by their (stereotypical) expectations about the teacher. As the class progresses, students will begin to develop ideas about their emerging relationship with this particular teacher. Finally, after a number of lessons (which may take weeks or months), the students' tentative ideas will have stabilised and they can tell what "kind" of teacher they have. In the systems approach to communication, the focus is on the effect of communication on the persons involved (pragmatic aspect). In our conceptualisation of the interpersonal perspective, we focus on the *perceptions* of students toward the behaviour of their teachers. To describe these perceptions, Wubbels, Créton, and Hooymayers (1985, cited in Wubbels & Levy, 1993) applied Leary's general model for interpersonal relationships (Leary,1957) to the context of education. The Leary model has been extensively investigated in clinical psychology and

psychotherapeutic settings (Strack, 1996). It has proven to be adept at describing interpersonal relationships (e.g. Foa, 1961; Lonner 1980). According to Leary, two dimensions are important - Dominance-Submission and Hostility-Affection.

Adapting the Leary Model to the context of education, Wubbels et al. (1985) labelled the two dimensions *Influence* (Dominance-Submission) and *Proximity* (Opposition-Cooperation). They structured interpersonal teacher behaviour into eight segments: leadership, helpful/friendly understanding, giving students freedom and responsibility, uncertain, dissatisfied, admonishing and strict. Figure 1 is a graphic representation of the adapted model for education, the *Model for Interpersonal Teacher Behaviour* (Wubbels, et al, 1985).

[Figure 1 about here]

The sections are labelled DC, CD, etc. according to their position in the coordinate system (much like the directions in a compass). For example, the two sectors “leadership” and “helpful/friendly” are both characterised by Dominance and Cooperation. In the DC sector, the Dominance aspect prevails over Cooperation. A teacher displaying DC behaviour might be seen by students as enthusiastic, motivating, and the like. The adjacent CD sector includes behaviours of a more cooperative and less dominant type; the CD teacher might be seen as helpful, friendly and considerate.

The *Questionnaire on Teacher Interaction* (QTI) (Wubbels et al., 1985) was developed based on this model and can be used to map students’ (and teachers’) perceptions of teacher interpersonal behaviour according to the MITB. The QTI originally consisted of 77 items, answered on a Likert-type 5-point scale. The items of

the QTI refer to the eight sectors of behaviour – leadership, helpful/friendly, understanding, giving responsibility/freedom, uncertain, dissatisfied, admonishing and strict – that jointly make up the Model for Interpersonal Teacher Behaviour (MITB). Typical items of the QTI are presented in Table 1.

[Table 1 about here]

Much recent attention on affective variables, particularly attitudes, in education research stems from the view that affective variables are as important as cognitive variables in influencing, possibly predicting, learning and other outcomes (Koballa, 1988). Evaluative quality is the central attribute of the attitude concept—like or dislike (Shrigley, Koballa, & Simpson, 1988), including terms such as interest, enjoyment, and satisfaction (Gardner & Gauld, 1990) and even curiosity, confidence, and perseverance (Shulman & Tamir, 1972). Shrigley (1983) stated that it is generally agreed that attitude is not innate, but learned as part of culture.

Klopfer (1976) alleviated the semantic problems caused by the multiple meanings attached to the term '*attitude toward science*' by developing six categories of conceptually different attitudinal aims. These categories were: manifestation of favourable attitudes to science and scientists; acceptance of scientific enquiry as a way of thought; adoption of scientific attitudes; enjoyment of science learning experiences; development of interest in science and science-related activities; and development of interest in pursuing a career in science (Shulman & Tamir, 1972). The *Test of Science Related Attitudes* (TOSRA), designed to measure these scales separately, was written for use with secondary school students (Fraser, 1978, 1981). One of the TOSRA scales, from which the 7-item *Attitude To This Class* scale was

devised, was selected for this study. This scale has been validated in Australia (Fisher, Rickards, Goh, & Wong, 1997a, b) and Korea (Kim, Fisher, & Fraser, 1999, 2000). The original name for this TOSRA scale, the *Enjoyment of Science Lessons* (ENJ) (Fraser & Fisher, 1982), was chosen for this study. It has been shown that enjoyment (or pleasure) is strongly related to other attitudinal concepts and elements, such as relevance, confidence, interest and effort (e.g. den Brok, 2001). Thus, the more enjoyment students experience in science, the more relevance they attach to science for their future education and occupation, the more confidence they have in performing well in science, the more interested they are in science, and the more effort they are willing to invest into learning science.

The question on how to motivate students for science has occupied teachers, trainers and researchers for several decades. Interest in the effect that teachers may have on students' affective outcomes can be found in multiple research domains, such as research on teaching of science, school and teacher effectiveness research focussed on science and learning environments research.

Within the domain of learning environments research, several studies have investigated relationships between teacher-student interpersonal behaviour and students' attitude towards science (e.g. Fraser, 1981; Rickards, 1998). These studies showed a very consistent pattern of associations. All have found a positive effect for both teacher Influence and Proximity on students' attitudes toward science. Generally, effects of Proximity are somewhat stronger than those of Influence. In a study of physics teachers and their students, Brekelmans, Wubbels and Créton (1990) found a clear relationship between Proximity and students' attitudes toward Physics: the stronger the perception of Proximity the more positive the attitude of the

students. Other learning environment studies found positive relationships between teachers' helpful/friendly and understanding behaviour, and pleasure, confidence, effort and relevance in either Physics, Chemistry, Biology or Math (Brekelmans, et al., 2002).

Positive, strong associations have also been demonstrated between several interpersonal behaviour sectors, such as leadership and helpful/friendly, and attitude toward science, while negative relationships were found with admonishing, dissatisfied, and, in most cases, strictness (Evans, 1998; Goh, 1994; Henderson, 1995; Rawnsley, 1997).

Only a small number of studies has investigated the effects of interpersonal teacher behaviour sectors on students' attitudes toward science while accounting for other teacher variables, such as stimulating student investigation in the science classroom, student cohesiveness, student negotiation, shared control between teacher and student over science-related learning activities (e.g. Fraser, 1998; 2002). Most of these were conducted in Australia (Goh, 1994; Henderson, 1995; Rawnsley, 1997). Two studies indicated similar amounts of variance explained by interpersonal and other teacher behaviours (Henderson, 1995; Rawnsley, 1997), while one reported larger amounts of variance explained by interpersonal behaviour than by other teacher behaviours (Goh, 1994). All of the studies reported that much of the variance was shared by all teacher behaviours, rather than explained by only interpersonal behaviour or other teacher behaviours.

Effects of student, teacher and class characteristics on students' attitudes have also been investigated. With respect to student gender, results are inconsistent: some studies show that boys have more positive attitudes toward science subjects than girls (e.g. Knuver & Brandsma, 1993; den Brok, 2001; Evans, 1998; Hill & Rowe,

1996), while other studies show no gender effects (e.g. Goh, 1994; Henderson, 1995). Evans (1998) showed that student ethnic background may be related to their attitudes: she found that students born in Australia (the home country) had more positive attitudes toward science than did students from other backgrounds (such as Africa, India or Asian countries). Associations between teacher-student interpersonal behaviour and students' attitudes toward science have been found in various countries. Research results (indicating positive associations) have been replicated for science students in Singapore and Australia (Fisher, et al., 1997a, 1997b), science students in Korea (Kim, et al., 1999, 2000), and (secondary) chemistry students in Brunei (Riah & Fraser, 1997). Only one study has investigated these associations within primary education (e.g. Goh & Fraser, 1995; 1998). This study was conducted in Singapore and showed similar associations in strength and direction as did studies conducted in secondary education: the strongest positive association was found with the Leadership scale , while the strongest negative association was found with the Uncertain scale.

While research on the relationship between interpersonal teacher behaviour and student attitudes displays fairly consistent results, most studies are subject to some limitations. First, with the exception of the Brekelmans et al. (1990) study, none of the studies employed multilevel analysis techniques. Instead, one-way analyses of variance (ANOVA), multivariate analyses of variance or correlations were used to investigate associations. While these analytic techniques can provide useful information, they usually *overestimate* effects because they assume random sampling. In most studies, classes were sampled as a whole, meaning that data were hierarchical in nature. Second, in most cases the significant results were not corrected for covariates, such as student, teacher or class characteristics. In some

cases, corrections were only limited to a small number of other teacher behaviours. Again, this may have led to *overestimation* of the influence of interpersonal teacher behaviour on student motivation. Research has shown that teacher behaviours – and students' perceptions of them – are partially dependent on and may interact with characteristics of respondents and the context in which they occur (Levy, den Brok, Wubbels & Brekelmans, 2003). Third, most studies were conducted within secondary education. No information is available whether associations are similar in primary education.

3. Research Questions

This study investigated the relationship between teacher-student interpersonal behaviour and students' enjoyment of primary science classes in Brunei. The following research questions were investigated:

1. *To what degree are primary science students' enjoyment of primary science determined by their teachers and classes?*
2. *What relationship exists between students' enjoyment of primary science and their teachers' interpersonal behaviour, after correction for student, class and teacher covariates?*

4. Method

4.1 Instrumentation

Teacher-student interpersonal behaviour was mapped with the QTI (Wubbels, et al., 1985; 1987). To adapt the QTI to primary education classes in Brunei, the (English language) 48-item Australian version of the QTI was administered in a pilot study

(Scott & Fisher, 2000, 2001). Since this pilot study indicated several problems with language and context suitability, several changes were made. It was decided to use the primary education version (Goh, & Fraser, 1996), rather than the secondary education version. The primary education version used simplified vocabulary and sentence structure. Secondly, the response format was simplified to a 3-point Likert scale (with answering options 'mostly', 'sometimes', and 'seldom'. It is important to note that the middle response is positive rather than neutral. Thirdly, the primary education version was translated and adapted to the Standard Malay language.

The adapted and translated QTI version (48 items) was used to map students' perceptions of their teachers' interpersonal behaviour. Given the unique context and QTI version used, several analyses were performed to ensure quality of the instrument. First, items of the QTI and the Enjoyment of Science scale were translated and back-translated in several rounds by multiple experts until translation left no distinctions between both languages. Also, teachers were interviewed, particularly about their teaching style and impact on students' enjoyment and learning.

To investigate the quality of the adaptation of the QTI in the Brunei primary education context, reliability and validity of the developed version were established (see Table 1). Items were removed from a scale if they contributed negatively to that scale or if their presence lowered the reliability coefficient of the scale. This resulted in six items being removed. Table 1 indicates the number of items in each scale.

Reliability coefficients of the QTI scales at the class level ranged from 0.70 (Strict) to 0.85 (Admonishing). This meant that scales were one-dimensional at the class level. Intra-class correlations were reasonable for most scales and ranged from 0.14 (Uncertain) to 0.26 (Student Freedom), indicating that the instrument was able to

distinguish between classes. Also, multilevel confirmatory factor analyses confirmed construct validity of the QTI, although some minor irregularities were found with respect to some of the sectors[3]. In terms of students' views, Student Freedom (SC) contained more Influence than hypothesized, and Dissatisfied (OS), seemed to incorporate more Cooperativeness than hypothesized. As a result, some overlap in meaning occurred between Student Freedom and Helpful/Friendly. Also, Dissatisfied was found in the position where one would expect Student Freedom and therefore overlapped completely with Uncertainty. Given these results, it was decided to use the QTI *dimension scores*, rather than *sector* scores, for the present study.

To measure students' attitudes, a 7-item Enjoyment of Science Class scale, was selected for this study based on the TOSRA (Fraser, 1981; Rickards, 1998). Apart from student attitude and teacher-student interpersonal behaviour, several covariates were included in the study: gender, age, ethnic background (language spoken at home most of the time and country of birth of the mother), socio-economic status (students indicated whether a housekeeper was present at home, whether they had a computer at home, and about their family size). Apart from these student background variables, teacher gender and class size were also included.

4.2 Sample

A complete set of data was gathered from 1,305 students, located in 64 classes. The teachers that taught these classes were located on 12 Government schools in the capital of Brunei Darussalam. Of these students, 42.3% was taught by specialist teachers (teachers specifically appointed for teaching primary science), 57.9% by general teachers (teachers who taught other subjects to the same students). Of the

students 51.1% were boys. Most students spoke the Bruneian language (94.2%) at home most of the time. Also, most students had a mother born in Brunei (81.9%). In 26.3% of the houses of students there was a maid, in 31.4% of the houses a computer. In terms of age, most students were either 11 years (37.5%), 12 years (36.0%) or 13 years (12.5%) old, but age ranged between 9 and 14. Family size ranged between 1 and 18 persons, with most students having a family of 5 or less (58.8%). Family size included parents, brothers and sisters, as well as other family members living in the same house.

4.3 Analyses

Multilevel analyses of variance were conducted on the attitude scores of students (with MLN for Windows). Models consisted of three levels: teacher, class and student. First, an empty model (with no independent variables) was tested in order to obtain raw percentages of variance in attitude at the student, class, and teacher level. In the second step, class and student variables were added. Non-significant variables were deleted from the model. Finally, interactions between variables were tested, both within and across levels.

5. Results

The first research question asks to what degree students' enjoyment of their science class is affected by their teachers or their class. To answer this research question, an empty model (with no independent variables) was tested. Variance estimates indicated that most of the differences in students' enjoyment for science related to the student level. Nevertheless, 5 percent in students' attitudes toward science was determined by class membership and almost 7 percent by their teacher. These

findings are similar to those found in other studies (e.g. Brekelmans, et al., 2002; den Brok, 2001; Rickards, 1998), and indicate that teachers and classes affect students' attitudes toward science to some degree.

The second research question asks how teacher interpersonal behaviour (influence and proximity) is related to students' enjoyment, taking into account the effects of teacher, class and student characteristics. It appeared that both Influence (regression coefficient of .28) and Proximity (regression coefficient of .31) have a large and positive effect on students' attitudes toward science: the more dominant and cooperative the teacher is being perceived, the greater students' enjoyment in science is! Moreover, it appears that both Influence and Proximity are equally important, a finding that is somewhat different from prior research that indicated a stronger effect of Proximity on student motivation (Brekelmans, et al., 2002).

[Figure 2 about here]

Figures 2 and 3 display scatter plots of the relationship between science attitudes (ATTIT) and the two interpersonal dimension scores (DS and CO). From Figures 2 and 3, it can be seen that relationships between the two dimension scores and attitude are linear. It can also be seen that, on average, primary science teachers in Brunei are perceived as highly dominant (mean=0.96, standard deviation=0.19) and moderately cooperative (mean=0.43, standard deviation=0.27). Compared with other studies using dimension scores, teachers in this study are perceived much higher on the influence dimension, but are perceived equally high on the proximity dimension (den Brok, 2001).

[Figure 3 about here]

Some of the covariates appeared to be related to students' attitudes as well. It seemed that boys experienced more enjoyment in science than girls. This finding is in keeping with some of the prior research indicating similar gender differences (e.g. den Brok, 2001; Evans, 1998). Furthermore, older students appear to be less motivated for science than younger students and students whose mother was born in Brunei have more favourable attitudes toward science than students with mothers born outside Brunei. None of the other covariates - socio-economic status, teacher gender and class size - had a statistically significant effect on students' attitudes toward science.

The effects of teacher interpersonal behaviours were immense compared to the effect of the other variables. Alone, both behaviour variables explain 23.5 out of the total of 24.4 percent of explained variance. This compares to more than 95 percent of the explained variance, and leaves the amounts of unexplained variance at the class and teacher levels practically zero. These percentages are much higher than in prior research (den Brok, 2001). This may be due to the context of the present study; which was conducted in primary education. Younger students may be more sensitive to and dependent on the relationship they have with their teachers. No interaction effects between variables were found.

6. Discussion

The results of this study indicated that teachers and classes may affect students' enjoyment of science to a significant degree and that both teacher Influence and Proximity positively affect these attitudes: the more dominant and cooperative the

teacher was perceived, the higher students' enjoyment in science. These findings are in keeping with prior research (Brekelmans, et al., 2002; den Brok, 2001; Rickards, 1998). The outcomes of this study confirm the predictive validity of the QTI, both across cultures and education levels. Similar to prior research in secondary science education in countries such as the Netherlands, Australia and Singapore, the present study confirmed earlier findings with primary science students in Brunei.

For teachers, the results stress the importance of interpersonal behaviour in eliciting and maintaining students' motivation and attitudes. These findings are significant, since they show that teachers are able to affect student achievement directly - with their interpersonal behaviour - and indirectly, via students' subject-related attitudes. Also, in this particular study, it seemed that not only teacher cooperation (helpful/friendly and understanding) behaviour was important, but also teacher dominance (leadership, strictness). In order to motivate students, teachers need both of these elements. To realise this, teachers should be able to set clear rules and procedures, provide structure in activities and science content, listening to students' explanations, providing clear instructions, set high standards for achievement, expect the best performance of every student and be willing to repeat their explanations. Also, teachers should be able to mix student freedom over learning science and their behaviour in the classroom with their own regulation and control over these processes.

It was found that teachers in Brunei were perceived as more dominant than teachers in other countries, such as Australia, Singapore (e.g. Goh & Fraser, 1996), Korea (Kim, et al., 1999) the USA and the Netherlands (e.g. Wubbels & Levy, 1993). These findings might be related to the particular context of Brunei and cultural values related to teaching. For example, it has been observed that students in Brunei were

quieter in class, tests were often harder for students, and classroom structure appeared more formal allowing fewer teacher-student interaction than observed in schools in Australia (e.g. Scott, 2001). However, whether such cultural interpretations of our findings are correct, deserves further study, probably by means of interviewing students and teachers and by conducting more explicit cross-cultural comparisons between countries.

While the outcomes of the study have important practical value for science teachers - as they indicate that knowledge on students' perceptions of their teachers may help them in gauging the effects of their actions on students' attitudes – as well as for researchers in science education, the results should be interpreted with caution. Although the study compensated for some of the limitations of prior research by using multilevel analysis and by correcting the effects of teaching for several covariates, it was also subject to some limitations.

First, its effects are limited to student enjoyment in science. This is only one of the attitudinal concepts relevant in science education. Future research could investigate the effects of teaching on attitudinal concepts such as effort, interest, confidence and relevancy (e.g. den Brok, 2001; Gardner & Gauld, 1990; Shulman & Tamir, 1972). Second, the study focussed on teacher interpersonal behaviour, which is one of the many competencies relevant in teaching (e.g. Brekelmans, Sleegers & Fraser, 2000). Future research could include other teacher behaviours or classroom environment instruments and concepts alongside interpersonal behaviour, such as student cohesiveness, investigation, shared control, involvement, clarity, et cetera. Such research could then compare the importance of interpersonal behaviour to these other behaviours, as well as its overlap with other behaviours. Other research, for

example, has shown that interpersonal behaviour may be conditional to other teacher behaviours (e.g. Brekelmans, et al., 2000; den Brok, 2001).

Last but not least, some concerns emerged with respect to the construct validity of the QTI in this study. It is not known whether these problems have affected the outcomes of our study and to what degree. First and foremost, they indicate that, in order to adapt learning environments instruments such as the QTI to other cultures (Brunei) and contexts (primary education), simply translating items or limiting answer categories might not be sufficient. Even with specific alteration of items to the cultural context and simplification of the wording to fit the instrument to lower age groups, some of scales indicated validity problems. Future research is necessary to enhance our understanding of the QTI in the Brunei primary education context.

Notes:

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[2] In government schools in Brunei Darussalam, the medium of instruction in lower primary school (years 1, 2, and 3) is Malay (except for the study of English language). Upper primary (years 4, 5, and 6) schooling is bilingual. Students study Malay language, Islamic religion, physical education, arts and handicrafts in Malay. They study English language, geography, history, mathematics, and science in English medium. Since 1992, upper primary students have been taught three lessons (25 minutes each) of science each week. The science syllabus is content-based,

emphasizing recall of knowledge covering a wide range of topics of biology, physics, and chemistry. At the end of upper primary, all students sit five external, pen-and-paper Primary Certificate Examinations (PCE) in the subjects of Malay language, English language, mathematics, science, and General Paper, the latter four examinations being in English language. Results on these PCE are used to select and stream students for secondary schooling.

[3] Further details can be obtained from the first author of this manuscript.

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Table 1

Typical Items for the Questionnaire on Teacher Interaction (QTI).

Scale (number of items)	Typical item	Alpha	ICC
DC Leadership (6)	This teacher is a good leader	0.82	0.24
CD Helpful/friendly (6)	This teacher is someone we can depend on	0.83	0.19
CS Understanding (5)	If we have something to say this teacher will listen	0.82	0.22
SC Student freedom (4)	This teacher gives us a lot of free time in class	0.76	0.26
SO Uncertain (5)	This teacher seems uncertain	0.79	0.14
OS Dissatisfied (6)	This teacher is suspicious	0.74	0.16
OD Admonishing (6)	This teacher gets angry	0.85	0.22
DO Strict (4)	This teacher is strict	0.70	0.17

Note: ICC = Intra Class Correlation

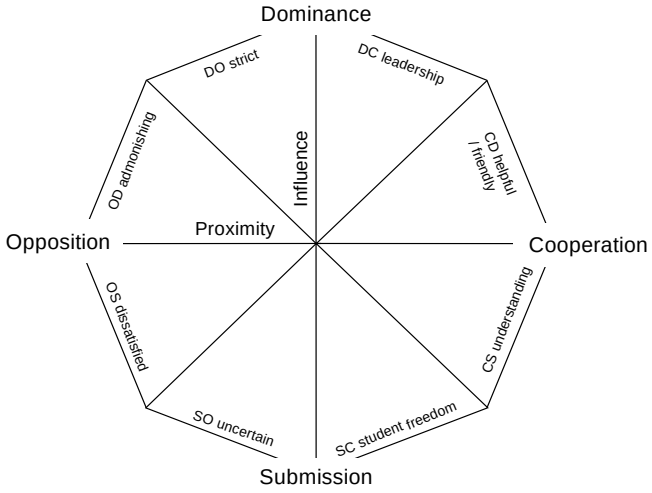

Figure 1. *The Model for Interpersonal Teacher Behaviour (MITB).*

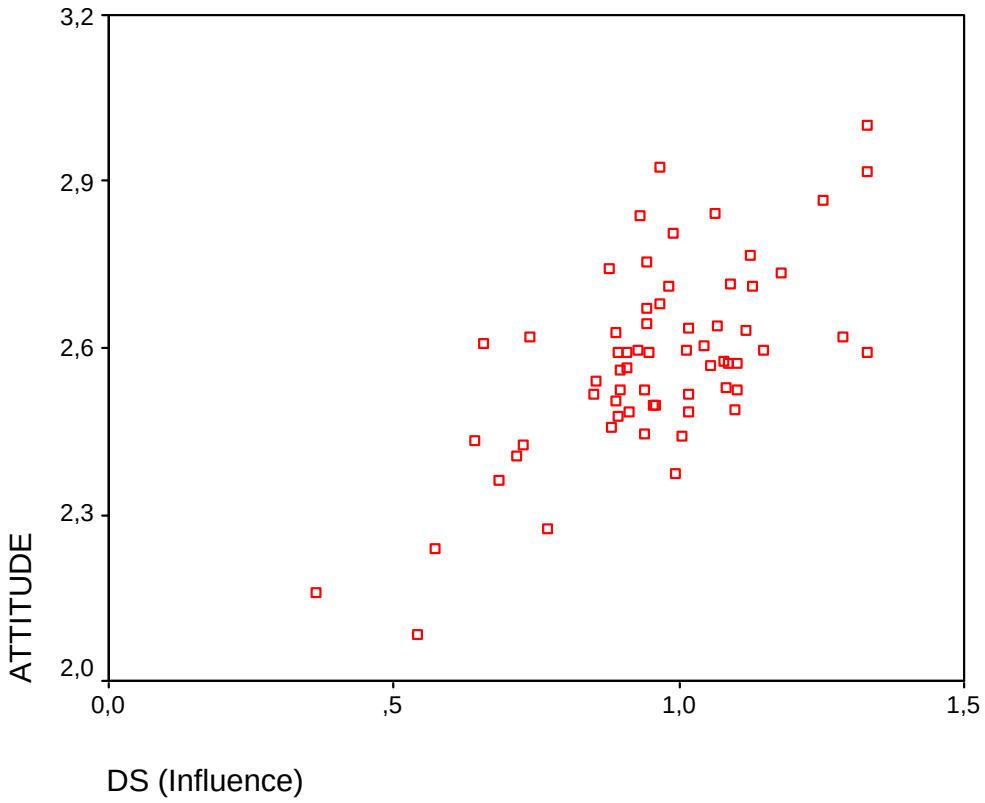

Figure 2. *Scatterplot of the association between Influence (DS) scores and enjoyment attitude toward science (ATTITUDE).*

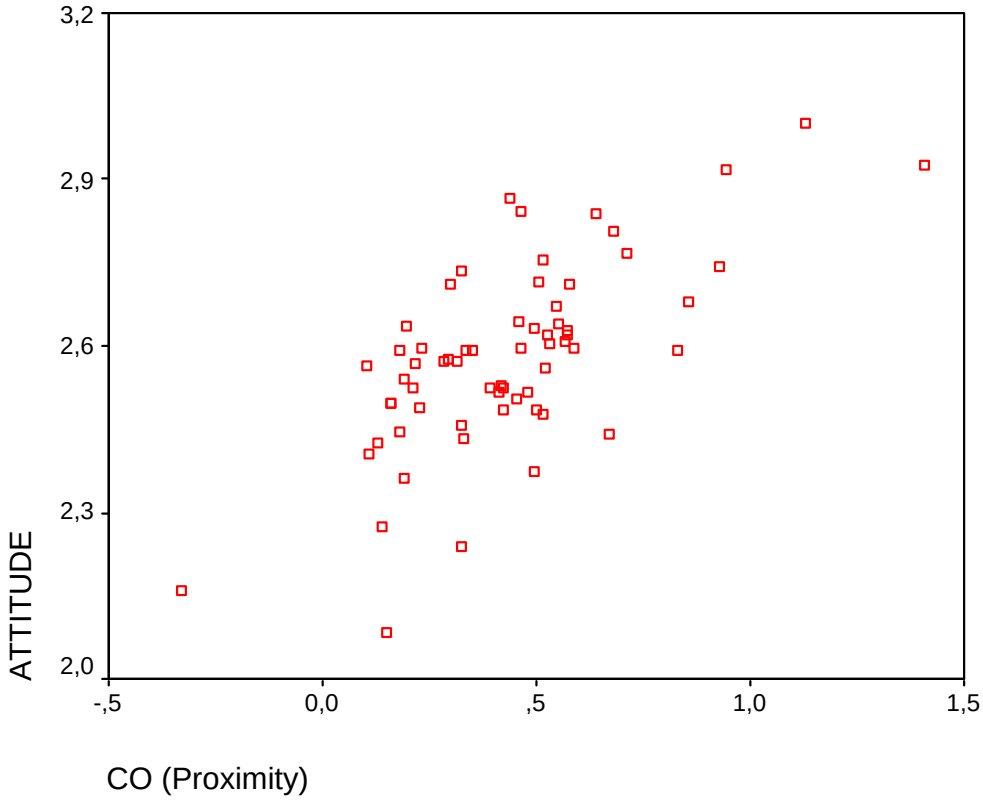

Figure 3. *Scatterplot of the association between Proximity (CO) scores and attitude of enjoyment toward science (ATTITUDE).*