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THE AUSTRALIAN SCIENCE TEACHER: A TYPOLOGY OF TEACHER–STUDENT INTERPERSONAL BEHAVIOUR IN AUSTRALIAN SCIENCE CLASSES

ABSTRACT. This study reports the first development in Australia of science teacher typologies of teacher–student interpersonal behaviour. Students' perceptions of teacher–student interpersonal behaviour were measured using the Questionnaire on Teacher Interaction (QTI). Earlier work with the QTI in The Netherlands has revealed eight different interpersonal styles, which were later confirmed with an American sample of secondary school teachers. The present study investigated the extent to which typologies found in earlier studies also apply to a sample of Australian secondary school science teachers. Data were first checked to examine whether the eight profiles found in The Netherlands and the USA were also present in the Australian data. A cluster analysis using various clustering methods and procedures was used to determine Australian typologies and compare these with earlier Dutch findings. Results of the cluster analyses were verified by analyses of variance, by plotting QTI scale scores graphically, and by presenting a set of sector graphics to two independent researchers and having them sort these into different profiles as found in the statistical analyses. The resultant typologies and implications for professional development and research are presented.

1. RATIONALE

Almost everyone has had some sort of experience with teachers as a student in a school. These experiences lead to individuals developing an understanding or perception of how they see their teachers and what type of teacher that person is in relation to other teachers. A person's experience can be expressed in simple terms such as "I like this teacher", or in more complex terms that take into account a more longitudinal perspective of the experiences that a person has had when communicating with a teacher over time. In both cases, teaching is about communication.

For the last two decades, scholars in the domain of learning environments research have been involved in conceptualising students' and teachers' perceptions of the teacher in terms of the interpersonal relationship between teachers and students (e.g. Fraser, 1998; Wubbels & Brekelmans, 1998). Not only has this research shown that many (beginning and experienced) teachers are confronted with problems that relate to the teacher–student

relationship in the classroom (e.g. Veenman, 1984; Wubbels & Levy, 1993), but it has also been demonstrated that students' perceptions of this relationship are strongly related to their educational outcomes, such as subject-related attitudes and cognitive achievement (Brekelmans, Wubbels & den Brok, 2002; den Brok, 2001; den Brok, Brekelmans & Wubbels, 2004; Fraser, 1998; Henderson, Fisher & Fraser, 2000; Wubbels & Levy, 1993).

In order to stimulate teachers' professional development with respect to teacher–student relationships in directions that promote positive student outcomes and meaningful learning, instruments devised to measure students' (and teachers') perceptions can be very helpful. If teachers can compare their own views with those of their students or their own preferences, differences between each of these views can provide interesting clues for guiding changes in behaviour (den Brok, Brekelmans, Levy & Wubbels, 2002; Fisher, Fraser & Cresswell, 1995; Fisher & Rickards, 2000). Teacher reflection on their own and their students' perceptions of teaching can be further enhanced if information containing these perceptions is presented in various ways (Wubbels, 1992). Images or profiles are one of these alternative ways of presenting such information, together with written information about item, scale or (higher-order) dimension scores. Images and profiles are powerful tools for reflection because they can be used to conceptualise complex and interrelated information (as is the case with the teacher–student relationship), because they can summarise information into (smaller) chunks that are easier to comprehend, and because they can stimulate associations and links within teachers' own knowledge if they are accompanied with powerful labels (e.g. Copeland, Birmingham, de la Cruz & Lewin, 1993; Weber & Mitchell, 1996; Wubbels, 1992).

To measure perceptions of teacher–student interpersonal behaviour, Wubbels and his colleagues (Wubbels, Créton & Hooymayers, 1985, 1987) designed a questionnaire named the Questionnaire on Teacher Interaction (QTI). The QTI has been used in both research on teaching and learning environments and in teacher professional development (den Brok, Brekelmans et al., 2002). Moreover, research with the QTI has shown that teacher–student communication patterns remain relatively stable in classrooms (Wubbels et al., 1985; Wubbels, Brekelmans & Hermans, 1987; Wubbels & Levy, 1993) and that these patterns are distinct and take typical recognisable forms (e.g. Wubbels, Brekelmans & Hermans, 1987; Wubbels & Levy, 1991). Based on this research, a typology of interpersonal teaching styles was developed (Brekelmans, Levy & Rodriguez, 1993). Eight distinct interpersonal profiles were found and named Directive, Authoritative, Tolerant/Authoritative, Tolerant, Uncertain/Tolerant, Uncertain/Aggressive, Repressive and Drudging (further information on these eight types can be found in the third section of this article). These eight profiles consistently appear with both American and Dutch samples of teachers (e.g. Wubbels &

Brekelmans, 1998). Using classroom observation, each of these styles was further described in terms of typical student and teacher behaviour (e.g. Levy, Rodriguez & Wubbels, 1992; Wubbels, Brekelmans & Hermans, 1987).

Our study was conducted with several goals in mind. First, apart from a typology by Fraser (1986) and the typology of interpersonal teaching styles described above, little research has been reported on typifying learning environments. Research examining the cross-cultural validity of such styles or profiles is even less common. Also, while the typology of interpersonal teaching styles has been validated for teachers in The Netherlands and the USA, there is no information with respect to its applicability to Australian teachers. Such information is likely to be very helpful if the QTI is being used (in Australia) in teacher professional development and/or teacher education programs. A validated typology also could provide powerful additional feedback to both teachers and researchers using the QTI in Australia. Therefore, this study investigated the extent to which the existing typologies from The Netherlands apply to Australian teachers and what types of interpersonal profiles appear to be present with a large sample of Australian secondary school science teachers.

2. TEACHER–STUDENT INTERPERSONAL BEHAVIOUR

Because teachers communicate in many ways, they naturally develop different types of relationships with students. Some other factors that can influence teacher behaviour are the nature of the school environment, its geographic location, the socioeconomic status of the school and its students, and the subject taught. Some teachers are business-like and others lenient. Some are distant and others friendly. To describe these characteristics more clearly, the communication model of Leary (1957) was adopted. Leary stated that communication could be described by two dimensions – a *Dominance/Submission* dimension and a *Cooperation/Opposition* dimension. Occasionally, the dimensions have been given different names by educators, such as 'status' and 'solidarity' (Brown, 1965), 'warmth' and 'directivity' (Dunkin & Biddle, 1974), or 'authority' and 'affiliation' (Slater, 1962).

Thus, the communication of both (or all) parties in an interaction can be described in terms of how cooperative they are (*Proximity*) and who is controlling the interaction and to what degree (*Influence*). Researchers subsequently applied the model to teaching (Wubbels & Levy, 1993). They built a paradigm which divided Leary's original two dimensions into the eight different sectors shown in Figure 1 to form the Model for Interpersonal Teacher Behaviour (MITB), thus demonstrating how the Leary model can be translated to the classroom.
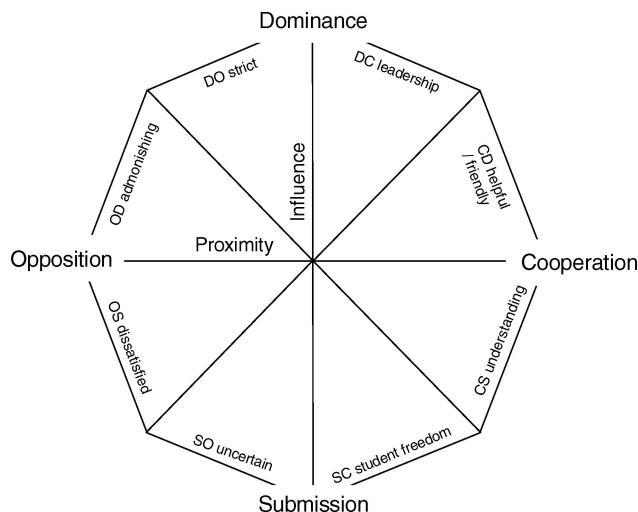
Figure 1. The model for Interpersonal Teacher Behaviour (Wubbels & Levy, 1993).

Figure 1 shows how the interactions described above can be represented in the model. The eight sectors are labelled DC, CD, etc. according to their position in the coordinate system (much like the directions on a compass). For example, the two sectors DC and CD are both characterised by Dominance and Cooperation. In the DC sector, however, the Dominance aspect prevails over the Cooperation aspect. Thus, a teacher displaying Leadership (DC) might be explaining something to the class or organising groups. The adjacent Helpful/Friendly (CD) sector includes behaviours of a more cooperative and less dominant character; the teacher might be seen assisting students, acting in a friendly manner or being considerate towards their students. The boundaries between sectors are not strict, as there is overlap between neighbouring categories as well as association between scales. For example, behaviour such as listening to students has both helpful/friendly and understanding characteristics. On the other hand, sectors opposite each other on the chart describe opposite behaviour (student freedom vs. strict, for example). These properties are typically confirmed when inter-scale correlations are examined (den Brok, 2001; Wubbels & Levy, 1991, 1993).

It is important to note that teachers can exhibit acceptable behaviour in each sector. There are situations in which it is appropriate for a teacher to be dissatisfied, or uncertain, or admonishing (or any other category). It appears that most teachers have communication styles with behaviours in every category.

To assess interpersonal teacher behaviour, the Questionnaire on Teacher Interaction (QTI) was designed according to the two-dimensional Leary

model and the eight sectors described above. The QTI was originally developed in The Netherlands and consisted of 77 items (Wubbels et al., 1985), a 64-item version was constructed in the USA in 1988 (Wubbels & Levy, 1991) and a 48-item version in Australia in 1993 (Fisher, Fraser & Wubbels, 1993). Items were formulated, based on large numbers of interviews with both teachers and students, and the construction process of the questionnaire included many rounds of careful testing (Wubbels & Levy, 1993).

The QTI has a 5-point response scale, ranging from Never/Not At All to Always/Very Often. It is scored on the basis of eight scales (that correspond to the eight sectors of the Model for Interpersonal Teacher Behaviour) and two summarising dimensions of Influence (DS) and Proximity (CO). The Dominance/Submission (DS) dimension is primarily comprised of behaviours in the sectors closest to the DS axis – Strict, Leadership, Uncertainty and Student Freedom (formerly Student Responsibility/Freedom). The sectors that mostly make up the Co-operation/Opposition (CO) dimension are Helpful/Friendly, Understanding, Dissatisfied and Admonishing. In Table I, typical items are provided for each of the eight scales of the QTI.

The QTI has acceptable reliability and validity when used in Grades 7–12 (Wubbels & Levy, 1993). A review of the validity and reliability of over 20 studies that have used the QTI over a period of 17 years (den Brok, 2001) showed that reliability of the eight scales (sectors) is sufficient and consistent across classes. The internal consistencies (Cronbach's alpha) at class level are generally above 0.80. The agreement between the scores of students in a single class met the general requirements for agreement between observer scores (Brekelmans, 1989; Brekelmans et al., 2002). The mean of the internal consistencies was 0.92 (Cronbach's alpha; students' scores in one class were considered as repeated measures). From a generalisability study (Shavelson, Webb & Burstein, 1986), it was concluded

TABLE I

Typical Items in the English Version of the QTI

Scale (sector)	Typical item
DC – Leadership	This teacher acts confidently.
CD – Helpful/friendly	This teacher is friendly.
CS – Understanding	This teacher is patient.
SC – Student freedom	We can influence this teacher.
SO – Uncertain	This teacher is hesitant.
OS – Dissatisfied	This teacher is suspicious.
OD – Admonishing	This teacher gets angry quickly.
DO – Strict	This teacher is strict.

(Brekelmans, 1989) that the QTI should be administered to at least 10 students in a class for the data to be reliable. However, the QTI does not need to be administered more than once per year, because interpersonal style remains relatively stable. A minimum of two classes should complete the questionnaire for each teacher to achieve a reliable measure of overall style (Brekelmans, 1989). Factor analyses on class means and LISREL analyses (Brekelmans, 1989; den Brok, 2001; Wubbels, Brekelmans & Hermans, 1987) revealed that the two-dimensional structure did indeed support the eight scales. Brekelmans (1989) demonstrated that both dimensions (or factors) together explained 80% of the variance on all the scales of the Dutch QTI. Similar results were obtained for the American version (Wubbels & Levy, 1991).

3. RESEARCH ON INTERPERSONAL TEACHING STYLES

Using data gathered with the QTI, researchers conducted cluster analyses (Everitt, 1980; Wishart, 1978) to derive a typology of interpersonal teaching styles (e.g. Brekelmans, Levy & Rodriguez, 1993; Wubbels, Brekelmans & Hermans, 1987). As noted previously, these interpersonal profiles have been labelled as Directive, Authoritative, Tolerant-Authoritative, Tolerant, Uncertain-Tolerant, Uncertain-Aggressive, Repressive and Drudging. The typology found was further validated by observations in classrooms showing qualitative differences between each of the eight types. A separate hand-sort of 'teaching profiles' (e.g. visual representations of scale scores on the QTI) conducted by the researchers involved (e.g. Brekelmans, Levy & Rodriguez, 1993) also resulted in a set of types similar to the one found by statistical analyses.

The eight types can be characterised by means of the two dimensions in the Model for Interpersonal Teacher Behaviour. The Authoritative, Tolerant/Authoritative and Tolerant profiles are patterns in which students perceive their teachers relatively high on the Proximity Dimension, with the Tolerant type lowest on the Influence Dimension. Less cooperative than the three previous types are the Directive, Uncertain/Tolerant, and Drudging profiles, with the Uncertain/Tolerant type lowest on the Dominance Dimension. The least cooperative pattern of interpersonal relationships is demonstrated by the Repressive and Uncertain/Aggressive types. Repressive teachers are the most dominant of all eight types.

In Figure 2, the types are characterised by means of graphic representations using the eight sections of the Model of Interpersonal Teacher Behaviour. The greater the shaded part in each section, the more the pattern of interpersonal relationships is characterised by this sector[1] (see Figure 1).
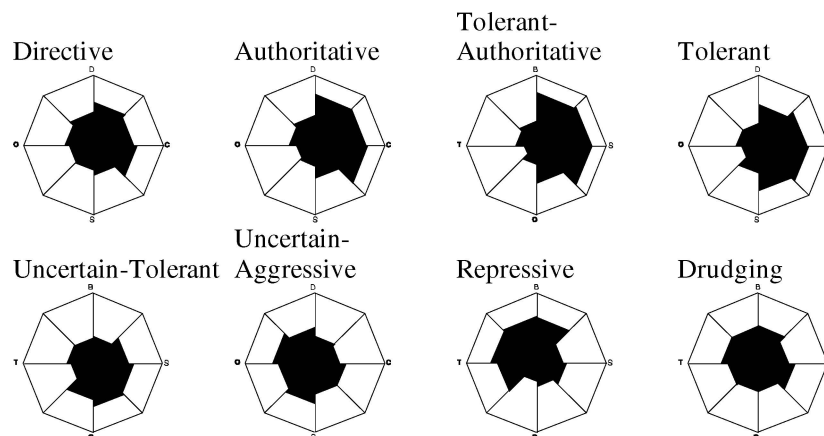
Figure 2. Graphic representations of the 8 types of patterns of interpersonal relationships.

Each of the eight types can also be described in terms of what can be seen in the classroom. These descriptions were based on videotaped lessons made in classes of teachers representing the whole range of interpersonal types. For example[2], the class of a Tolerant and Authoritative teacher is described as follows (Brekelmans, Levy & Rodriguez, 1993, p. 50):

Tolerant and Authoritative teachers maintain a structure which supports student responsibility and freedom. They use a variety of methods, to which students respond well. They frequently organize their lessons around small group work. While the class environment resembles that of an Authoritative teacher, the Tolerant-Authoritative teacher develops closer relationships with students. They enjoy the class and are highly involved in most lessons. Both students and teacher can occasionally be seen laughing, and there is very little need to enforce the rules. The teacher ignores minor disruptions, choosing instead to concentrate on the lesson. Students work to reach their own and the teacher's instructional goals with little or no complaints.

As to be expected, the class of an Uncertain/Aggressive teacher, one of the other types, is completely different (e.g. Brekelmans, Levy & Rodriguez, 1993, p. 51):

These classes are characterized by an aggressive kind of disorder. Teacher and students regard each other as opponents and spend almost all their time in symmetrically escalating conflicts. Students seize nearly every opportunity to be disruptive, and continually provoke the teacher by jumping up, laughing and shouting out. This generally brings a panicked over-reaction from the teacher which is met by even greater student misbehaviour. An observer in this class might see the teacher and student fighting over a book which the student has been reading. The teacher grabs the book in an effort to force the student to pay attention. The student resists because s/he thinks the teacher has no right to his/her property. Since neither one backs down, the situation often escalates out of control. In the middle of the confusion, the Uncertain-Aggressive teacher may suddenly try to discipline a few students, but often

manages to miss the real culprits. Because of the teacher's unpredictable and unbalanced behaviour, the students feel that s/he is to blame. Rules of behaviour aren't communicated or explained properly. The teacher spends most of his/her time trying to manage the class, yet seems unwilling to experiment with different instructional techniques. S/he prefers to think "first, they'll have to behave". Learning is the least important aspect of the class, unfortunately.

The eight interpersonal types have also been linked to student outcomes (Brekelmans, Wubbels & Levy, 1993). Repressive teachers, followed by Tolerant and Directive teachers, realised highest achievement. Lowest achievement was found in classes of Uncertain-Tolerant and Uncertain-Aggressive teachers. Highest motivation has been found in classes of Authoritative, Tolerant-Authoritative and Directive teachers, while lowest motivation occurred in classes of Drudging and Uncertain-Aggressive teachers. The pattern found for the Tolerant-Authoritative teachers approximates the image of the 'best' or 'ideal' teacher.

Because students' (and teachers') perceptions on the QTI comprise observations over a longer period of time, interpersonal styles (and as such the typology) are rather stable. Nevertheless, different profiles can be found in different classes of teachers (e.g. Wubbels & Levy, 1993) and teachers seem to change from type to type over their teaching career (e.g. Brekelmans et al., 2002). Major types during the student teaching period are the Tolerant and Tolerant/Uncertain profiles. Authoritative and Tolerant/Authoritative profiles can be found more often after 2 years of experience in teaching. Towards the end of the teaching career, the number of teachers with Repressive profiles increases. No differences in profiles have been reported between male and female teachers, or between teachers from different cultural origins.

The eight typical profiles originally found in Dutch samples were confirmed with a USA sample (Wubbels & Levy, 1993), and appeared to be similarly distributed over the population of teachers. However, the typology has not been validated with other samples or countries, which is one of the main reasons for conducting the present study.

4. RESEARCH QUESTIONS

- What distribution of interpersonal profiles (as used in prior research) can be found in a large sample of Australian secondary school teachers?
- To what degree is the Australian typology of interpersonal teacher behaviour (constructed specifically from a large sample of Australian secondary school teachers) similar to the interpersonal typology found in earlier research?

5. METHOD

5.1. *Sample and Instrumentation*

For the purpose of the present study, a large data set of 6148 Australian science students from Grades 8–10 and their 283 teachers was constructed. This is the largest database of student perceptions on the QTI in Australia to date. The set includes data from four states – Queensland, Victoria, Western Australia and New South Wales – and is sufficiently diverse to encompass the possible range of interpersonal behaviours to be found in Australia.

The Australian 48-item version of the QTI was used for this study. In order to make sure that the sectors and dimensions of the Model for Inter-personal Behaviour were adequately represented by the QTI, the reliability and validity of the instrument with this sample were carefully checked. Table II contains reliability coefficients (Cronbach's alpha) at both the student and class levels for each of the scales of the QTI, as well as multilevel intra-class correlation coefficients (Snijders & Bosker, 1999), which indicate the amount of variance at the class level compared to the total amount of variance present.

Class-level reliability coefficients for the QTI ranged from moderately strong (DO = 0.79; SO = 0.82) to strong (CD, CS = 0.93). Individual-level reliability coefficients ranged from somewhat moderate (DO = 0.62) to moderately strong (CD = 0.86). Intra-class correlations are around 0.20, indicating that the scales are sufficiently able to distinguish between different classes and teachers. Intra-class correlations are lowest for Dissatisfied (OS) and highest for Leadership (DC).

TABLE II

Reliability (Alpha Coefficient) of QTI Scales at the Student and Teacher Levels and the Intra-Class Correlation (ICC)

Scale	Alpha reliability		ICC
	Student ($N = 6148$)	Teacher ($N = 283$)	
DC – Leadership	0.81	0.92	0.26
CD – Helpful/friendly	0.86	0.93	0.25
CS – Understanding	0.83	0.93	0.23
SC – Student freedom	0.65	0.85	0.21
SO – Uncertain	0.69	0.82	0.18
OS – Dissatisfied	0.79	0.90	0.15
OD – Admonishing	0.77	0.86	0.24
DO – Strict	0.62	0.79	0.17

The construct validity was investigated in a number of ways. First, an exploratory factor analysis (maximum likelihood, rotation by hand; e.g. den Brok, 2001) was conducted on the (aggregated) QTI scale scores in order to see whether two dimensions (or factors) were present in the data. This analysis indicated that two factors with eigenvalues larger than 1.0 could be extracted. These factors resembled the two interpersonal dimensions and explained 75% of the variance. The first factor explained 58% of the variance and the second factor explained an additional 17%.

Second, correlations were computed between scales at the class level (these can be found in Table III). This correlation matrix was then investigated for its circular structure by computing a *Correspondence Index* (with the RANDALL software; Tracey, 1994; Tracey & Schneider, 1995). The Correspondence Index indicates to what degree and with what level of probability a correlation matrix corresponds to the circumplex (e.g. circular) structure of the model for interpersonal behaviour. If a circumplex model applies to the data, correlations should be highly positive for neighbouring scales, decreasing as one moves around the model scales until they become highly negative with scales on the opposite end of the interpersonal circle (Gurtman & Pincus, 2000). The CI for this study was 0.74 ($p = 0.0004$), indicating that for the present sample – in terms of the correlational structure – a circular ordering applies to the scales of the QTI.

To further explore whether the MITB (Model for Interpersonal Teacher Behaviour) applied to the data, multilevel confirmatory factor analyses (with Mplus) were conducted. Two models were tested, an ideal interpersonal circumplex model (e.g. Fabrigar, Visser & Browne, 1997; Gaines et al., 1997) which exactly represents Figure 1, and an irregular circumplex

TABLE III
Scale Intercorrelations for the QTI at the Teacher Level

Scale	DC	CD	CS	SC	SO	OS	OD	DO
DC – Leadership	1.00							
CD – Helpful/friendly	0.82*	1.00						
CS – Understanding	0.82*	0.89*	1.00					
SC – Student freedom	−0.00	0.38*	0.29*	1.00				
SO – Uncertain	−0.74*	−0.52*	−0.55*	0.32*	1.00			
OS – Dissatisfied	−0.70*	−0.75*	−0.79*	−0.02	0.62*	1.00		
OD – Admonishing	−0.56*	−0.69*	−0.78*	−0.13	0.49*	0.84*	1.00	
DO – Strict	−0.07	−0.42*	−0.38*	−0.60*	−0.15*	0.35*	0.48*	1.00

$N = 283$.
$^*p < 0.05$.

model (a model with two, independent dimensions and free factor load-ings, e.g. Fabrigar et al., 1997; Gaines et al., 1997). The ideal circumplex model, specifying scale positions exactly as shown in Figure 1, displayed reasonable fit ($\chi^2 = 608.74$ with $p = 0.000$; CFI $= 0.97$; TLI $= 0.93$; RMSEA $= 0.06$ and SRMR $= 0.17$ for the between level). While some of these model fit indicators suggested acceptable fit (e.g. CFI was above 0.95 and RMSEA close to 0.05), others indicated that the model fit could be improved (TLI was below 0.95; SRMR above 0.05). Moreover, in the ideal circumplex model, most of the structural relations between variables indicated high amounts of unexplained variance, which is another sign that the model tested could be improved. The model fit for the irregular circumplex model was sufficient ($\chi^2 = 239.94$ with $p = 0.000$; CFI $= 0.99$; TLI $= 0.95$; RMSEA $= 0.05$; SRMR $= 0.05$ for the between level). Thus, a model with two uncorrelated factors (e.g. the interpersonal dimen-sions) and free factor loadings (e.g. interpersonal sectors were allowed to deviate from their positions as hypothesised in Figure 1) seemed to fit to the data.

Factor loadings of the irregular model (representing 'dimension posi-tions') are graphically displayed in Figure 3. It appears that the Model for Interpersonal Behaviour applies to the sample to a large degree, as scales seem to follow a circular ordering and are represented by two independent dimensions. Some of the scales displayed dislocation compared to their theoretically-hypothesised positions, particularly CS and OD, which had moved counter-clockwise considerably.
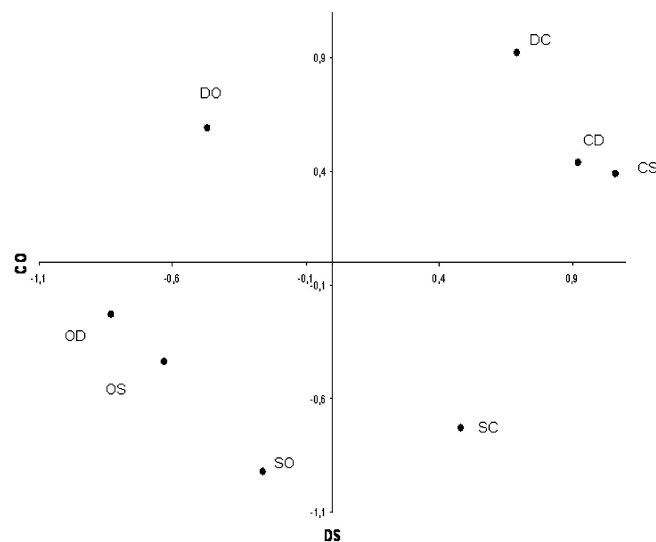

Figure 3. Graphical representation of the factor loadings for QTI scales.

The validity and reliability for the present sample seem to align well with previous findings investigating these properties for the QTI (e.g. den Brok, 2001; Wubbels & Levy, 1993).

5.2. *Analyses*

In order to answer the research questions, a number of analyses were performed. First, using SPSS, it was determined which of the eight existing interpersonal profiles best resembled the classes of each participating teacher. In this way, it could be established what kind of distribution of (earlier constructed) interpersonal types was present in our sample. If this distribution is different from those found in the USA and The Netherlands, this might be an indication of weak applicability of the existing interpersonal typology to the Australian context.

Second, to create a specific typology for the Australian sample of teachers we performed a cluster analysis. We felt that it was important to keep our analyses similar (where possible) to the analyses conducted for the original typology (Brekelmans, 1989), in order to rule out methodological causes for possible differences in results. According to Brekelmans (1989), it is important in the construction process to look for differences between types with respect to the magnitude within each of the eight sector scores (elevation), with respect to variance in the sector scores (scatter), and with respect to the overall pattern displayed in the sector scores (shape). She therefore suggested using the 'complete linkage' method to group classes and the 'similarity ratio' to determine whether a class belongs to a specific type. Because Brekelmans used CLUSTAN, while our study used SPSS, which lacks the similarity ratio, it was decided to use 'squared Euclidian distances' instead, as this method best approximated the similarity ratio used in Brekelmans' study. To compare the outcomes of the cluster analysis to those of Brekelmans' study, we calculated the percentage of pairs of units that were classified in the same cluster in both analyses.

Third, outcomes of the cluster analysis described above were verified. An analysis of variance (ANOVA) on the eight sector scores with the constructed typology as the explanatory variable was used to check if sufficient amounts of variance could be explained by the cluster outcomes. By doing so, the optimal cluster solution (in terms of the number of types) could be established. In order to interpret findings, outcomes of the Australian classification were also represented graphically in terms of the eight sector or scale scores.

Fourth, for each teacher present in the sample, a graphical display was made of the resulting QTI profile. These profiles were sorted into groups that – according to the researchers – seemed to be similar. The result of

this sorting was compared to the outcomes of the cluster analyses in order to further check the validity of the outcomes.

6. RESULTS

Frequency distribution for the existing typology are presented in Table IV. As can be seen, more than 85% of the teachers could be classified as either being Directive, Authoritative or Tolerant/Authoritative. Uncertain/ Tolerant, Uncertain/Aggressive and Repressive teachers were hardly present in the Australian sample.

While all teachers could be classified as belonging to one of the previously-found profiles, the typology explained between 30.7% (Student Freedom) and 80.4% (Helping/Friendly and Understanding) of the variance in scale scores. In terms of the two interpersonal dimensions (based on the eight scales), the existing typology could explain 31.8% of the variance in influence and 85.4% of the variance in proximity.

When comparing the percentages in the Australian sample with those of Brekelmans' study, it seems there are more Authoritative and Tolerant/Authoritative teachers in the Australian sample, while the Dutch/USA sample contains more Tolerant, Uncertain/Tolerant and Uncertain/Aggressive teachers. If these findings resemble sampling differences, differences in QTI versions or cultural differences cannot be determined in this study.

To determine whether class scale scores for the present sample lead empirically to a similar or different typology as the one found for the

TABLE IV

Frequency of Occurrence for Original Types in the Australian and Dutch Samples

Interpersonal type (original)	Australian sample		Dutch sample[a]
	Frequency	%	%
Directive	44	15.5	18.2
Authoritative	106	37.5	14.9
Tolerant-authoritative	96	33.9	10.4
Tolerant	17	6.0	23.5
Uncertain-tolerant	4	1.4	15.3
Uncertain-aggressive	3	1.1	6.5
Repressive	2	0.7	3.2
Drudging	11	3.9	0.3
Total	283	100.0	100.0

[a]Brekelmans et al. (1993).

TABLE V

Frequency of Occurrence of Teachers in
terms of the New Cluster Solution

Cluster type (new)	Frequency
Type 1	89
Type 2	115
Type 3	6
Type 4	43
Type 5	15
Type 6	7
Type 7	8
Total	283

Dutch and American teachers, a cluster analysis was performed (see Analysis section). This analysis, using Squared Euclidian Distances to classify teachers and Complete Linkage as a grouping procedure, indicated that the best and most distinctive typology consisted of seven types of teachers. Table V contains a frequency distribution of teachers according to each of the seven types found in the cluster analyses, which are graphically displayed in Figure 4. As can be seen in Table V, Type 1 (89 teachers), Type 2 (115 teachers) and Type 4 (43 teachers) are found most often. An analysis of variance (ANOVA), using the cluster solution to explain variance in QTI scale scores, showed that the clusters were able to account for a large amount of the differences in QTI scale scores between teachers. Roughly between 30% (Student Freedom) and 80% (Helpful/Friendly) of the differences could be explained. This means that the cluster solution can be regarded as an adequate representation of the variation in interpersonal behaviour found in our sample.

A visual comparison of the graphical profiles of the Brekelmans' typology (Figure 2) and the Australian typology (Figure 4) indicates that four of the profiles in both typologies could be classified as similar. Looking at the graphical patterns as displayed in Figure 4, these teachers in both samples could be classified as Tolerant/Authoritative (Australian Type 1), Authoritative (Australian Type 2), Directive (Australian Type 4) and Uncertain/Aggressive (Australian Type 7). In total, 73.1% of the teachers in the Australian sample belonged to one of these four types.

Three types of teachers (Types 3, 5 and 6 in Figure 4) could not be labelled easily, because their patterns deviated somewhat from the original Dutch/USA typology. The third type contained similar amounts of leadership, helping/friendly, and understanding behaviours as the Authoritative (or Tolerant-Authoritative) type, but also contained a high amount of strict
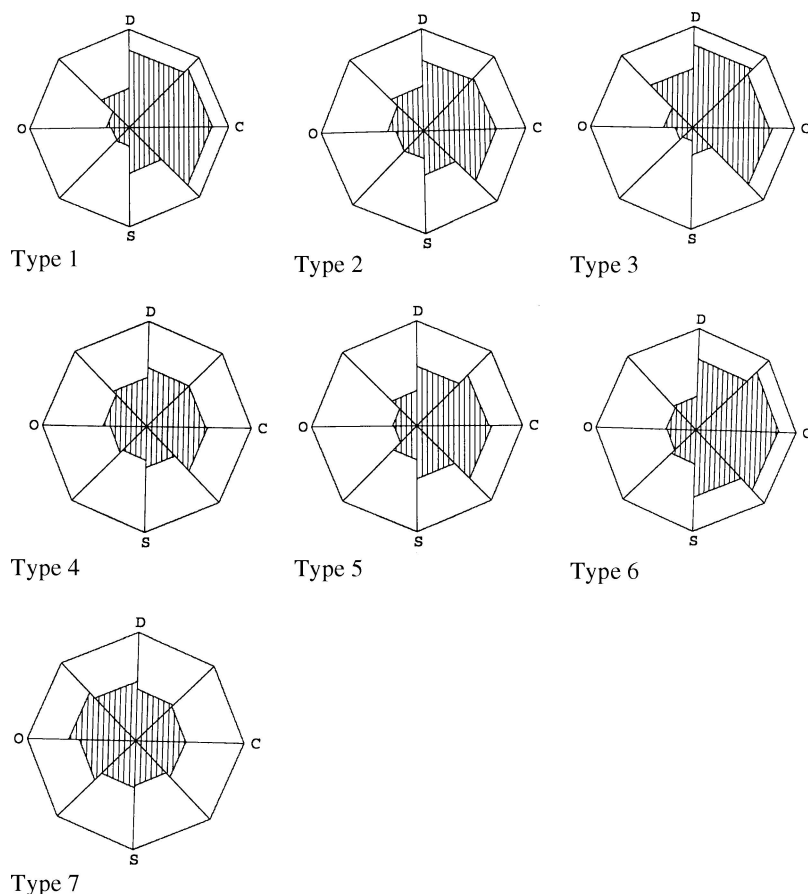
Figure 4. Graphical depiction of the sample cluster solution in terms of the eight QTI scales.

behaviour and gave a relatively small amount of freedom to the students. However, given the low degree to which admonishing, dissatisfied and uncertain behaviours were present in this type, it could not be classified as Repressive. Because this type seemed to combine characteristics of both the (original) Directive and Authoritative types, it was labelled as Directive-Authoritative. The fifth and sixth types were similar pattern-wise. However, while both types contained relatively high amounts of helpful/friendly and understanding behaviours, together with some leadership and student freedom behaviours (and low amounts scored in the other sectors), this was particularly true for the sixth type. Therefore, the sixth type of teacher was labelled as Flexible, while the fifth type was labelled as Cooperative (or Supportive). The fifth type resembles the Tolerant teacher of the Dutch typology best, but gave less student freedom. The sixth type also resembles

the Tolerant teacher best, but contains much more leadership. They are both different from the Dutch/USA Uncertain-Tolerant teacher because they contain less uncertain behaviour, but are different from the Tolerant-Authoritative teacher because they give more freedom to the students (in case of the sixth type) or less leadership behaviour (in case of the fifth type).

7. Discussion

This study investigated whether an existing typology of interpersonal communication styles developed in The Netherlands and the USA (Brekelmans, Levy & Rodriguez, 1993) applies to an Australian sample of secondary school teachers. While all existing types were located in the Australian sample, results nevertheless suggest that the existing typology only partially applies to the Australian context.

It seemed that several profiles were less common in the Australian sample, such as the Tolerant, Uncertain-Aggressive and Uncertain-Tolerant types, whereas other profiles were much more common, such as the Authoritative and Tolerant-Authoritative types. These findings reflect a lower presence of uncertainty in Australian teachers' behaviour. Compared with the USA and The Netherlands, interpersonal communication between teachers and students in the classroom in Australia might be characterised as having a higher degree of respect and formality in some schools. The idea of a 'fair go for all' in the classroom and the development of a mutual respect in communication patterns could account for some of the differences compared with the Dutch and USA samples.

Using cluster analysis, this study was able to identify a new Australian typology. It was created and compared with the existing Dutch/USA typologies. The results of this analysis provided support for the existence of a relatively replicable typology of seven distinct interpersonal patterns. This again confirmed that earlier classifications only partially applied to the Australian situation.

Four out of the seven types in the Australian sample resembled the types identified earlier to such a degree that they were considered similar: Tolerant-Authoritative (Type 1), Authoritative (Type 2), Directive (Type 4) and Uncertain-Aggressive (Type 7). One type seemed to be a clear-cut combination of two existing types and was labelled as Directive-Authoritative (Type 3). The two remaining types seemed unique to the Australian context and were labelled as Flexible (Type 6) and Cooperative-Supportive (Type 5). The two new types were characterised by high amounts of helpful/friendly and understanding behaviours, and moderately high amounts of both leadership and student freedom behaviours. Thus, both of these

types of teachers are able both to display leadership and to provide opportunities for students to have freedom, depending on the situation. These types seem to be particularly relevant in learning environments that require much independent and self-directed learning by students.

While the findings of this study seem to indicate that additional styles might be necessary to describe the interpersonal climate in Australian classes, future research is needed to verify these findings. No explanation could be provided or was sought in this study for the emergence of new teacher styles. Therefore, alternative explanations associated with cultural differences could not be ruled out.

One such alternative cause for differences in the outcomes of this study and other international studies might lie in the sampling procedure. In The Netherlands (and the USA), typologies were constructed using data of one large school with all teachers and their students participating. This study used a sample of voluntary teachers from a large number of schools in four Australian states.

Another cause for differences in the typologies could be specific characteristics of teachers or their students that were not taken into account in this study. Earlier work with the QTI has shown that students' perceptions of their teachers are related to characteristics of themselves (e.g. gender, age, report card grade, and ethnic background), as well as characteristics of the teacher and class (e.g. class size, teacher gender, teacher experience, and teacher ethnicity) (den Brok, Levy, Rodriguez & Wubbels, 2002; Levy, den Brok, Wubbels & Brekelmans, 2003; Rickards, 1998). Depending on the distribution of these characteristics, perceptions in terms of QTI scales or dimensions, and therefore types might differ and cause possible differences with respect to earlier work on typologies.

A third alternative explanation might lie in the use of different versions of the QTI: whereas the Australian version (Fisher et al., 1993) consisted of 48 items, the American version consisted of 64 items (Wubbels & Levy, 1991), and the Dutch version had 77 items (Wubbels et al., 1985). Though the 48 items of the Australian version are present in all versions of the QTI, the extra items could have exerted undue influence over the final findings for typologies in other countries.

The outcomes of this study are important for both researchers and teachers. For teachers, the typologies can be used as a feedback tool and a personal means of comparison between peers and between earlier self-administration of the QTI in order to explore changes over time and perhaps subjects taught. For professional development, teachers not only can compare their own perceptions with their ideals or the perceptions of their students (e.g. den Brok et al., 2002), but they can also compare their own perceptions or those of their students with each of the different types to see with which typologies they fit best. Typologies have the advantage of

being able to provide an instant picture of teaching against known groupings and summarise the learning environment in just one word, rather than in terms of several scales or many items. This makes them particularly practical and suitable for teacher self-reflection. The results of this study show that there are several teaching styles containing both high amounts of Influence and Proximity, which are properties which previously have been associated with cognitive and affective student outcomes. Nevertheless, distinctive differences exist between each of these styles, which range from authoritative to flexible, and teachers and educators should develop sensitivity and skill in distinguishing between them. Such competencies could help in providing more detailed and adequate feedback to teachers, and help them in showing teachers that there are several ways to achieve their goals in the classroom.

Also, student motivation and achievement could be linked with the various profiles, as well as other variables (see the section describing research on interpersonal communication styles). In this way, schools and teachers are provided with benchmarks to help them in determining their own goals and policy, as well as their vision of teaching. For example, those profiles that have been found to be more closely associated with more positive student outcomes could be used in conjunction with teacher ideal perceptions for a particular classroom to guide professional development for that teacher.

For researchers and teachers alike, it is important to verify the stability of these findings and to provide more suggestions and explanations for differences compared with the results of earlier work. Such research should also include qualitative data, such as interviews and observations of both teacher and student participants, in order to provide descriptions for newly found types and to validate the labels attached to them. Moreover, such observations could also verify descriptions of existing types that have been found to apply to the Australian setting. While profiles might be similar in different cultures, it might very well be that they are based on different behaviours and situations, or inferred from different observational cues. A validation of these factors is currently under way in the Australian context by the authors.

NOTES

1. These graphic representations are achieved by shading in each sector of the model of interpersonal teacher behaviour. The ratio of the length of the perpendicular bisector of the shaded part and the length of the perpendicular bisector of the total sector equals the ratio of the observed score and the maximum score for that sector.
2. We only provide two sample descriptions here. For a description of all the eight types, we refer to Brekelmans, Levy & Rodriguez (1993).

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