A Relationship between the Pair Effect and the Learner Characteristic at Pair Work in Computer Literacy Education

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Abstract: We have introduced pair works to university-level computer literacy education as opposed to the traditional one, standalone teaching. In this paper, in order to extract the learner characteristics factors that influence the pair work effects such as test-score improvement level, pair-work activity level and pair-work satisfaction level, we conducted two experimental pair work classes in computer literacy exercise courses. For the investigation, we used two main questionnaire surveys, TEG Ⅱ and GAMI as personality indexes. The result showed that the personality index has clear strong correlation with the degree of activity and degree of satisfaction in TEG Ⅱ and also to the degree of score elevation in GAMI. The personality score, obtained from the result, is useful for more effective pair combination.

Keywords: Computer literacy education, pair work, pair combination, personality

1. Research Background and Objective

Following the global educational trends of recent years, active learning, wherein students discover a problem and attempt to find a solution on their own, has been increasingly required. To implement active learning, gaining and increasing information literacy, which serve as the basis of information collection and transmission, are also necessary. To address these issues, we implemented lessons for university freshmen, incorporating pair work into information literacy education, and confirmed its effectiveness. Subsequently, we concluded that pair work can be very effective for the education.

For effective pair work, the method of forming pairs is important and fundamental. In many cases, however, pairs are determined randomly, e.g., according to the order of students' ID numbers or seating arrangement. Moreover, research specializing in pair formation is almost nonexistent.

Hence, since 2008, we have continued a survey to establish a pair formation method that optimizes student combinations. Thus far, we have clarified the following: 1) Problem solving by a pair exceeds that by an individual, and pair achievement is generally significantly higher than individual achievement; 2) the most effective pair combinations included those with a small difference in basic scholarship, and mixed gender (Uchida and Oya, 2011). However, our experience also shows that the personality of student must influence the pair effect.

Thus, this paper focuses on the personality traits that have been reported to affect cooperative learning and aims to improve the pair-work effectiveness by devising pair combinations according to quantitative scale scores.

2. Personality and Pair Effect

We investigated the learning motivation closely related to the class and the personality traits according to egograms, effective in diagnosing tendencies of interpersonal communication.

Used to measure personality traits, the egogram is widely used in the medical field, but also in education—to examine university curriculum that considers students' characteristics and their awareness of information morals. There are many types of egogram. In this study, TEG II (Tokyo

University Psychosomatic Medicine TEG Association, 2006), widely and generally used, was administered. To measure learning motivation, we used GAMI (the Gakugei Academic Motivation Inventory, Shimoyama, 1985), a widely used scale with criteria for classifying learners' characteristics. To develop e-learning materials suitable for different learning motivation types, relevance verification of learning motivation, and Internet usage, GAMI is a psychological scale that standardizes learning motivation measurement.

For the pair effect, we used three values: 1) test-score improvement level, 2) pair-work activity and 3) pair-work satisfaction level. The test-score improvement level represents the extent of increase or decrease in the score deviation value of the pair test, compared with the individual test deviation value. To measure pair-work activity, we used the number of utterances during pair work. Because, the amount of utterance is effective in the state estimation of cooperation working. Furthermore, the students' satisfaction level will be considered as an important factor for effective pair work. The post-questionnaire measured two values for satisfaction level: the overall pair work satisfaction level and the pair-combination satisfaction level.

3. Method

In 2013, we conducted experimental classes using pair work. The participants were approximately 160 students participating in computer literacy courses in four classes at two private universities in Japan. In April, we conducted a preliminary survey on the pair combination indicators which are basic academic ability and gender. Following nine computer literacy lessons based on a simultaneous method, an individual test was conducted to calculate the pair effect. Our experimental pair work classes were conducted once a week for two weeks in June. Each pair comprised a male and female with similar academic abilities, which was confirmed to have a significant impact by a previous study. In the first pair work test (Test 1), a 15-minute practical test based on the word processing qualification examination was conducted. At the same time we conducted a 10-minute survey of personality (TEG Ⅱ). In the second test (Test 2), a 25-minute assignment to create a sample document for a display poster and a 10-minute survey of personality (GAMI) were allocated. Before the pair work, a 5-minute free talk period was provided to develop smooth conversations between pair members who were meeting for the first time. We recorded the exchanges from the free talk to the end of the pair work with an IC recorder. After the pair work, we conducted a 21-item questionnaire survey on problem solving in pairs.

The procedure of analysis is as follows: First, we performed a basic analysis of the pair effect from test-score improvement level and activity level of Test 1 and Test 2, results of the overall pair work, and the pair-combination satisfaction level. Next, we attempted to find the correlation coefficients among TEG II and GAMI, the test-score improvement level, activity, and satisfaction level in an effort to select the elements involved in the pair effect from the significance probability.

4. Personality Score and Estimation

To examine whether a relationship exists between TEG II, GAMI and the pair effect, we analyzed its correlation with the result test-score improvement level, activity, and satisfaction level. The result showed that the personality's characteristics has clear strong correlation with the degree of activity and degree of satisfaction in TEG Ⅱ and also to the degree of score elevation in GAMI.

On the basis of these results, we summarized the scales of GAMI and TEG II that show relationships with the test-score improvement level, pair-work activity, and pair-work satisfaction level (see Table 1). A single asterisk (*) refers to points with 5% significance and a double asterisk (**) refers to points with 1% significance. There is a clear strong correlation between five items of GAMI regarding the test-score improvement level, four items of TEG II and two items of GAMI regarding activity, and four items of TEG II and seven items of GAMI regarding satisfaction level. From these results, we believe each effect of pair work—mixed gender with small basic academic ability difference—could be improved by devising pair formation using TEG II and GAMI.

Then, we proposed a pair formation improvement method using the values obtained from TEG II and GAMI: First, on the basis of these results, we calculated the individual personality score (PS) using the scale scores of GAMI and TEG II. Next, we divided the students into three groups, L, M, and H, using the quartile method. Then, the LL pair with the personality trait of low mutual pair effect was

Table 1: Relevance between personality factors and each pair effect.

		test-score improvement level		pair-work activity level		pair-work satisfaction level	
		Test1	Test2	Test1	Test2	pair work	pair-combination
TEGⅡ	①CP(Critical Parent)	-.057	-.092	.113	.156	.221 **	.193 *
	②NP(Nurturing Parent)	-.116	-.121	.149	.278 **	.375 **	.161 *
	③A(Adult)	.054	.067	-.181 *	-.178 *	-.047	-.017
	④FC(Free Child)	.021	-.034	.186 *	.263 **	.358	.176 *
	⑤AC(Adapted Child)	.018	.008	-.189 *	-.136	-.128 **	-.003
GAMI	①Voluntary learning attitude	-.224 **	-.261 **	.134	.017	.073	.202 **
	②Achievement-oriented attitude	-.034	-.042	-.036	.062	.287 **	.158 *
	③Sense of responsibility	-.113	-.189 *	.194 *	.219 **	.303 **	.240 **
	④Amenability	-.118	-.140	-.055	.013	.298 **	.182 *
	⑤Self-assessment	-.208 **	-.162 *	.100	.095	.228 **	.037
	⑥Tendency to avoid failure	-.001	-.002	-.084	.004	-.074	-.189 *
	⑦Lack of persistency	.150	.230 **	-.097	-.055	-.138	-.175 *
	⑧Lack of learning values	.285 **	.282 **	-.177 *	-.106	.006	-.149

** p<.01 * p<.05

extracted, after which we swapped partners in order for them to be paired with those having personality traits with high mutual pair effect. In addition, we also tried to evaluate this change's possibility by simulating the effect when rearranging the pair using PS.

Using the TEG II and GAMI scale scores, we examined various formulas for the PS calculation method. Finally, we decided to use the formula in which the total number of asterisks in the Table 1 was multiplied by each scale score presents normality.

In order to verify the effect of the pair combination using PS which we propose, we performed the experiment class for verification from June to July in 2014. We rearranged the partner of the pair with low PS (LL pair) and compared the pair effect of a recombination groups and non-groups. As a result, the value of the group which rearranged the degree of results rise, the test-score improvement level, the pair-work activity level and the pair-work satisfaction level became high.

In conclusion, it became clear that the pair combination method using PS raises the pair effect of the whole class work.

5. Summary

Pair work using the pair combination indicators was introduced in the information literacy course. We mainly examined the learners' personalities as it is a major factor impacting pair effect. We clarified that personality traits extracted by TEG II and GAMI are strongly involved in the test-score improvement level, activity, and satisfaction level. Therefore, it is suggested that even in pair formation, we can improve the effectiveness of indicators by incorporating some TEG II and GAMI items in addition to the two confirmed ones (gender and basic academic ability difference). Moreover, we performed a pair rearrangement using PS calculated in this study. Test-score improvement level, activity, and satisfaction level were simulated. As a result, the class's overall pair-effect level improved through elimination of pairs in which both personalities were with low effect.

The investigation in 2014 shows that this method improves the class's overall pair effect level.

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