Detecting Patterns of Dynamic Teacher-Learner Interactions in Online Adult Learning Through a Dynamic Systems Approach

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Abstract: This study investigated teacher-learner interaction patterns in the context of adult online learning. This study shows the applicability of dynamic systems approach in research on online adult learning. We employ a dynamic systems approach method, the State Space Grid, to capture dynamic interaction patterns between a teacher and learners. Results showed that the interaction patterns and their characteristics were distinct in each experimental class but also indicated that some interaction patterns were recurrent over the course.

Introduction

In this paper, we describe the detection and visualization of complex and dynamic interaction patterns in online adult learning by utilizing one of the methods in dynamic systems approaches, the State Space Grid (Granic, Hollenstein, Dishion, & Patterson, 2003; Hollenstein, 2013; Lewis, Lamey, & Douglas, 1999). Prior research has utilized the approach in the context of parent-child interaction (Granic & Lamey, 2002); in the study presented in this paper, we apply it to teacher-student interaction to detect patterns and show how the patterns change over time.

The research questions are: "What kinds of combination of utterances can be seen in the interaction between a teacher and learners?" and "How do the combinations change over the course?"

Methods

11 Japanese adults participated in this study (two females and nine males). Their ages vary from early 30s to mid 50s. The professional backgrounds of the participants varied (e.g., CEO, business consultant, business/personal coach). The high variability of the participants allows inferences on the ability of the approach to detect recurring dynamic patterns. All of the participants voluntarily participated in this study.

The data in this study are obtained from recordings of an online course held by the first author in 2015. The course consisted of 5 two-hour classes over two months. Teaching consisted primarily in discussing topics introduced in the first class of the course. The course aimed at offering academic and practical knowledge of adult development theory. The coding scheme was developed using a Grounded Theory Approach (Glaser & Strauss, 1967); the coding categories are listed in table 1. The Cohen's Kappa statistic was .87, showing strong inter-rater reliability of the coding system.

Table 1: Codes for utterances of teacher (left column) and learners (right column)

Number	Teacher Utterance Category	Learner Utterance Category
1	Instruction	Spontaneous Simple Comment
2	Open Question	Spontaneous Meaningful Comment
3	Closed Question	Spontaneous Open Question
4	Encouraging Open Question	Spontaneous Closed Question
5	Encouraging Closed Question	Encouraged Simple Comment
6	Reframe Response	Encouraged Meaningful Comment
7	Simple Response	Encouraged Open Question

State Space Grid

State Space Grid (SSG) is a software program to analyze a dynamic system's behavior in a state space (Granic et al., 2003; Hollenstein, 2013; Lewis et al., 1999). The uniqueness of the method is to highlight recurrent patterns within the interaction of two state variables. The method can also generate automatically the trajectory of the change of interaction patterns. In addition, SSG can provide researchers with a number of indicators on the screen of the software to examine a specific characteristic of an interaction.

Results

Interaction patterns and the trajectories

SSG generated the following figures (See Figure 1). Each numeric symbol in the figures corresponds with the contents in Table 1.
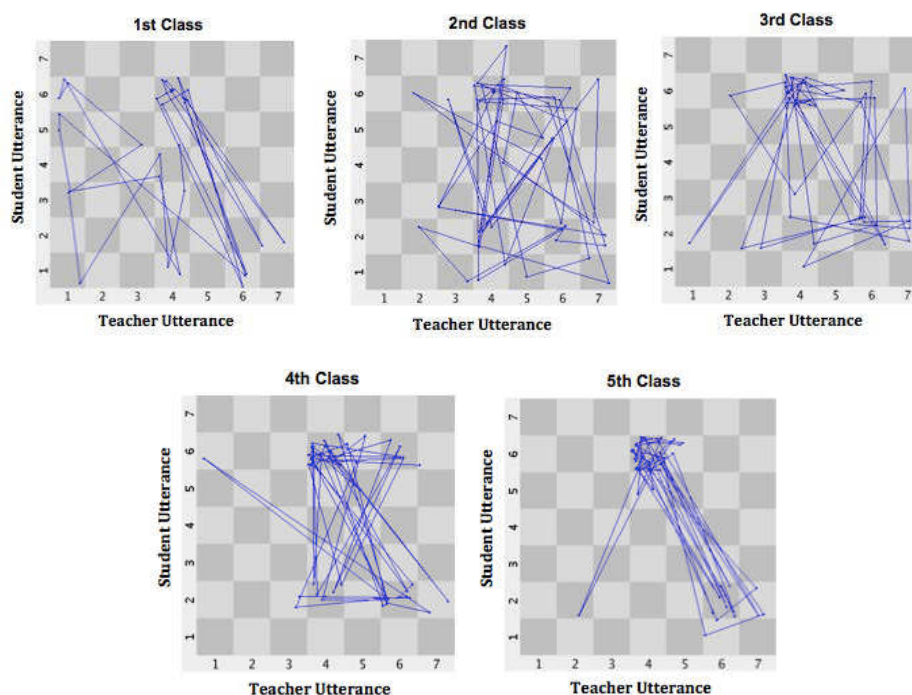

Figure 1. State space grids for five classes in terms of behaviors.

Figure 1 illustrates that each class showed different types of trajectories. It also demonstrates that a couple of cells frequently appeared. E.g., (Teacher utterance, Learner utterance) = (4, 6). The figure also shows that some combinations occurred less frequently (i.e., (1, 1), (4, 1), (7, 2)).

One captivating phenomenon is that the teacher started to frequently use "reframe response" from the second class. One reason might be related to the fact that the learning environment of the first class was more conventional than the other classes in that the teacher had to explain the purpose and structure of the course and had to offer theoretical instructions so that the learners can deepen the discussion in the succeeding classes.

Discussion

The characteristics of combinations of utterances identified by this study offer rich information on the dynamic nature of the teacher-learner interaction. If we focused only on either a teacher or learners, we would not detect such a dynamic process of interaction. In sum, this study suggests researchers that a study on dynamic interaction processes should not examine variables separately but investigate combination of variables that characterize the interaction. Also, SSG enables us to explore the trajectories of change of interaction patterns.

References

Glaser, B. G., & Strauss, A. L. (1967). *The discovery of grounded theory: Strategies for qualitative research.* Hawthorne, NY: Aldine de Gruyter.

Granic, I., & Lamey, A. V. (2002). Combining dynamic systems and multivariate analyses to compare the mother-child interactions of externalizing subtypes. *Journal of Abnormal Child Psychology, 30*(3).

Granic, I., Hollenstein, T., Dishion, T. J., & Patterson, G. R. (2003). Longitudinal analysis of flexibility and reorganization in early adolescence: A dynamic systems study of family interactions. *Developmental Psychology, 39*(3), 606-617.

Hollenstein, T. (2013). *State space grids: Depicting dynamics across-development.* New York: Springer.

Lewis, M. D., Lamey, A. V., & Douglas, L. (1999). A new dynamic systems model for the analysis of early socioemotional development. *Developmental Science, 2*(4), 457-475.