# Using GRA and GSM Methods to Identify the Learning Strategies of Good Language Learners

B. T. Wang, H. T. Chen, and H. Y. Chang

*Abstract*—**While learning a language, there are some learners who can learn it quickly, but come learners can't. If we know more about the learning strategies of the successful language learners, we could use this information to enhance the poor language learner's learning. The paper proposes to use the soft-computing methods: grey relational analysis (GRA) and grey structural modeling (GSM) to explore the learning strategy path of the good language learner. The purpose is to find the importance order of the learning strategies. Then both learners and teachers can adjust their learning and teaching styles in language acquisition. In order to quantify the data, 10 professional English teachers are interviewed, and their attitudes towards the learning strategies are calculated through the soft-computing methods. The results show that the planning strategy is the basic strategy of being a good language learner while communication strategy ranks the top. Overall, the results not only provide objective perceptions of good language learner's learning strategy path, but the proposed soft-computing methods can be applied to the future decision-making fields.**

*Index Terms*—**GRA, GSM, good language learner, language acquisition.**

## I. INTRODUCTION

Not until the 1970's did the researchers focus on the learner differences may have an influence on the language learning [1], [2]. They started to question why and how it is that some people can learn a foreign language quickly while others, with same opportunities, are failures. In addition, they tried to find out the strategies, which the good language learners use, and suggested teachers to help the less successful language learners improve their learning [3], [4]. It is also important for teachers to be aware of the characteristics of the good language learner, their aptitude, and motivation [5], [6]. As Rubin [5] says:

"If all peoples can learn their first language easily and well (although some have more verbal skills than others) why does this innate ability seem to decline for some when second language learning is the task?"

In the last decades, the educational system in Taiwan always put emphasis on the exams, and good language learner has been considered as a person who could get the highest score on the exam, no matter how good his performance is outside the classroom. However, the situation has changed these days. The educational system is now influenced by the American's, where by changes have been made, such as cancellation of the joint entrance exam, and use of a multiple entrance program, instead.

Meanwhile, the Taiwanese educational system starts to focus on the language learner's performance outside the classroom, and they try to see the learner's communicative competence, the listening or speaking skills. For them, the definition of the good language learner changed, because a lot of teachers found that the students who get high grades in school have difficulty in watching foreign movies or listening to English broadcast, and they realize that there is something beyond the exams.

Therefore, it is teacher's responsibility to discover what makes one language learner to become more successful than another. However, deciding the characteristics or learning strategy of the good language learner is never easy [7]. So, the paper uses the method of grey relational analysis (GRA) and grey structural modeling (GSM) to find out the importance of the learning strategies and the learning strategy path in an objective way.

The article first summarizes the 10 learning strategies of a good language learner [6], and they become the main research data of this paper. Then 10 professional English teachers are invited to evaluate the importance of the learning strategies. Next, method of GRA is used to calculate the *gamma* value of each learning strategy. Later, these learning strategies of the good language learner are put in order based on their *gamma* values. Finally, Grey Structural Modeling (GSM) is used to present the results in a figure which helps the audience understand the learning path better. Besides, the GSM figure also provides the clear organization of good language learners' learning strategies.

In this paper, section two introduces the learning strategies of a good language learner and the math methods. Section three is the introduction of participants and research execution. Section four incudes the discussion of the results. Finally, the research conclusions and recommendations are discussed.

On the whole, only after we realize the learning strategies of the good language learners can we help the poor language learners. Greater attention is again paid to the teachers in the classroom, and as long as they know the needs and lacks of the students, they could train the language learners to become successful.

## II. LITERATURE REVIEW

In this section, the learning strategies of the good language learner are discussed, and then methods of GRA and GSM are introduced.

### A. *Learning Strategies of a Good Language Learner*

Stern says that language learners face three problems when they learn the target language [6]. The first problem is their first language may influence their second language learning, followed by the communication efficiency problem and rational and intuitive learning. In order to solve the above three problems, Stern [6] declares 10 strategies of the good language learners, and they are listed in Table I.

TABLE I: THE LEARNING STRATEGIES OF A GOOD LANGUAGE LEARNER
[CITED FROM STERN, 1975, PP. 4-5]

| Coding | Strategies | Descriptions |
|--------|-----------|--------------|
| I(1) | (1) Planning Strategy | A personal learning style or positive learning strategies. |
| I(2) | (2) Active Strategy | An active approach to the learning task. |
| I(3) | (3) Empathic Strategy | To learnt and outgoing approach to the target language and empathy to its speakers. |
| I(4) | (4) Formal Strategy | Technical know-how about how to tackle a language. |
| I(5) | (5) Experimental Strategy | Strategies of experimentation and planning with the object of developing the new language into an ordered system and revising. |
| I(6) | (6) Semantic Strategy | Constant searching for meaning. |
| I(7) | (7) Practice Strategy | Willingness to practice. |
| I(8) | (8) Communication Strategy | To use the language in real communication. |
| I(9) | (9) Monitoring Strategy | Self-monitoring and critical sensitivity to language use. |
| I(10) | (10) Internalization Strategy | Developing the target language more as a separate reference system and learning to think in it. |

As a whole, researchers observe that successful language learners spend more time on learning, and using the target language; moreover, they make themselves to immerse in the target language [5].

### B. *GRA*

The grey system theory was proposed by Deng in 1982, and the grey system theory includes internal information system model which is either insufficient or incomplete, and the grey system theory can be used for relational analysis [8]-[15]. The GRA is an important approach of the grey system theory because GRA not only applies to cluster the data which have same features, but also measures their relationships [8]-[15].

Step 1: Establish raw data. In GRA space { $P(X); \Gamma$ }, there is a vector: $x_i = (x_i(1), x_i(2), x_i(3), \cdots, x_i(k))$ (1)

where $i = 0, 1, 2, 3, \cdots, n$, and $k = 1, 2, 3, \cdots, m$

Step 2: Grey relational calculation.

$$\Gamma_{0i} = \Gamma(x_o(k), x_i(k)) = \frac{\overline{\Delta}_{\max} - \overline{\Delta}_{0i}}{\overline{\Delta}_{\max} - \overline{\Delta}_{\min}} \qquad (2)$$

In this paper, GRA calculation is used to reach the *gamma* values, which is between 0 to 1. Moreover, it is used to do the clustering of finding the objective solution of educational decision-making fields [8]-[15].

### C. *GSM*

Grey Structural Modeling (GSM) is originated from the GRA, and it is established from two steps: estimating a hierarchy and paths among the elements [16], [17]. The generation of GSM is described below [18]:

Step 1: $S$ is a set and $S_i$, $S_j$ are given elements in $S$. The matrix of $S$ is as follows:

$$S = \begin{bmatrix} s_{11} & s_{12} & \cdots & s_{1m} \\ s_{21} & s_{22} & \cdots & s_{2m} \\ \vdots & \vdots & \ddots & \vdots \\ s_{m1} & s_{m2} & \cdots & s_{mm} \end{bmatrix} \qquad (3)$$

where $i, j = 1, 2, 3, \cdots, m; 0 \le s_{ij} \le 1$.

Step 2: In order to find the path of elements, the grey relational analysis is applied as follows:

$$\gamma_{ij} = 1 - \frac{\| x_i - x_j \|_\rho}{\max\limits_{\forall i} \max\limits_{\forall j} \| x_i - x_j \|_\rho} \qquad (4)$$

where $\rho = 2$.

Step 3: Setting hierarchical class information. Let $C_i$ become the hierarchical class set and each $C_i$ is given as follows:

$$C_i = \left\{ s_j \middle| e_{ij} \le \theta \right\} \qquad (5)$$

For $i = j$, $e_{ij} = 0$. Then the matrix is shown as follows:

$$E = \begin{bmatrix} e_{11} & e_{12} & \cdots & e_{1m} \\ e_{21} & e_{22} & \cdots & e_{2m} \\ \vdots & \vdots & \ddots & \vdots \\ e_{m1} & e_{m2} & \cdots & e_{mn} \end{bmatrix} \qquad (6)$$

Step 4: Path information is given as follows:

$$P = \left\{ (s_i, s_j) \middle| \gamma_{ij} \ge \psi, \gamma_{0i} < \gamma_{0j} \right\} \qquad (7)$$

where $\psi$ is path coefficient $(0 \le \psi \le 1)$; $\Gamma$ is the grey relational matrix and it is defined as follows:

$$\Gamma = \begin{bmatrix} \gamma_{11} & \gamma_{12} & \cdots & \gamma_{1m} \\ \gamma_{21} & \gamma_{22} & \cdots & \gamma_{2m} \\ \vdots & \vdots & \ddots & \vdots \\ \gamma_{m1} & \gamma_{m2} & \cdots & \gamma_{mm} \end{bmatrix} \qquad (8)$$

## III. RESEARCH DESIGN

### A. *Participants*

The paper interviewed 10 professional English teachers who have been teaching English for more than 5 years, and

they are coded as *P(A)* to *P(J)* in Table II.

TABLE II: PARTICIPANTS INFORMATION

| English teachers | Teaching experiences | English teachers | Teaching experiences |
|---|---|---|---|
| P(A) | 6 years | P(F) | 7 years |
| P(B) | 8 years | P(G) | 5 years |
| P(C) | 5 years | P(H) | 7 years |
| P(D) | 5 years | P(I) | 10 years |
| P(E) | 9 years | P(J) | 5 years |

The reasons of selecting these people are because they are experienced teachers who can provide correct opinions.

### B. Procedure

First, the learning strategies in Table I are coded as *I*(1) to *I*(10) from strategy (1) to strategy (10) (see Table I). In order to find the learning strategy path of a good language learner, the 10 professional English teachers are asked to decide which strategy is more important than the others and then the method of GRA is used to calculate the weighting (*gamma* value) of each strategy. That is, the professional English teachers evaluate the learning strategies in Table I and assign scores based on their professional judgment. As a result, the *gamma* values of the learning strategies are listed in Table III as follows.

TABLE III: GAMMA VALUES OF THE LEARNING STRATEGIES

| Learning strategies | *Gamma* values | Learning strategies | *Gamma* values |
|---|---|---|---|
| I(1)Planning Strategy | 0 | I(6)Semantic Strategy | 0.266 |
| I(2)Active Strategy | 0.447 | I(7)Practice Strategy | 0.447 |
| I(3)Empathic Strategy | 0.579 | I(8)Communication Strategy | 1 |
| I(4)Formal Strategy | 0.256 | I(9)Monitoring Strategy | 0.626 |
| I(5)Experimental Strategy | 0.834 | I(10)Internalization Strategy | 0.626 |

According to Table III, the order of importance of learning strategies can be obtained through their *gamma* values, and they are shown as follows:

$$I(8) > I(5) > I(9) = I(10) > I(3) > I(2) = I(7) >$$
$$I(6) > I(4) > I(1)$$

Table III shows that the planning strategy is the basis of all the strategies in language learning, and the communication strategy is the ultimate goal which learners should achieve. Meanwhile, the monitoring strategy and the internalization strategy, the active strategy and the practice strategy obtain the same *gamma* values, which reveal their equal importance in language learning.

### C. GSM Learning Strategy Path Generation

After the GRA calculation, the *gamma* value of each learning strategy can be achieved (see Table III). According to these *gamma* values, the GSM structure of good language learner's learning strategy path can be presented in Fig. 1.
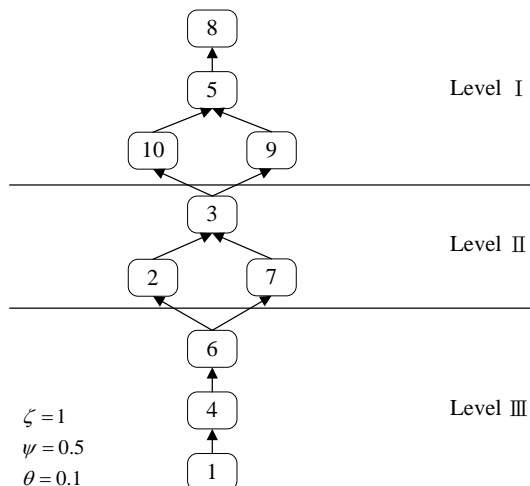


$\zeta = 1$
$\psi = 0.5$
$\theta = 0.1$

Fig. 1. GSM of learning strategy path.

## IV. DISCUSSION

Based on the learning strategy path presented in Fig. 1, there are four suggested learning strategy paths, and they are coded as learning strategy path *L*(1) to learning strategy path *L*(4) which are listed in detail as follows.

Learning path *L*(1):

*I*(1) planning strategy—*I*(4) formal strategy—*I*(6) semantic strategy—*I*(2) active strategy—*I*(3) empathic strategy—*I*(10) internalization strategy—*I*(5) experimental strategy—*I*(8) communication strategy

Learning path *L*(2):

*I*(1) planning strategy—*I*(4) formal strategy—*I*(6) semantic strategy—I(7) practice strategy—*I*(3) empathic strategy—I(9) monitoring strategy—*I*(5) experimental strategy—I(8) communication strategy

Learning path L(3):

*I*(1) planning strategy—*I*(4) formal strategy—*I*(6) semantic strategy—*I*(2) active strategy—*I*(3) empathic strategy—*I*(9) monitoring strategy—*I*(5) experimental strategy—*I*(8) communication strategy

Learning path *L*(4):

*I*(1) planning strategy—*I*(4) formal strategy—*I*(6) semantic strategy—*I*(7) practice strategy—*I*(3) empathic strategy—*I*(10) Internalization strategy—*I*(5) experimental strategy—*I*(8) communication strategy

Although, the four learning strategy paths seem to be different, they have the same start point *I*(1) and the same end point *I*(8). That is, all the participants agree that the planning strategy is the foundation of the good language learner's learning strategy, and the communication strategy is the final goal which good language learners want to achieve. In Fig. 1, Level III presents the base of learning strategies, including planning strategy, formal strategy and semantic strategy. It considers the learning style, technical know-how about how to tackle a language, and learners will constant search for meaning. So, in this stage, self-awareness is the most important concern. After fulfilling the Level III requirements, language learners can move on to Level II, which includes active strategy, practice strategy and empathic strategy. In this level, keep practicing seems to be the most important issue. The final stage is Level I, including

internalization strategy, monitoring strategy, experimental strategy and communication strategy. In Level I, how to apply the language in real life situation is our most concern.

According to the results, it is hoped that both the teachers and the language learners could benefit from the results. When they understand the language learning strategy paths, they may not only adjust their attitudes toward language learning, but they are also more confident.

## V. CONCLUSIONS

This study systematically uses the GRA and the GSM methods to form a path for language learners, and the conclusions of the paper can be summarized as follows:

1) Obviously, it is hard for the teachers to change the learner's personality or learning style, but strategies can be introduced to the language learners. Teachers should consider the strategy used by the students when design teaching activities. They could incorporate strategy training activities into regular classroom: providing activities with a wide range of learning strategies to meet the needs of their students that prefer different learning styles, and use different learning strategies. For example, the communication strategy can encourage the learners to use the language in real life; the planning strategy offers the learners an opportunity to develop his or her learning style.

2) Teacher's beliefs are changing: since what a teacher's expects of the learner determines the study of the learner, we have to be attention to the teacher's personality, the teaching skills, the ability to understand young people, and to integrate the classroom activities into the student's social background. Therefore, due to the different culture, we cannot say that the Taiwanese English language teachers have wrong beliefs. As I said before, the educational system in Taiwan is changing right now, and nowadays, there are more and more teachers believe that they should consider more factors of the good language learner, not only depend on the exams.

3) Giving confidence to the language learners that everyone could become a successful language learner: teachers should be aware of the student's difficulties, such as feeling of being embarrassed, or the heavy academic load from school, and try to release their anxiety. In addition, letting the good language learners share their learning experiences in class may be helpful as well.

4) The methods of GRA and GSM are objective. By using GRA calculation, the results are between 0 to 1 which present the coordinates' distance from the origin. Besides, these methods can position and sort the learning strategies quantitatively and correctly.

5) The methods of GRA and GSM are reliable. Because the article interviewed 10 professional English teachers to provide their opinions on good language learner's learning strategies, the evaluation process is more reliable.

Overall, this is an innovative method to use GRA and

GSM methods to quantify language learning strategies and try to find out the paths. However, this is only a preliminary investigation. The results can be more convinced if other soft-computing method, like the fuzzy theory or the rough set, could be included in the future researches.

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