# Interpersonal Behavior: More vs. Less Favorable Teachers*

**Hajar Ghafarpour** (Corresponding Author)

*Department of English Language Teaching, University of Isfahan, Isfahan, Iran.*

Ghafarpour.hjr@gmail.com

**Ahmad Moinzadeh**

*Department of English Language Teaching, University of Isfahan, Isfahan, Iran.*

moin@fgn.ui.ac.ir

## Abstract

Classrooms can be regarded as dynamic systems in which behaviors of teachers and students affect each other mutually and in a spiral manner. In this study it was intended to investigate differences in interpersonal behaviors of a more vs. a less favorable teacher at micro- and macro-levels. To analyze classroom interaction dynamically and in real-time, State Space Grid technique was applied. On the macro-level, teacher profiles were determined based on vector method. 211 students of six classes rated the behavior of their own teacher and an imaginary ideal one. One teacher who was closest to and one farthest from that ideal were identified and their classes were video-taped. Two raters coded behaviors with a joystick and then content and structure of interaction were analyzed. Differences on the micro-level were especially noticeable in the strength of attractors, not in their position. Structurally, the behavior of the more favorable teacher had higher variability and less predictability. On the macro-level, the more favorable teacher had Authoritative, and the less favorable one had Directive profiles. The results of this study can be used in promoting interactive ground of the class and in teacher education programs.

**Introduction**

Teacher-student interaction is a key asset in the quality of teaching and learning since effective classroom interactions enhance students' achievement and motivation (Maulanaa, Opdenakker, den Brok & Bosker, 2011; Nugent, 2009; Passini, Molinari & Speltini, 2015; Urhahne, 2015; Wei & Onsawad, 2007; Wubbels & Brekelmans, 2005). To delineate various interpersonal behavior of teachers, the Model for Interpersonal Teacher Behavior (MITB) can be applied. It is an orthogonal model consisting of two basic dimensions of agency and communion represented as two axis of a coordinate system. Agency or influence (presented on the *y* axis) indicates the extent to which teachers exert influence on students (Dominance) or are passively influenced by them (Submission). Communion or proximity (presented on the *x* axis) points at the extent to which teachers can establish rapport with their students, seeking cooperation (Affection) or conflict with students while interacting (Hostility). The two dimensions underlie eight types of teacher behaviors. Figure 1 provides an overview of typical teacher behaviors. In literature, various terminologies have been attributed to these dimensions (Bruckmüller & Abele, 2013; Wubbels, Brekelmans, den Brok & van Tartwijk, 2006). Here, the terms steering, friendly, understanding, complying, uncertain, dissatisfied, reprimanding and enforcing are used.
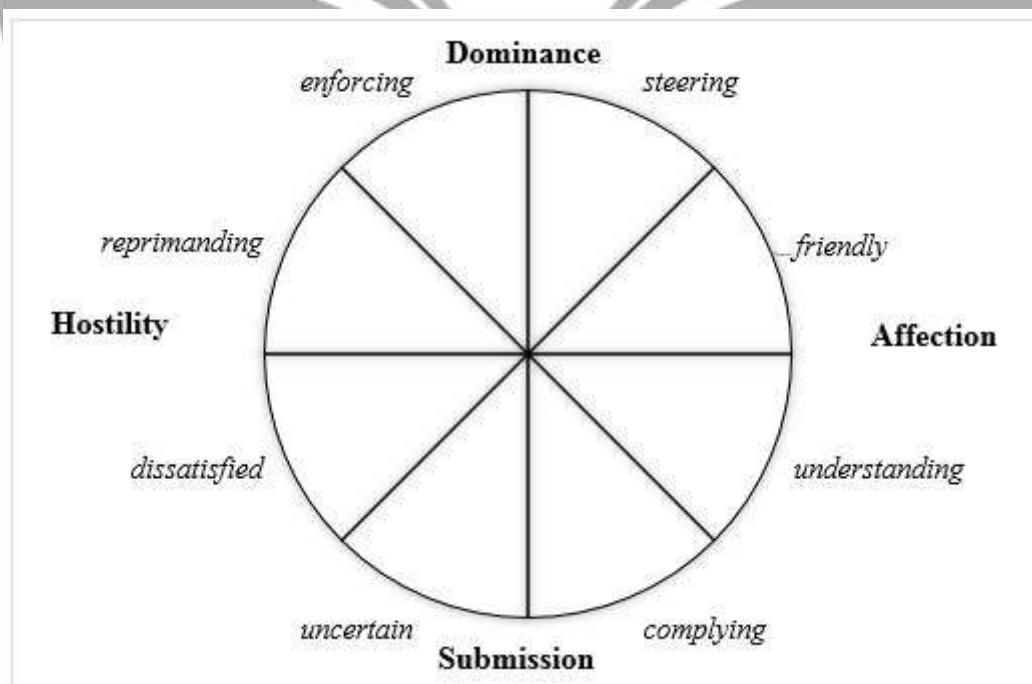


**Figure 1.** Model for Interpersonal Teacher Behavior

A particular combination of these eight scale scores make teachers' interpersonal profiles or typologies. These profiles have been named Directive, Authoritative, Tolerant/Authoritative, Tolerant, Uncertain/Tolerant, Uncertain/Aggressive, Repressive and Drudging. The graphical presentation of these typologies, alongside with relevant teacher traits and effects on students' achievement and motivation are presented in table 1, based on den Brok, Taconis and Fisher (2010).

Attempts in describing optimal teacher-student interaction which can ultimately lead to effective teaching, have usually lead to fragmented descriptive studies (Pianta, 2016). Much of

literature on classroom interaction used to be centered on specific behaviors of teachers, counting how frequently each behavior occurred and then providing a description of effective teaching by combining discrete behaviors (Tuckman, 1995). However, an alternative approach is studying the interaction process in real time, through microgenetic research; here, the class is regarded as a dynamic system in which interaction develops and changes over time (O'Connor, 2010; Pennings & Brekelmans et al., 2014; Pennings & van Tartwijk et al., 2014; Roorda, 2012).
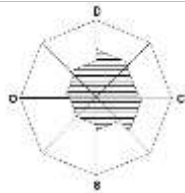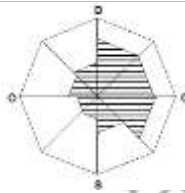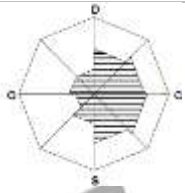
| Directive | Authoritative | Tolerant/ authoritative | Tolerant |
|---|---|---|---|
| *Key words* Well srtuctured; Task-oriented; high standards; occasionally friendly S. attitudes: moderate S. achievement: high | *Key words* Well srtuctured; Task-oriented; personal interest in students; lecture S. attitudes: high S. achievement: high | *Key words* Student freedom/ reponsibility; occasional laughing; variety of methods S. attitudes: high S. achievement: high | *Key words* Disorganized; students have some real power; individual work S. attitudes: moderate S. achievement: high |
| Uncertain/ Tolerant | Uncertain/ Aggressive | Repressive | Druging |
| *Key words* Unstructured; not task oriented; cooperative S. attitudes: moderate S. achievement: low | *Key words* Disordderly; not task-oriented, unbalanced teacher behvaior; aggressive S. attitudes: low S. achievement: low | *Key words* Structured but not well organized; uninvolved docile students; unpleasant S. attitudes: low S. achievement: high | *Key words* Teacher continuously struggles to manage the class; neither enthusiastic nor supportive nor competitive S. attitudes: low S. achievement: moderate |

**Table 1. Teacher typologies (den Brok et al., 2010; page 46)**

Interactions among people is dynamic and develops over time; actually, one of the basic assumptions of interpersonal theory is that interactions are never linear but always nonlinear and cyclical (Kenny, Kashy & Cook, 2006). According to Complex Dynamic System (CDS) theory, interactions take place on hierarchical time-scales of micro-, meso- and macro-levels (Hollenstein, 2013). In micro-level time scale, interactions occur and develop in real-time, i.e. every moment; in meso-level time scale interactions occur from hour to hour; and finally in macro-level time scales interactions happen in developmental time like month to month or year to year. Students' general impressions about their teachers' behaviors, gained after several sessions, can inform macro-level interactions. After each session, they may have an idea about their teacher's behavior which can be investigated at meso-level and finally, in each session impressions can be made at every instance that can be revealed by micro-level analysis.

To analyze real time interaction Space State Grid (SSG) technique can be applied. State space is the space of all *possible* states of a system, here the classroom, that is presented as a two dimensional grid. Each cell on the grid represents a possible state of the system. Sequence of states or changes of states of a system in time can be plotted in SSG which is called a trajectory. CDS theorists use two main characteristics of SSG to analyze real time interaction: *content* and *structure*. Content of the real time behavior is conceptualized in terms of attractors. Attractor is an absorbing state. It is the behavior which *pulls* the system from other states and consequently it has higher number of visits. Interaction is resistant against changes when there is an attractor. The other main characteristic of dynamic systems is structure that is the process of change and transformation of states. Actually, structure is the dynamics of a system (Hollenstein, 2013).

One of the studies which explored how SSG can be employed to map teacher-student interaction was by Mainhard, Pennings, Wubbels and Brekelmans (2012). They analyzed the content and structure of two secondary school classrooms which had contrasting social climates, i.e. a classroom with a more positive climate as indicated by higher levels of teacher control and affiliation and a classroom with poorer climate as indicated by lower control and affiliation. These were based on the perceptions of students assessed via a questionnaire called Questionnaire on Teacher Interaction (QTI). The results of this study indicated that undesirable interactions appeared to feature weaker attractors and higher variability. Considering variability not as noise but as an indicator of interaction quality, they aimed at exploring the value of variability in describing classroom interaction. They came up with the result that there was more variability in the classroom with poorer climate. This was specially caused by more frequent and less favorable interactions.

To see whether there are differences in the content and structure of real-time interpersonal behavior of teachers, Pennings (2017a) and Pennings and Brekelmans et al. (2014) used a CDS approach. They identified eight teachers with different interpersonal profiles. With respect to the content, they found the expected differences between teachers and a correspondence between the micro- and macro- level analysis. They further claimed that measuring the content of interaction in only a couple of minutes (micro-level analysis) can possibly discriminate teachers in the same way as the general perception of students (macro-level analysis). Regarding structure, it was found that teachers with lower levels of agency and communion have higher variability in real time behavior. They also concluded that in real time interactions difference between teachers are less than difference between situations which means that teachers interact nearly similarly but their reactions may differ depending on the situation. This implies that when comparing variability in interactions, it is better to take the situation and context into account.

Characterizing interaction based on interpersonal content, structure and complementarity, Pennings and van Tartwijk et al. (2014) studied two teachers with distinct teacher student relationships. These teachers were selected based on the scores the students gave them through the questionnaire on teacher interaction. Accordingly, one teacher was characterized by high agency and low communion and the other by low agency and high communion. They used a joystick device to measure teacher-student interaction based on agency and communion.

Results indicated that interpersonal content and complementarity discriminated between teachers whereas interpersonal structure did not.

Pennings and Mainhard (2016) took a process oriented approach to analyze teacher student interaction using State Space Grid technique through which an analysis of moment-to-moment or real time classroom interaction was made possible. They concluded that the classroom climate will be more favorable when there is a moderately high level of agency and communion attractors and the interaction gets more variable or chaotic when it diverts from these more favorable states.

Teacher-student's real-time interpersonal behaviors can fit together and relate to the teacher's interpersonal style. Pennings (2017b) performed a case study in which she identified two teachers with distinct interpersonal style, one helpful and one struggling. It was found that contrary to the interactions of the struggling teacher, those of the helpful teacher largely followed the complementarity principle; i.e. the behaviors of teacher and students fit well together.

Ghafarpour, Moinzadeh and Eslamirasekh (2018) found that among the eight scales of teachers' interpersonal behavior, students' motivation is significantly and positively correlated with the friendly scale, and significantly and negatively correlated with dissatisfied, and reprimanding scales. In a further study, Ghafarpour and Moinzadeh (2019), relying on CDS, found that, compared with teachers' agency, communion has a somewhat stronger effect on students' motivation. Additionally, interpersonal behaviors of a more and less experienced teacher were compared and it was demonstrated that the behavior of the more experienced teacher was more predictable.

In a recent study by Pennings and Hollenstein (2019) it was found that more and less favorable teachers could be discriminated via variability but not by the predictability of their behavior. That is somehow in contrast with previous research (Pennings & van Tartwijk et al., 2014). Authors provided some explanations. First, less favorable teachers change their behaviors but these changes are in predictable patterns. Therefore, predictability of the behavior of less favorable teachers does not differ significantly from those of more favorable teachers. Second, only the first ten minutes of the class were observed. Maybe the class beginning is more predictable and hence observing more of a class will be more illuminating.

The purpose of the present study was to investigate and compare interpersonal behaviors of two teachers who were identified as less and more favorable based on teacher evaluation scores and a questionnaire, at macro- and micro-level. At macro-level, typologies of these two teachers were determined and at micro-level, their classes were considered to be dynamic systems in which interactions developed over time and were approached in terms of content and structure. Of the main concern is to see whether these two teachers differ with regard to predictability in their behaviors. It is hypothesized that the interpersonal behavior of the less favorable teacher has more variability and less predictability and features weaker attractors which are lower in agency and communion.

## Method
## Participants

Two teachers were selected for the micro-level, qualitative analysis. The rationale for choosing them lies firstly on their scores for teacher evaluation and secondly on a questionnaire filled by students. The teacher evaluation is administered each semester by the university and done by the students. There were thirty teachers teaching general English course at university level. To ensure a fair selection of cases, three teachers with the highest and three with the lowest scores were chosen. The questionnaires were given to students of these six teachers at the end of the semester and 211 questionnaires were returned. There were between 25 and 35 students in each class and the age range of students was 18-26. The age range of teachers was 25-50 and they had at least five years of experience of teaching similar courses. They were both male and female students and teachers. Questionnaires were filled at the end of the semester so that students can have a better general perception of the interpersonal behaviors of their teachers. Classes were video-taped in a session when teachers were teaching reading comprehension.

## Instruments

Questionnaire on Teacher Interaction (QTI) was used to find out which teacher is closest to and which one is farthest from the imaginary ideal teacher. In order to analyze interpersonal behavior on micro level a joystick and a program for numerical recording of behavior, called Joymon, were employed. Then, the coded data were plotted on space state grids, using Gridware tool.

### *Questionnaire on teacher interaction (QTI)*

QTI is a well-established questionnaire which measures students' perceptions of teachers' interactive behavior. These perceptions are formed after several sessions. The version used in this study consists of 48 items, divided into eight scales corresponding to the eight behavior types. Examples of QTI items are: 'This teacher talks enthusiastically about her/his subject', 'This teacher trusts us' and 'This teacher seems uncertain'. The items are to be rated on a five-point Likert scale, ranging from 'Never/Not at all' to 'Always/Very'. Its reliability and validity have been investigated by e.g. Wubbels and Levy (1991), Fisher, Henderson and Fraser (1995), den Brok, (2001), Passini et al. (2015) and Ahmadi Safa and Doosti (2017). This questionnaire was translated and adapted for the present study. For the purpose of the present study, its validity was checked by an expert and Cronbach's alpha showed that it has an acceptable reliability of 0.71.

### *Sadler's joystick tracking device*

The joystick enables us to code behaviors simultaneously for agency and communion and so there is no need to code them separately. Real time interpersonal behavior of teachers was coded continuously using Sadler's joystick tracking device (Sadler et al., 2009). According to Markey, Lowmaster and Eichler (2010) the joystick tracking device is planned to observe both verbal and nonverbal behaviors which have clear interpersonal meaning.

### *Joymon program*

The joystick tracking device comes with a computer program called Joymon.exe (Lizdek et al., 2012). The program numerically records the exact location of the joystick within a two

dimensional space, based on X- and Y-coordinates. The resulting files can be opened in excel or notepad. They are comma delimited and should be transformed into tab delimited for further analysis.

### GridWare

GridWare is a versatile tool for manipulating and visualizing data. It has several measures for identifying, qualifying and visualizing attractors and their relative strength; these measures include duration per cell and duration per visit. It can also demonstrate trajectories and the structure of interaction. Measures used to investigate the structure of interaction are dispersion and entropy. Dispersion indicates the extent to which behaviors are distributed across the SSG. It is also the overall scatteredness across the SSG, controlling for proportional cell durations. It has a value between 0 (no variability) and 1 (maximum variability). Visit entropy is another measure of structure based on the number of transitions between cells. It provides a measure for predictability; the higher the entropy, the less the predictability. For a thorough explanation on GridWare and how the measures are derived one can refer to its manual by Lamey, Hollenstein, Lewis and Granic (2004).

### Procedure

Students were asked to rate the interpersonal behavior of their own teacher and an imaginary ideal teacher via a questionnaire (QTI). One teacher who was closest to and one who was farthest from that ideal were identified. For the micro-level investigations, the video recordings of the classes of these two teachers were analyzed. Thirty minutes of their classes were selected to be coded. These thirty minutes included three, ten minutes of the actual beginning, middle and end of the session. Coding was done by a joystick in terms of communion and agency. The codes were recorded by Joymon program. The program enters the code twice per second. As in Lizdek, et al. (2012), the first 10 seconds from every time series were deleted in order to avoid the possibility of 'boxcar' artifacts that is spurious coding due to preparatory conditions. Accordingly, on the whole, 14160 codes were generated, 3540 codes for each class, by each rater.

Coding was done by two raters to establish inter-rater reliability. The first rater had received three hours of training from an expert and attended a workshop on the applications of joystick by another expert for 5 hours. A set of benchmarks was established based on the literature and trainings. For example, the teacher is steering when he/she leads, organizes, gives orders and determines procedure. When the teacher shows interest, supports and inspires confidence and trust, he/she is friendly. These benchmarks are presented in the appendix.

After being trained and having established the benchmarks, the first rater trained the second one and after 5 hours of mutual practice data was coded. Intra-class correlation (ICC, K=2) was used to measure reliability, the result of which showed a reliability of 0.91. The codes were then averaged and entered into GridWare to identify the content and structure of interactions.

One way to determine content of interaction is to identify attractors for which there are several empirical methods (Hollenstein, 2013). In this study, winnowing method is employed. The basic idea of winnowing is that an attractor is a state which is more probable than others. It is a way of differentiating inconsequential variation from systematic variation. It is an

iterative process by which the cells with the lowest durations are deleted step by step and finally the cell(s) with the highest duration remain on the basis of a criterion heterogeneity score. The heterogeneity score is calculated via the following formula:

$$Heterogenity_j = \frac{\sum (Observed_i - Expected_j)^2 / Expected_j}{\# \ of \ cells_j}$$

where $_j$ is the index of relevant iteration and $_i$ is the index of the cell.

Finally, to identify attractors, the heterogeneity proportion which is the ratio of H value of each step to that of the first step should be calculated and the results should be examined for scree. The cell corresponding to the value after the largest drop is recognized as an attractor. In Lewis, Lamey and Douglas (1999) 'large' was defined as approximately 50% or more. If no large drop occurs, then the scree value can be taken as the last drop to 0 for the final single-cell iteration. If more than one attractor is identified and they are adjacent, they make an attractor region. The grid of the present study is 121 cell= 11*11 which makes the procedure complicated. In order to avoid computational mistakes data are entered into EXCEL 2016 and to facilitate calculations, formulas are incorporated into the file.

To determine teacher typologies, the vector method is applied. Circular profiles provide a chance for basic structural analysis since scores on a circular measure are vectors with magnitude and dimension. Hence, a summary point is provided in the two dimensional interpersonal space which indicates the overall trend in the profile. Actually, this method involves vector arithmetic. As a first step, each score was standardized. The standard score (z) was calculated relying on the score, mean and standard deviation. Then, each z score in the profile was weighted by being multiplied by the sine (to obtain the *y*-component) or cosine (to obtain the *x*-component) of the relevant vector's angular direction (θ) in the circle. Communion and Agency were derived through the following formula:

$$Communion = 0.25 * \Sigma.z_i * \cos(\theta_i)$$

$$Agency = 0.25 * \Sigma.z_i * \sin(\theta_i)$$

where 0.25 is a scaling factor for an eight octant circle, $z_i$ is the person's standard score on the scale or scale$i$, and $\theta i$ is the angular location of the scale (0◦, 45◦, 90◦, etc. as in figure 2).

As a final step, vector's angular displacement, which indicates teacher typology, was derived using the arctangent formula (modified for a result in degrees), as in the following formula:

$$Angle = tan^{-1}(Agency/Communion) * 180/\pi$$

Traditionally, in interpersonal models, the fixed point is at the ''three o'clock'' position and displacement is measured in degrees, in a counterclockwise direction but in the present study, the fixed point was considered to be "twelve o'clock" and direction was clockwise. Because this made comprehension of angels easier and in line with the general interpretation of IPC, i.e. in IPC, DC profile was the first type, and CD was the second, while in the traditional arrangement that is vice versa, and this goes on for other scales as well. These are schematically presented in figure 2.
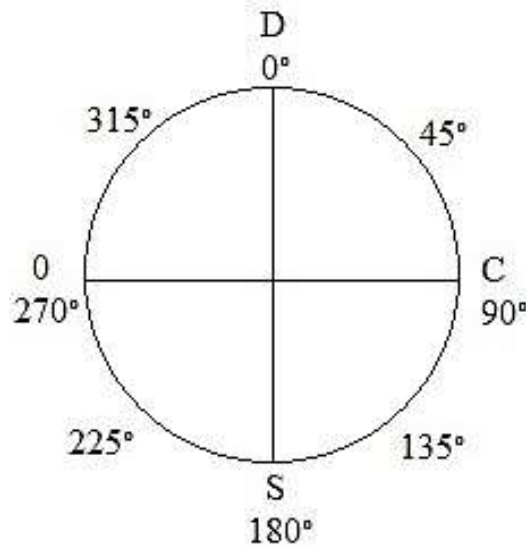
**Figure 2.** Angels defining teacher typologies

The resultant angles indicate teacher typology, as is presented in table 2. The column on the left presents angle interpretations via the traditional approach (0 degree at 3 o'clock and counterclockwise) and the column on the right present interpretations in the present study (0 degree at 12 o'clock and clockwise).

| Angle | Relevant typology in the traditional approach | Relevant typology in this study |
|---|---|---|
| $0 < \theta < 45$ | Authoritative | Directive |
| $45 < \theta < 90$ | Directive | Authoritative |
| $90 < \theta < 135$ | Drudging | Tolerant/Authoritative |
| $135 < \theta < 180$ | Repressive | Tolerant |
| $180 < \theta < 225$ | Uncertain/Aggressive | Uncertain/Tolerant |
| $225 < \theta < 270$ | Uncertain/Tolerant | Uncertain/Aggressive |
| $270 < \theta < 315$ | Tolerant | Repressive |
| $315 < \theta$ | Tolerant/Authoritative | Drudging |

**Table 2.** Typologies and the relevant angles

## Results

In each of the six classes, students scored interpersonal behavior of their actual teacher and an imaginary ideal one and the mean scores of the actual teachers were compared to those of the ideal teacher, for all items on QTI, through paired t-test. The highest t-value pertained to teacher *f* and the lowest to teacher *a*. Therefore, teacher *f* was identified to be the closest to and teacher *a* as the farthest from the ideal. Based on QTI and through vector method teacher profiles were determined. The teacher closest to the ideal had Tolerant/Authoritative profile and the one farthest had Uncertain/Tolerant profile, as can be seen in table 3. The ideal teacher had Authoritative profile.

To see whether these two teachers were significantly different in their QTI scores, another paired t-test was run, reported as the seventh pair in table 3 which indicated that they were not significantly different.

| | | Paired Differences | | | | | t | df | Sig. 2-tailed | Teacher rofiles |
| | | Mean | SD | Std. Error Mean | 95% Confidenc Interval of th Difference | | | | | |
| | | | | | Lower | Upper | | | | |
| Teacher a | actual-ideal | -2.19 | 5.56 | .44 | -3.06 | -1.32 | -4.97 | 158 | .000 | Directive |
| Teacher b | actual-ideal | -.27 | 2.16 | .14 | -.54 | .00 | -1.94 | 240 | .054 | Authoritative |
| Teacher c | actual-ideal | -1.45 | 5.32 | .35 | -2.13 | -.77 | -4.20 | 236 | .000 | Authoritative |
| Teacher d | actual-ideal | -1.16 | 3.95 | .34 | -1.82 | -.49 | -3.45 | 138 | .001 | Authoritative |
| Teacher e | actual-ideal | -.45 | 3.01 | .23 | -.89 | .00 | -1.98 | 178 | .049 | Authoritative |
| Teacher f | actual-ideal | -.26 | 2.26 | .19 | -.63 | .11 | -1.37 | 142 | .173 | Authoritative |
| Teachers a & f | Actual-actual | -1.36 | 9.23 | .74 | -2.81 | 0.09 | -1.85 | 156 | 0.07 | ------------- |

**Table 3.** difference between each teacher and the ideal one and teachers' profiles

Table 4 presents the general characteristics of classroom interpersonal behavior of the two teacher. They seemed to be basically different with regard to the factors defining content of their interaction. The mean number of visits for teacher *f* was considerably more than that for teacher *a*. Teacher *a* lingered in visits and stayed longer in cells.

| Characteristics / teachers | Teacher a | Teacher f |
| --- | --- | --- |
| Mean number of visits | 165.33 | 269.33 |
| Duration per cell | 58.86 | 50.19 |
| Duration per visit | 7.85 | 4.65 |
| Dispersion | 0.82 | 0.90 |
| Entropy | 2.42 | 2.73 |

**Table 4.** General characteristics of classroom interpersonal behavior of the more (teacher *f*) vs. the less (teacher *a*) favorable teacher

The whole number of events for both class rooms was 1199. In teacher *a*'s classroom the mean number of events in communion negative states was 147.33; this means that 12.36% of events occurred in communion negative area. There is no event in the communion negative region for teacher *f*. The mean number of events in agency negative region was 297.67 for teacher *a*. For teacher *f,* that was 87.33. These were equal to or 25% and 11.28%, respectively. This means that teacher *a*'s behavior had more events in negative regions. Consequently, the two teachers differ both in terms of communion and agency. The SSGs of these two classes are presented in figures 3 and 4.
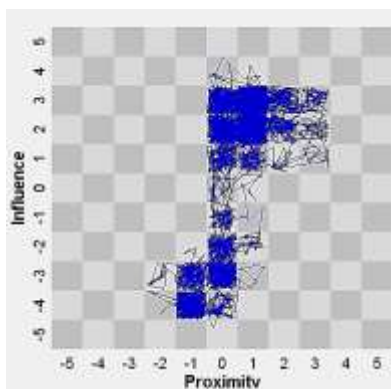


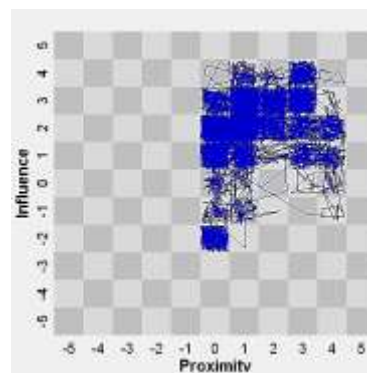**Figure 3.** SSG for teacher *a* (less favorable)



**Figure 4.** SSG for teacher *f* (more favorable)

The cells can be identified with their components on X and Y axis so that if a cell is identified as (1,2) this means that its component on the X axis is 1 and on the Y axis is 2; therefore, the communion is 1 and agency is 2. Accordingly, for teacher *a,* the most frequently visited cells are (-1,-4), (0,2), (1,2) and (1,3). For teacher *f,* the most visited cells are (0,1), (0,2), (1,2) and (1,3). Teacher *a* paid visit to more extreme agency negative areas. These show that in the more favorable classroom, teacher had high levels of communion and moderate dominance. In the less favorable class, communion was low and dominance was generally low and sometimes high but it still remains what these signify about the content of interaction. For this purpose attractors should be identified.

Based on the winnowing procedure, for teacher *a*, cells (1,2) and (1,3) made an attractor region and for teacher *f,* cells (1,2), (0,2) and (1,3) were identified to be an attractor region. This means that, with respect to the dominant behaviors, neither communion nor agency of the two teachers differed substantially. Of course, it should be born in mind that the difference between these two teachers is not statistically significant.

Both dispersion and entropy of class *f* were more than those of class *a*. This shows that class *f* was structurally more variable and unpredictable. These added with the durations per visits and per cells, reflect that teacher *a*'s behavior was more predictable and had less variability. It took time for teacher *a* to change behavior. Interpersonal behaviors in both classes were scattered and not accumulated in one state or region.

Assume that the grid is divided into four regions of agency positive-communion positive (let it be called region 1), agency negative-communion positive (region 2), agency negative-communion negative (region 3) and agency positive-communion negative (region 4). Region measures show that dispersion of behavior of the more favorable teacher in region 1 was more than in region 2, i.e. 0.91 vs. 0.52 and there was no visit to regions 3 or 4 for this teacher, since this teacher exhibited no communion negative behavior. For the less favorable teacher, too, the highest dispersion belonged to region 1, i.e. 0.79 but still it is much less than that of the more favorable teacher. There was no visit to region 3 and dispersions of regions 2 and 4 were 0.64 and 0.32, respectively.

Regarding teacher typologies, based on the vector method, the agency and communion of teacher *a* were -0.47 and -0.72, respectively; Those of teacher *f* were 0.52 and 0.4. Both communion and agency of teacher *a* were less than those of teacher *f.* The resultant angle for teacher *a* was 33.23 and that for teacher *f* was 52.71. Therefore, the typology of teacher *a* was Directive and that of teacher *f* was Authoritative, i.e. the more favorable teacher was Authoritative and the less favorable one was Directive. Actually, five out of the six teachers in this study had Authoritative profiles and just one, the least favorable, had Directive typology. No other typology was detected.

## Discussions and conclusions

Considering factors defining content of interaction, interpersonal behaviors of the more favorable teacher and the less favorable one differed mainly in terms of mean number of visits which was considerably larger for the teacher who was closer to the ideal. With respect to the place of attractors, these two teachers did not differ noticeably. As in Mainhard et al. (2012), differences between the two classes were especially noticeable in the strength of attractors, not

in their position. They believe that classes of the most and the least favorable teachers look quite similar most of the times; there are just small differences reflected by the general social climate of the class. Trajectories of less favorable classes stayed relatively longer in less favorable agency and communion states while the trajectory of the other class seemed to just shortly tap these less favorable states, and then returned quickly to more favorable ones. Therefore, interaction in both classrooms was primarily characterized by a positive interpersonal behavior, and had similar attractors.

Mainhard et al. (2012) and Pennings and Mainhard (2016) suggested that variation can be used as a potent variable in explaining the difference between these two classes, in that less favorable classes have higher variability in teacher's behavior. Pennings and Brekelmans et al. (2014), too, found higher variability in real-time behavior for teachers with interpersonal profiles characterized by lower levels of agency and communion. In the present study, the two classes were different in terms of variability but contrary to the three aforementioned studies, the more favorable class had higher variability. This may indicate that interpersonal content can better discriminate teachers. Pennings and van Tartwijk et al. (2014), too, concluded that interpersonal content and complementarity discriminated between teachers, and that interpersonal structure did not.

Pennings (2017b) found that in terms of variance, proximity dimension played a key role in her study; teachers with higher communion had lower variance than those with lower proximity. The entropies in her study ranged between 3.07 and 4.46 which are more than those of the present study (2.42 and 2.73). That is, even the highest entropy in the present study is less than that of the lowest one in her study. Teacher behaviors changed more frequently in Pennings' study. This can imply that teacher *a* might have been be too inactive. Consequently, it can be concluded that a certain amount of variability is required in classes, otherwise it will be monotonous. The optimal amount of this variability remains to be investigated.

Of course the difference between these two teachers was not statistically significant and measures could not be statistically compared. Perhaps teachers with profiles which are more distant from Tolerant/Authoritative typology, like Repressive or Uncertain/Aggressive typologies, can reflect this difference more clearly. Or, this study may further confirm Pennings and van Tartwijk et al. (2014)'s study whereby, interpersonal structure or variability is not a distinguishing factor. However, in line with Penning and Hollenstein (2019) variability too can be distinguishing factor.

Therefore, the research hypothesis, stating that the interpersonal behavior of the less favorable teacher has more variability and less predictability and features attractors which are lower in agency and communion is rejected. Because the more the favorable teacher had higher variability and less predictability; additionally, the place of attractors does not differ significantly in the two grids and the behavior of the less favorable teacher had less variability.

The results of this study can be applied to enhance the quality of relationships that exist between teachers and learners because teachers can be made aware of and decide on the optimum amount of variability in their behaviour and content of it in terms of agency and communion. Subsequently, this boosts learners' motivation and achievement. It can also be used extensively in promoting the communicative ground of the class. A balanced amount of

teachers' agency and communion can also enrich the interactive mood of the classroom by providing a ground and encouraging learners to participate more actively. This is especially helpful for those students who are too shy to take turn in the class.

This study can have implications for teacher education too, to raise consciousness and for teacher trainings to favor their professional development. A better understanding of teaching-learning processes can elucidate the temporal stream of interactions and assist optimal learning trajectories (Steenbeek & van Geert, 2013).

For further study, it is useful to see how differently teachers behave in diverse situations, for example, in dealing with disruptive behaviors, responding to questions, giving feedback, explaining, scaffolding and initiating and terminating the class. All these and other variables can affect the general social climate of the class and are good points to be investigated either individually or for comparing teachers in terms of their experiences or classes in terms of being favorable. These can also further testify whether differences within teachers are larger than differences between teachers, as Pennings and Brkelmans et al. (2014) believe. More importantly, using measures which can yield data for statistical analysis can be more illuminating.

Studying dyads is especially helpful when analyzing complementarity as in Dermody, Thomas, Hopwood, Durbin and Wright (2017). Moreover, the impact of the micro-analysis of interpersonal behavior, either per dyads or solo, can be investigated not only on students, in terms of their achievement, motivation and engagement, but also on teachers in terms of their wellbeing (Spilt, Koomen & Thij, 2011), burn out and job satisfaction (Pennings 2017a).

Finally, as teachers' interpersonal behaviours may play a more significant role in some fields of study rather than the others, the interdisciplinary variations can be an issue of investigation. Also, since behaviours are context- and culture-dependent, cross-cultural differences can also be taken into consideration for further research. Furthermore, the principle of adaptability has gained recent attention and is an appealing subject to be investigated by further studies.

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## Appendix

A set of benchmarks for coding interpersonal behavior

| Steering | Friendly | Understanding | Complying | Uncertain | Dissatisfied | Reprimanding | Enforcing |
|---|---|---|---|---|---|---|---|
| Y+ X+ | Y+ X+ | Y- X+ | Y- X+ | Y- X- | Y- X- | Y+ X- | Y+ X- |
| leads Organizes gives orders determines procedure structures classroom situation notice what's happening set tasks explains holds attention | shows interest is friendly is considerate is supporting inspires confidence & trust can make a joke | listens with interest empathizes shows confidence and understanding is open with students accepts apologies looks for ways to settle differences is patient | gives opportunity for independent work gives freedom & responsibility approves of something | is uncertain keeps a low profile hesitates apologizes waits & sees what will happen | expresses dissatisfaction looks unhappy criticizes waits for silence looks glum criticizes | gets angry expresses irritation & anger forbids punishes corrects | imposes Checks maintains silence strictly enforces the rules gets class silent |